



ICRAMCS 2023

March 16-17-18, 2023 | ISSN: 2605-7700



Scopus



WEB OF SCIENCE



CALL FOR PAPER

- ① Computational and Applied Mathematics
- ② International Journal of Mathematical, Engineering and Management Sciences
- ③ Journal of Mathematical Modeling and Computing
- ④ Moroccan Journal of Pure and Applied Analysis

IMPORTANT DEADLINES

Submission of abstracts: Jan. 31, 2023
Registration: Jan. 31, 2023
Notification of accep.: Feb. 05, 2023
Payment: Feb. 10, 2023
Program publishing: Mar. 10, 2023
Conference date: March 16-18, 2023
Paper Submission: April 30, 2023

Coordinator: Youssef EL FOUTAYENI

<https://icramcs2023.sciencesconf.org/data>

Conference Proceedings Report

ICRAMCS 2023 Proceedings ISSN: 2605-7700



FOREWORD & ACKNOWLEDGEMENTS

The 5th Edition of the **I**nternational **C**onference on **R**esearch in **A**ppplied **M**athematics and **C**omputer **S**cience (**ICRAMCS 2023**) is a platform where experts and scholars from around the world gather to discuss and share their knowledge, ideas and research findings in the fields of mathematics and computer science. This conference provides an opportunity for participants to network, collaborate and advance the state-of-the-art in these rapidly evolving fields.

Mathematics and computer science are both critical components of our daily lives, as they play a fundamental role in shaping our modern world. From the calculations needed for basic household budgeting to the algorithms that power our social media feeds, these disciplines impact every aspect of our lives, from science and technology to finance and entertainment.

The importance of mathematics and computer science in our world is ever-increasing, and the Congress of Mathematics and Computer Science serves as a crucial forum for experts to share new discoveries, techniques, and tools that can help to improve our understanding of these subjects and advance the development of innovative applications.

Through this congress, participants can contribute to building a better future by exploring new ideas and applications in mathematics and computer science. The knowledge and expertise shared in this event can help us to better understand our world and to develop solutions to the complex challenges we face.

This conference has several major objectives, in particular:

- To bring together doctoral students and research professors in the fields of applied sciences and new technologies.
- To consolidate the scientific cooperation between the university and the socio-economic environment in the field of applied sciences.

- To allow young researchers to present and discuss their research work before a panel of specialists and university professors.
- To contribute to the development of a database, which can help decision makers to opt for a better management strategy.

The abstracts of these conference proceedings were presented at the 5th International Conference on Research in Applied Mathematics and Computer Science (ICRAMCS 2023). These conference proceedings include abstracts that underwent a rigorous review by two or more reviewers. These papers represent current important work in the field of Mathematics & Computer Science and are elaborations of the ICRAMCS conference reports.

These abstracts are provided for all presenters who have submitted abstracts and have registered as of February 01, 2023. Although every effort has been made to ensure accurate reproduction of these abstracts, the conference organizers cannot be held accountable for inaccuracies that may have occurred in their reproduction. Any changes made after February 01, 2023 to either the content of the abstracts or presentation status will not be included in these proceedings.

We wish to acknowledge the conference program committee and reviewers, for their substantial contributions and our institutions, for their support.

Sincerely,

On behalf of the Organizing Committee of ICRAMCS 2023
Prof. Youssef EL FOUTAYENI
Laboratory Analysis, Modeling and Simulation LAMS
Faculty of Sciences Ben M'Sik
Hassan II University of Casablanca, Casablanca, Morocco

ORGANIZING COMMITTEE



INTERNATIONAL PROGRAM COMMITTEE

Pierre AUGER, IRD Paris, France

Khalid BOUSHABA, Howard University, Washington, DC, USA

Hassan EL AMRI, Hassan II University of Casablanca, Morocco

Abdelhaq EL JAI, University of Perpignan, Perpignan, France

Samira EL YACOUBI, University of Perpignan, France

Khalil EZZINBI, University of Cadi Ayad, Morocco

Gabriele GRANDI, University of Bologna, Italy

David INFIELD, University of Strathclyde, Glasgow, UK

Bachir KERBOUA, Faculty of Technology, University of Tlemcen

Andrew KUN-YI LIN, National Chung-Hsing University, Taiwan

Chaabane LAMICHE, Mohamed Boudiaf University, Algeria

Rachid MCHICH, National School of Commerce and Management, Tangier

Stig MUNK-NIELSEN, Aalborg University, Denmark

Joseph OLORUNFEMI OJO, Tennessee Technological University, USA

Christian REHTANZ, TU Dortmund, Germany

Abdelaziz SOUFYANE, University of Sharjah, UAE

Cemil TUNC, Van Yuzuncu Yil University, Turkey

El Hassan ZERRIK, University of Moulay Ismail, Morocco

TABLE OF CONTENTS

Foreword & Acknowledgements

Organizing Committee

International Program Committee

ABSTRACTS

S1	NOURDINE EL AMARTY, BADR EL HAJI, MOSTAFA EL MOUMNI: Entropy solutions for strongly nonlinear elliptic problems having large monotonicity with measure data in weighted Orlicz-Sobolev spaces	1
S1	RACHID BOUNA, IZEM NOUH, MOHAMED M SHADI, SEAID MOHAMMED: Isogeometric Analysis of 3D Heat Conduction	2
S1	BENAISSA ZERROUDI: On the improvement of the approximation order of the triangular Shepard operator	3
S1	AHMED MOUSSAID: Study of numerical stability and bifurcation analysis in a system of neutral differential equations	4
S1	HAMZA BOULLOUZ: Numerical modelling of the flow of a resin through a fibrous media: application to the RTM process	5
S1	SOUKAINA YACINI, CHAKIR ALLALOU, KHALID HILAL: On the existence of a weak solution for a nonlinear elliptic system involving the $(p(x),q(x))$ -Laplacian-like operators	6
S1	TARIK ASLAOUI, BEN AMMA BOUCHRA, MELLIANI SAID, CHADLI LALLA SAADIA: Solving second-order differential equations with fuzzy boundary conditions	7
S1	BOUCHRA BEN AMMA, MELLIANI SAID, CHADLI LALLA SAADIA: On new solutions of intuitionistic fuzzy differential equations	8
S1	NAOUFEL HATIME, MELLIANI SAID, EL MFADEL ALI, ELOMARI MHAMED: On Newton's law of cooling with time delay and Psi Caputo fractional derivatives	9
S1	HASSAN KHAIDER, CHAKIR ALLALOU, SAID MELLIANI, ACHRAF AZANZAL: On the fractional Navier-Stokes-Coriolis in Besov type Characterized by Semigroups	10
S1	FATIMA OUIDIRNE, CHAKIR ALLALOU, MOHAMED OUKESSOU: Global existence theorem for the generalized micropolar fluid system in the variable exponents Fourier-Besov spaces	11
S1	ABDELLATIF SEMMOURI, JOURHMANE MOSTAFA: Solving Linear Fractional Differential Equations	12
S5	WAFAA NABLAOUI: Quasi-linear elliptic equations with data in $L^{\{1\}}$ on a compact Riemannian manifold	13
S5	MOHAMED DRISSI, MOHAMED MANSOURI, SAID MESMOUDI: A high-order continuation-based Spectral approach for bifurcation analysis within	14
S5	MHAMED MABROUK: Strong and total fenchel dualities for robust composed convex optimization in locally convex spaces	15

S5	MOURAD OUYADRI, LAABISSI MOHAMED: Positive state controllability of discrete linear time-invariant systems	16
S5	MERYIEME EL FARRAGUI: Analytical solution of the simple shear flow of a Johnson-Segalman fluid with slip along the fixed wall	17
S5	OTMANE MALLOUK, MOHAMED ETTAOUIL: Network-based deep transfer learning Applied to pneumonia detection	18
S5	ABDESSLAM OUAZIZ: On a new fractional Sobolev space with variable exponent on complete manifolds	19
S5	SALMA MOUJID, AMRANI SOUHLI HICHAM, KADDAR ABDELILAH: High-Order Scheme For Solving The Nonlinear Diffusion Equation	20
S5	NAJAT RAFI, KHADIJA BOUZKOURA: Courbes elliptiques sur A_n et applications	21
S5	SAHAR ECHAJEI, HANANE FERJOUCHIA, MOSTAFA RACHIK: Machine Learning and Causal Inference Methods for Health Services Research	22
S5	SOUMAYA NOUNA, MOHAMED MANSOURI, BOUJAMAA ACHCHAB, ASSIA NOUNA: The Deep Learning Solution of the Helmholtz Equations	23
S5	ABDELOUAHED MIRI, KARAM ALLALI: Minimizing total weighted tardiness for the permutation flow shop scheduling problem, under the constraint of sequence independent setup time	24
S5	ALI SMOUK, RADID ATIKA: Discrete Energy Behavior of thermoelastic Timoshenko System with Cattaneo's Law	25
S5	AMINE FAIZ: Fixed points of fuzzy monotone maps	26
S2	ABDELOUAHED KOUIBIA, PASADAS MIGUEL: A shape-preserving approximation problem for filling holes of generalized offset surfaces	27
S2	HAFIDA ATTI, BEN AMMA BOUCHRA, MELLIANI SAID, CHADLI LALLA SAADIA: Intuitionistic Fuzzy Symmetric Solutions of Linear Systems	28
S2	JAMAL DAOUDI, TAJANI CHAKIR: Optimization method based on bio-inspired approaches for solving a Robin inverse problem	29
S2	HAMZA TOUFGA, MUSTAPHA LHOUS, AYOUB SAKKOUM, LAHBIB BENHAMAD: Discret mathematical modelling and optimal control of a spatiotemporal tuberculosis model	30
S2	NISRINE MARRAKCHI: Hybridization of Air Quality Forecasting Models Using deep-learning and Holt Winters method: An Original Approach to Detect Ozone Concentration Peaks	31
S2	CHAKIR TAJANI, DAOUDI JAMAL: A novel combined regularization algorithm for solving an inverse problem for Helmholtz equation	32
S2	SAFAE EL FILALI, BOURAS KHALID: Weak compactness of almost L-weakly and almost Mweakly compact operators	33
S2	ABDELAZIZ CHAHED, BERGAM AMAL, EL HARRAK ANOUAR: A New Finite Volume Scheme for Advection-Dominated Problems: Application to Air Quality Problem	34
S2	MOHAMED MRINI, BERGAM AMAL, EL HARRAK ANOUAR: Optimization of a two-dimensional mesh generator	35

S2	ABDERRAHIM SAHLI, EL HADRI ZOUHAIR, HANAFI MOHAMED: Overcoming convergence problems in PLS path modelling	36
S2	AMINE MARAH: Existence and comparison results for nonlinear parabolic equations having a natural growth terms	37
S2	SAID ELBOSTANI: The Moving Least Square Method for Solving the Nonlinear Hyperbolic Equation	38
S6	MOHAMED EL IDRISSE, ESSOUFI EL-HASSAN: Solutions for the fractional Heisenberg-viscoelasticity equations	39
S6	MOHAMED BENMOUANE, EL HASSAN ESSOUFI, CHAHID AYOUCHE: Global weak solution for the compressible Landau-Lifshitz-Bloch-Heisenberg equation	40
S6	SOUMAYA IDAAMAR: A comparative study of iterative reconstruction algorithms for Electrical Impedance Tomography(EIT)	41
S6	ABDERRAHMAN ABBASSI: Modeling of freight international transportation with uncertain data	42
S6	ABDELLAH OUAMMOU, TARAMIT HAMID, EL HANJRI ADNANE, HANINI MOHAMED: Modeling PMD to Control the Allocation of resources in a Cloud Computing System using Reserve Machines	43
S6	ABDELGHALI AMMAR, LAGHDIR MOHAMED, RIKOUANE AHMED: Generalized weak ϵ -subdifferential and applications	44
S6	ABDELHAK ESSOUNAINI, BOUCHAIB KHAJJI, HASSAN LAARABI, MOSTAFA RACHIK: Modeling mathematical and Analysis of an Alcohol drinking with n complications	45
S6	ABDELALI MOHIB: Numerical Solution of Volterra Integro-Differential Equation Using Moving Least Square Method	46
S6	LARBI RAKHIMI, DAHER RADOUAN: An Analogue of Titchmarsh's Theorem for Laguerre Transforms Using Moduli of Continuity	47
S6	ABDELBAR EL MANSOURI, BOUCHAIB KHAJJI, ABDERRAHIM LABZAI, MOHAMED BELAM: Optimal control in a mathematical model of a spread of the Obesity Epidemic and its impact on Diabetes	48
S6	SALMA LAHBABI, DAVID GONTIER, ABDALLAH MAICHINE: DFT model for 2D homogeneous materials with magnetic field	49
S6	IMANE ZERGOUT: Systemic modeling of the innovation process deployed in a mechanical engineering project using Petri nets	50
S6	ZAINEB SARIR, BOUSSAIRI ABDERRAHIM: Exploring Real Vector Representations of Simple Graphs	51
S6	YAMNA ACHIK: A Double Step Size Method for Linear Complementarity Problem	52
S3	HASNAE EL HAMMAR, SAID MELLIANI, FARAH BALAADICH: Weak solutions to quasilinear elliptic obstacle Problems via Young measures	53
S3	NOUREDDINE MOUJANE, CHAKIR ALLALOU, SAID MELLIANI, MOHAMED EL OUAARABI: Study of some elliptic system of $(p(x),q(x))$ -Kirchhoff type with convection	54
S3	YOUSSEF FADIL, CHAKIR ALLALOU, MOHAMED OUKESSOU: Existence result for a Dirichlet problem dominated by nonlinear degenerate elliptic equation in Weighted variable exponent spaces	55

S3	KHALID BELLAJ, MOHAMMED BENMIR: Overlapping domain decomposition level set method for magnetic resonance images	56
S3	ABDELGHANI AZ-EDINE, MOSTAFA EL MOUMNI: Existence of results for some parabolic equations having nonlinear boundary conditions	57
S3	SIDI MOHAMED DOUIRI, ABDELMOUJIB BENKIRANE, MUSTAFA AIT KHELLOU: Some properties of Musielak spaces with only the log-Holder continuity condition and application	58
S3	ZAKARIA ZAIMI: Infinitely many solutions for an elliptic equation in divergent form with critical Sobolev exponent and concave-convex nonlinearities	59
S3	KHALID ATIFI: A new network architecture model for deep learning to solve an inverse source problem for a one-dimensional linear and nonlinear degenerate/singular hyperbolic problem	60
S3	MUSTAFA AIT KHELLOU: Renormalized solution to nonlinear elliptic equations with measure data in Musielak Spaces.	61
S3	MAHAMAT SALEH DAOUSSA HAGGAR, CYR S. NGAMOUIYH MOUSSATA, DÉRYL NATHAN BONA ZEBI YINDOULA, BENJAMIN MAMPASSI: Discrete non-standard formulation of PDE inverse problems	62
S3	ADNANE BELAKHDAR, BELAOUIDEL HASSAN, FILALI MOHAMMED, TSOULI NAJIB: Existence and multiplicity of solutions for a singular problem involving the $P(x)$ triharmonic operator in Ω	63
S3	MAMADOU ERAMANE BODIAN, WINNIE OSSETE NGOBA, SOUHAIBOU SAMBOU, PAPA BADIANE: Generalized study of the operator $\alpha \partial^k + \beta \partial^k + \gamma \partial^k + c$ in the weighted Hilbert space $L^2(C, e^{- z ^2})$	64
S7	KHALID EL HAIL, AZIZ OUHINO, MOHAMED KHALADI: Impact of Behavioral Modification on a Periodic Epidemiological Model	65
S7	GIAN MARCO PALAMARA, JOSE A. CAPITAN, DAVID ALONSO: Functional Responses: From Individual Processes to Feeding Experiments	66
S7	MOHAMMED SEMLALI, HATTAF KHALID, EL GOURARI AIAD: Stability analysis of a delayed COVID-19 transmission model involving immigration and vaccination	67
S7	ISMAIL EL HAKKI, RACHID MCHICH, AMAL BERGAM: A Bioeconomic Model of a Fishery with Variable Market Price: Aggregation, Control and MSY	68
S7	MOHAMMED BENMIR, TABBAKH ZINEB, ABOULAICH RAJAE, EL KARKRI JAAFAR: Agent-Based Simulation of a Multi-Strain SEIR Epidemic Model	69
S7	MARIEM ELKAF: Modeling the CTLs immune response in HBV DNA-containing capsids infection with logistics growth	70
S7	HAMZA AIT TAMERZ: Dynamics of HBV Infection with DNA-Containing Capsids, Logistics Growth, Saturated Rate and Therapy	71
S7	YOUSSEF EDDAGHOUC, IMANE AGMOUR, YOUSSEF EL FOUTAYENI: Modélisation bioéconomique d'un système complexe de ressources communes renouvelables : Application au cas des pêcheries du Maroc	72
S7	MOHAMED HAFDANE, IMANE AGMOUR, YOUSSEF EL FOUTAYENI: Study of Hopf bifurcation of delayed tritrophic system	73
S7	NABILA BEQQALI, KHALID HATTAF, NACEUR ACHTAICH: Vaccination against infectious diseases in the Moroccan education system	74

S7	HAMZA EL MAMOUNI, KHALID HATTAF, NOURA YOUSFI: A nonlinear epidemic model for COVID-19 with Hattaf fractional operator and fixed point theory	75
S7	IMANE BOUHIAOUI, IMANE BERRAIE: Mathematical study of compartmental models on marine species	76
S7	SIHAM HACHOUM, IMANE EL BERRAI, KHALID ADNAOUI: Contribution à l'analyse déterministe de quelques modèles épidémiologiques : cas des plantes naturelles	77
S7	FATIMAEZZAHRA BENDAHOU: Impact of Pollution on Sardine, Sardinella, and Mackerel Fishery: A Bioeconomic Approach	78
S4	IKRAM IMKEN, IMKEN IKRAM, NADIA IDRISSE FATMI, SALOUA EL AMRI: Study of Mathematical Model for Association of Diabetes and Coronavirus	79
S4	YASSINE BABRHOUE, EL BOUKARI BRAHIM: Mathematical study of SEIRS epidemic model under bilinear incidence rate	80
S4	HALIMA SRHIRI, CHAKIR ALLALOU, KHALID HILAL: A priori estimates for solutions of regular elliptic system	81
S4	FATIMA CHERKAOUI, KHALID HILAL, ABDELAZIZ QAFFOU: Mathematical analysis of an age structured sir epidemic model with conformable fractional derivative	82
S4	FATIMA EZZAHRAE FADILI, CHAKIR ALLALOU, KHALID HILAL: Stability and Hopf Bifurcation Analysis of SIQR Model with Time Delay	83
S4	CHAIMA EL MAGHRAOUI: Measure of noncompactness for solving -caputo-type fractional evolution equations	84
S4	AHMED FADILI: On the inversion of Laplace transform and admissibility for a class of Volterra integrodifferential problems.	85
S4	KHADIJA CHANNAN, HILAL KHALID, KAJOUNI AHMED: The Asymptotic Stability Of A Fractional Epidemiological Model "All Coronavirus Mutations" with Caputo Derivative	86
S4	NIHALE EL BOUKHARI, ZERRIK EL HASSAN: Existence of optimal controls for semilinear systems with a nonreflexive control space	87
S4	HAMZA BEN BRAHIM: On the Observability of A Class of Linear Time-Fractional Systems	88
S4	YOUNES OULAHOU: Nanofluid Natural Convection in a Square Cavity Including a Heated Obstacle Using Lattice Boltzmann Method	89
S4	ABDELATI EL ALLAOU: Analytical solution of a fractional logistic model for a population with Allee effect	90
S8	SOUFIANE YAHYAOUI, OUZAHRA MOHAMED: Optimal control problem for a class of bilinear systems with an unbounded control operator	91
S8	FARID MORTAJI, ABDELHADI ABTA: Dynamics of an SEIR model with infectivity in incubation period	92
S8	SOUKAINA HILAL, HASSAN LAARABI, MOSTAFA RACHIK: Optimal Control Strategy For Marriage Divorce	93
S8	CHADI AMISSI, EL MOSTAFA MAGRI, LARBI AFIFI, MUSTAPHA LHOUS: Compensation problem in linear fractional order time-invariant disturbed systems	94
S8	HIBA HIZAZI, MUSTAPHA LHOUS: An observer-based control of linear systems with uncertain parameters via LMI approach	95

S8	NOSSAIBA BABA: Allee effect study on bioeconomic model parameters	96
S8	AHMED DELBOUH, TSOULI AZZEDDINE: Sufficient and necessary conditions for exponential stabilization of distributed second order semilinear systems with time delay	97
S8	ABDELHADI MOUTASSIM: On four-dimensional absolute valued algebras with left omnipresent unit	98
S8	SARA EZZAHIR, BOUSSAIRI ABDERRAHIM, LAKHLIFI SOUFIANE, MAHZOUM SOUKAINE: Characterization of doubly regular tournaments by spectral slater index	99
S8	SOUKAINA MAHZOUM: On the skew-characteristic polynomial of tournaments	100
S8	IMANE SOUKTANI: Study of the spectral monomorphy of l2-structures	101
S8	ABDELKARIM BOUA: Jordan ideals of prime near-rings with algebraic identities	102
S8	EL MOKHTAR FANICH, ESSABAB SAID: On the affine k-symplectic manifolds	103
S8	SALMA KHAN, MALIKA IZID, SOUKAINA OURAB, AMINA OUZZANI CHAHDI: Surfaces de translation générées par des indicatrices sphériques de courbes régulières d'un espace euclidien à trois dimensions	104
S9	LAHCEN LAILI, HAFDI MOHAMED ALI: Goodness-of-fit in cox model with correlated covariates	105
S9	KHALID ALAJMI: On probability of constructing certain finite groups	106
S9	CARLOS MELIAN: Biodiversity dynamics in landscapes with fluctuating connectivity	107
S9	ANWAR EL FADIL EL IDRISSE: A Mathematical Model of Ideas Transmission	108
S9	AZIZ LMAKRI: Estimation dans les Modèles à Court-Panel avec Erreurs Bilinéaires	109
S9	SOUFIANE MOUSSATEN, S. DOUISSI, K. ES-SEBAIY: Asymptotics of the cross-variation of Young integrals with respect to general self-similar Gaussian process	110
S9	ALI LABRIJI: A Low-Cost Estimation Method for Conditional Probabilities in Resource-Constrained Environments	111
S9	ABDELADIM NAIT BRAHIM: switching diffusion epidemic model with varying population size	112
S9	ABDELALI CHAIB, BEN SAID MOHAMED, BERGAM AMAL: Numerical Analysis of Finite Difference Method for Fokker-Planck equation driven by symmetric Lévy motion	113
S9	AMAL EZZIDANI: Asymptotic analysis for a feed-forward network of multiclass processor sharing queues	114
S9	SOULAIMANE AZNAGUE: Threshold Behavior in a Stochastic SIS Epidemic Model with saturation incidence and logistic growth	115

S9	MOUHCINE TALJAOUI, MOSTAPHA BOUHAMZA: Integral bases of some families of quartic number fields	116
S9	FADOUA EL ASRI, TAJANI CHAKIR, FAKHOURI HANANE: A combined Ant Colony Optimization with Levy flight mechanism for the Probabilistic Traveling Salesman Problem with deadlines	117
S10	MISHARI AL-FORAIH: Computation of greeks in rough volterra stochastic volatility models	118
S10	YOUNESS SAOUDI, HAJAR SABIKI, MOULAY MEHDI FALLOUL, HANAA HACHIMI: The one-dimensional partial differential equation of Black-Scholes	119
S10	HICHAM OUHRAICHOU: Residual power series method for the approximate solutions of the space-time fractional Black-Scholes equation.	120
S10	MEHDI BAZZI: CoVaR modeling to measure the impact of climate risk on financial stability	121
S10	SAMIR FARHI: Analyse via une modélisation économétrique à vocation prévisionnelle de l'impact de la pandémie covid-19 sur les transferts des MRE	122
S10	FARAH BENOMAR, HICHAM EL BOUANANI, ABDELAAEZIZ EZZIANI: Impacte de la participation du Maroc aux Chaines de valeur mondiales sur la croissance économique: Application par l'approche autorégressif à retards échelonnés (ARDL)	123
S10	MAHA ELKARMOUCHI, SARA LASFAR, KHALID HATTAF, NOURA YOUSFI: Dynamics of IS-LM model with general investment and fiscal policy delays	124
S10	ASMAA IDMBAREK, MAYA FATIMA, BABA NOUSSAIBA, EL FOUTAYENI YOUSSEF: Utility Functions for Predator-Prey Game: A Possible Connection between the Esox Lucius-Gobio Model and the Utility Functions	125
S10	HAJAR NAFIA, YOUSSEF EL FOUTAYENI, NACEUR ACHTAICH: The use of American options to help oil producers during the spread of covid-19 pandemic	126
S10	TAKIDINE AHANDOUR, ZAHID MEHDI, DAAFI BOUBKER: Numerical methods for solving BSDEs using Neural Networks: Application to the American options	127
S10	MARIA ACIM: ARFIMA models applied to the financial market during the covid 19 crisis	128
S10	HOUSSAM BOUGHABI, EL QALLI YASSINE: Pricing of futures Bitcoin price under fractional volatility	129
S10	SELMA CHADLI, FIRDAOUS ZAIR, ABDELHAK YACOUBI: Optimizing Hospital Emergency Processes	130
S10	FIRDAOUS ZAIR, IMANE ZERGOUT: Conceptual modelling framework for B2C e-supply chain diagnostic: An application to a logistic service provider	131
S11	ABDERRAHMAN RETBI, EL WAHBI BOUAZZA: A note on L-Dunford-Pettis sets in a topological dual Banach space	132
S11	HIND BOUAAM, CHAKIR ALLALOU, SAID MELLIANI: The Nehari Manifold for a $p(m)$ -Kirchhoff problem with logarithmic nonlinearity on Riemannian manifolds	133
S11	ABDELMAJID KHADARI, DAHER RADOUAN: Fourier transform for integrable Boehmians on locally compact abelian groups	134
S11	FATIMA-EZZAHRA SADEK: Multiple recurrence in linear dynamics	135

S11	ISSAM DALI, DALI ISSAM, MOUSTAID MOHAMED BILAL: Equilibrium Problems: Existence Results without Ekeland's Variational Principle	136
S11	M'HAMED GHIATI: Continues dual operator frame in Hilbert A-module	137
S11	FAKHR-DINE NHARI: Continuous * -g-frames in Hilbert C^* -modules	138
S11	ADEL BABBAH, MOHAMED ZOHRY, AIMAD BARHMATE: Une classe des opérateurs de Toeplitz symétriquement complexe	139
S11	MOHAMED ROSSAFI, ABDELKARIM KARI: Fixed points for weakly contractive mappings in rectangular b-metric spaces	140
S11	ABDELHAI EL AZZOUZI: On the periodic solutions for a class of partial differential equation with infinite delay	141
S11	ABDELMJID KHCHINE, KHAZOU MOHAMED: Darbo's fixed point under weak topology features with application to a functional integral equation	142
S11	ADIL BAIZ, MOULINE JAMAL: Best Proximity Point of Generalized $(F - \tau)$ -Proximal Non-Self Contractions in Generalized Metric Spaces Spaces	143
S11	CHAIMAA BENZAROUALA, JANUSZ BRZDEK, LAHBIB OUBBI: A general fixed point theorem in random normed spaces and its applications	144
S12	ASSIA NOUNA, BOUJAMAA ACHCHAB, MOHAMED MANSOURI, SOUMAYA NOUNA: Classification of hyper spectral imaging use CNN for Land cover mapping	145
S12	KAMAL ADDOU: A Modular solution to bring transparency to the food supply chain by using public blockchain combined with IoT and machine learning	146
S12	SOUMIA CHAFI, KABIL MUSTAPHA, KAMOUISS ABDESSAMAD: Text Classification using Machine Learning in a Big Data environment, controlled with Fuzzy Logic	147
S12	KAWTAR IDHAMMOU OUYOUSSEF: Parameters estimation and simulation of a two-group epidemiological model using physics-informed neural networks (PINNs)	148
S12	OUMAIMA BELLAR, BAINA AMINE, BELLAFKIH MOSTAFA: Application of Machine Learning to Sentiment Analysis	149
S12	OKACHA DIYER, ACHTAICH NACEUR, NAJIB KHALID: The most important scientific learning skill justified by artificial intelligence	150
S12	HMAD ZENNOU, OUHDA MOHAMED, BASLAM MOHAMED: Toward an efficient emotion recognition from facial expressions using ML	151
S12	MAROUANE EL ABBASSI : A Hybrid Approach for Supplier Selection	152
S12	ISMAIL NANOU, RIYAMI BOUCHAIB, AZZOUAZI MOHAMED, LABRIJI HASSAN: Towards an approach to the development and democratization of MOOCs via artificial intelligence in higher education in Morocco	153
S12	ZAKARIAE SAIDI: Artificial Intelligence tool for Third molar angulation measurements, to predict extraction difficulty	154
S12	SARA CHAGDALI: Numerical simulation of the seakeeping of floating structures.	155
S12	HANANE BENADDI, LAAZ NAZIHA: E-government Interoperability and Data Standardization	156

S12	SOFIA EL AMOURY, DAFRANE ABDELILLAH, EL KHATTABI NOUSSAIMA, FAKHRI YOUSSEF: Use of genetic algorithms in convolutional neural networks to brain tumor image	157
S12	HIBAT EALLAH MOHTADI: Analytical model for task offloading in a fog	158
S12	MOHAMED DOUBIZ, MOUAD BANANE, ABDELALI ZAKRANI, ALLAE ERRAISSI: Smart Farming Connectivity: A Comparative Study of IoT Networking Solutions	159
S12	LHOUSSEINE AIT BEN MOUH, OUHDA MOHAMED, BASLAM MOHAMED: Trajectory Planning Applied to the Palmer Harvesting System	160
S12	AYOUB ES.SWIDI, SOUFIANE ARDCHIR, ABDERRAHMANE DAIF, MOHAMED AZZOUAZI: Traffic congestion multilevel classification using deep learning	161
S12	ICHRAK SAIF, SOUFIANE ARDCHIR, M. YASSINE EL GHOUMARI, SOUMYA OUNACER, MOHAMED AZZOUAZI: Data Analytics in insurance industry: challenges and opportunities	162
S13	AICHA AIT BAKRIM: Coupled projection methods in turbulence	163
S13	ABDERRAHIM BAHSSINI, NOUH IZEM, MOHAMMED SEAID, M SHADI MOHAMED: Fast Finite Element Solution for Nonlinear Heterogeneous Anisotropic Transient Diffusion Problems	164
S13	CHAYEL TRIPURA, CHAKRABORTY SAYANTA, BHATTACHARYA BABY: Picture fuzzy multi criteria group decision making approach for video conferencing tool selection	165
S13	BANYA DAS, SUSMITA ROY, BISWAJIT DAS, PARITOSH BHATTACHARYA: Artificial intelligent based modeling for weld bead geometry prediction of MIG-CO2 welding process made of EN-3A Grade Mild Steel using radial basis function neural network coupled with genetic algorithm	166
S13	CARLA SANTOS, DIAS CRISTINA, NUNES CÉLIA, MEXIA JOÃO TIAGO: Joining iso-structured models with commutative orthogonal block structure	167
S13	AZEDDINE SADIK, ABDELKRIM CHAKIB, IBRAHIM KHALIL, HAMID OUAISSA: Numerical study of shape optimization for flows governed by the Stokes equations	168
S13	MERYEM FAKHRAOUI: Pythagorean Fuzzy Artinian and Noetherian Rings	169
S13	LEKBIR MONSIF, JALILA EL GHORDAF: A mathematical analysis of Fractional SIR Epidemic Model in Caputo-Fabrizio sense	170
S13	FOUZIYA ZAMTAIN: The topological degree methods for COVID-19 in Morocco with a new fractional derivative	171
S13	HAYAT MALGHI: solution integral for an initial value neutral nonlinear hybrid with a psi-Caputo derivative	172
S13	IBRAHIM KHALIL, ABDELKRIM CHAKIB: On some geometrical eigenvalue problems governed by p-Laplacian operator	173
S13	ABDERRAHMANE OULTOU, A. OULTOU, O. BAIZ, H. BENAÏSSA: A class of fractional differential evolutionary mixed variational problem with application to frictional contact problem	174
S13	CYR-SÉRAPHIN NGAMOUIYIH MOUSSATA: An inverse formulation for identifying The silting process of river bank	175

S13	LAHBIB BENAHMADI, LHOUS MUSTAPHA, TRIDANE ABDESSAMAD: The Impact of imperfect COVID-19 vaccination on optimal containment	176
S13	OUALID RHOLAM: Inequalities for Fractional Integrals of a Generalized Class of Strongly Convex Stochastic processes	177
S14	EL MAHJOUR ECHCHAABAOU, LAGHDIR MOHAMED: Approximate strong subdifferential calculus for convex set-valued mappings and applications to set optimization	178
S14	SAMIRA KHATMI: Résolution de l'équation de transport dans le cas non positif au sens de Friedrichs	179
S14	HIND FARJIL, DOURI SIDI MOHAMED, MOUMNI MOHAMED: The existence and uniqueness results for the nonlinear elliptic equation in Orlicz spaces	180
S14	IBRAHIM DAHI, MOULAY RCHID SIDI AMMI: Renormalized solution for a triply nonlinear thermistor problem	181
S14	ISMAIL HADDANI, DOURI SIDI MOHAMED, AIT KHELLOU MUSTAFA: Existence of solutions for nonlinear parabolic equation with two lower order terms and L1 data	182
S14	SAIDA ID OUAZIZ, EL KHOMSSI MOHAMMED: Model COVID-19 dynamics and optimal control strategies	183
S14	ALI BOUFSSASSE, MOHAMED ETTOUILL: Reduction of redundancy in CNNs based on multi-objective optimization	184
S14	KHADIJA ZAHARI, EL KHAOULANI EL IDRISSE RACHID, BOURIHANE OUSSAMA: Buckling analysis of thin functionally graded plates under in-plane loading with a general model of higher order shear deformation theories	185
S14	ABDELHAKIM LOTFI: Development of a thermal model for Electric Machines using Model Order Reduction	186
S14	MANPREET KAUR, KANSAL MUNISH: A cubic class of iterative procedure for finding the generalized inverses	187
S14	AMINE EL HARFOUF: Heat Transfer analysis on Steady MHD casson nanofluid (Cu+Water) flow past between an isothermal parallel plates geometry Considering Thermal Radiation, Magnetic and Viscous Dissipations Effects via Cattaneo-Christov's approach	188
S14	ILYES ABERAOUZE: Harmonic curvature on Lie groups	189
S14	LAHCEN BOUGHROUM: Identifiability and sensitivity analysis of singular inverse problems arising from partial differential equations in Banach spaces	190
S14	YOUSSEF ELGUENNOUNI, MOHAMED HSSIKOU, JAMAL BALITI, YOUNES OULAHOU, MOHAMMED ALAOUI, HEAT TRANSFER OF NANOFLUID IN A CUBIC CAVITY: Heat Transfer of Nanofluid in a Cubic Cavity	191
S14	GHIZLANE DIKI, ELHOSSINE AZROUL, SARA BOUDA, MOHAMMED GUEDDA: Exploring the interplay between memory effects and vesicle dynamics: Exact analytical solutions	192
S15	MOHSINE JENNANE, KALMOUN EL MOSTAFA: Robust bi-level programming problems	193
S15	FATIMA EZZAHRA FIKRI: Modelling the Adaptive Immune Response in an HBV Infection Model with Virus to Cell Transmission in Both Liver with CTL Immune	194

Response and the Extrahepatic Tissu With Therapy

S15	HAJAR SADKI, KARAM ALLALI: Two metaheuristics for the no-idle permutation flow shop scheduling problem with makespan criterion.	195
S15	HAKIMA LASSAL, BENHARRAT BELAIDI: Growth of Meromorphic Solutions of Complex Linear Differential-Difference Equations	196
S15	OMAR HAMMOUTI: Anisotropic discrete boundary value problems	197
S15	ABDELLAH HAMIDI, EL AMROUSS ABDEL RACHID, KISSI FOUAD: Existence results for some Anisotropic Singular problems via the sub-supersolution method	198
S15	NOREDDINE MAKRAN, HAMMOUTI OMAR, TAARABTI SAID: A fixed points results for multivalued mappings in Hausdorff fuzzy b-metric spaces and Applications	199
S15	AICHA SAKHRI: Initial-boundary Value Problem with a Nonlocal Condition for a Nonlinear Fractional Differential Equation	200
S15	LITIKA RANI, KANSAL MUNISH: An efficient class of numerical methods with multidimensional generalization for solving systems of nonlinear models	201
S15	ZAKARIA LAMINE, MY ISMAIL MAMOUNI: Persistent homology, visualization of the characteristic length 2JOX	202
S15	HANANE ZAHRAOUI, ZIANI MOUHAMED: Image classification and segmentation for brain tumor prognosis using DCNN	203
S15	DJAOUIDA GUETTAL: Méthode de recouvrement non-uniforme d'optimisation globale	204
S15	HANI HAFIDI: solving transient infiltration flow with an imposed flux boundary using Localized meshless method.	205
S15	OSMAN TUNÇ: Novel Results on Qualitative Problems of Integro-Differential Equations	206
S15	NASSIRA MADANI, ZAKIA HAMMOUCH, ELHOUSSINE AZROUL: The Optimal Control Strategy of New Model of HIV/AIDS Transmission Based on Caputo-Fabrizio Derivative Order	207
S15	SAFAE L'KIMA, ELHOUSSINE AZROUL, ABDELOUAHED ALLA HAMOU: Analysis of the impact of migration using the SIA fractional model	208
S16	SEMA YAYLA: Robustness of a Tumor Growth Model	209
S16	FATIMA-EZZAHRA BOURHIM, M'HAMED ELOMARI, ALI EL MFADEL: Coupled systems of fractional evolution equation involving rho-Caputo fractional derivative	210
S16	ABDELMJID BENMERROUS, LALLA SAADIA CHADLI, ABDELAZIZ MOUJAHID, SAID MELLIANI: Generalized Solutions for Semilinear Fractional Evolution Equations	211
S16	ABDELAZIZ SABIRY, SAID MELLIANI, ABDERRAZAK KASSIDI: Existence of Renormalized Solutions for $p(x)$ -Parabolic Equations with General Data and Perturbed Terms	212
S16	IHYA TALIBI, BRAHIM EL BOUKARI, JALILA EL GHORDAF: Existence and uniqueness of solutions of nonlinear Langevin fractional differential equation	213
S16	GHIZLANE ZINEDDAINE, MELLIANI SAID, KASSIDI ABDERRAZAK: Periodic Solutions for Parabolic Fractional p -Laplacian Problems Via Topological Degree	214

	HAMZA JOURHMANE, KASSIDI ABDERRAZAK, HILAL KHALID, ELOMARI	
S16	M'HAMED: Existence of non-negative periodic solutions for a degenerate double phase Laplacian parabolic equation with strongly nonlinear source	215
S16	LATIFA EL BEZDAOUI: Generalized solutions of the Cauchy problem	216
S16	EL MEHDI IBRAHIMI, KHALID HILAL, AHMED KAJOUNI: Existence and uniqueness of the solution of a conformable fractional problem with a non-local condition	217
S16	LHOUCINE HMIDOUCH: Optimization method for a nonlinear elliptic problem in weighted Sobolev spaces with variable exponent.	218
S16	AHMED ABERQI: Obstacle Two Phase Equations with Hardy Potential	219
S16	MOHAMED KNIFDA: On a class of double phase problem involving potentials terms	220
S16	OMAR BENSLIMANE, AHMED ABERQI, JAOUAD BENNOUNA: Existence results of a new class of double phase problems	221
S16	AHMED EL OUARDANI, ABERQI AHMED, EL MASSOUDI MHAMED: Solvability of non linear parabolic systems in Musielack-spaces	222
S16	HOURIA EL-YAHYAOU, ELHOUSSINE AZROUL, ATHMANE BOUMAZOURH: Three solutions for a fractional $(p(x, \cdot), q(x, \cdot))$ -Kirchhoff type elliptic system	223
S16	NEZHA KAMALI, ELHOUSSINE AZROULL, MOHAMMED SHIMI: On a class of $p(x, \cdot)$ -integro-differential Kirchhoff-type problem with singular kernel	224
S17	MHAMED ELMASSOUDI, AHMED ABERQI, OMAR BENSLIMANE, MARIA ALESSANDRA RAGUSA: Nonnegative solution of a class of double phase problems with logarithmic nonlinearity	225
S17	KAWTHER AL ARFAJ: Lagrange RBF and Multilevel Lagrange RBF methods for the solution of elliptic BVPs	226
S17	HAJAR TALBI, FRANCISCO ORTEGÓN GALLEGRO, MOHAMED RHOUDAF: Analysis and numerical simulation of a system of two coupled nonlinear elliptic equations	227
S17	HAYAT BENKHALOU, MOHAMED BADR BENBOUBKER, HASSANE HJIAJ: Solutions in sense of distributions for anisotropic elliptic Neumann problem with data in $L^m(\Omega)$	228
S17	YOUSSEF HAJJI, HJIAJ HASSANE: Entropy solutions for some strongly noncoercive parabolic problems in anisotropic sobolev spaces	229
S17	RAJAE ZEROUALI, BOUCHAIB FERRAHI, HASSANE HJIAJ: Entropy solutions for some quasilinear and non-coercive unilateral elliptic problem	230
S17	CEMIL TUNÇ, MERVE ŞENGÜN: Ulam stabilities of nonlinear Volterra integro-differential equations	231
S17	KARIMA CHATOUH: Skew cyclic Linear codes over $R=R+wR+w^2 R$	232
S17	MOHSSINE OU-MHA, MOHAMED OUKESSOU, ABDERRAHMANE RAJI: Fuzzy Near-rings Involving Fuzzy Binary Operations	233
S17	ABDERRAHMANE RAJI: Jordan Ideals via Multiplicative Derivations and Commutativity in 3-Prime Near-Rings	234

S17	ABDELHADI ZAIM: Relaxed relative Hilali conjecture	235
S17	SANDRA FERREIRA: Moments and cumulants beyond the fourth order for additive models	236
S17	HAMID BEN YAKKOU: Common index divisor in number fields	237
S17	ABDELALI GRINI, CHILLALI ABDELHAKIM, ELHAMAM MOHA BEN TALEB: Twisted Hessian curves over the ring $F_q[X] / (X^n)$	238
S18	MOHAMED LADIB, AZIZ OUHINO: Extension of the next generation approach to a class of discrete epidemic models	239
S18	MANAL MENCHIH: Chaos analysis of fractional Lasota equation	240
S18	SAMIRA ZERBIB, HILAL KHALID, KAJOUNI AHMED: Existence and approximation of positive solutions of hybrid fractional differential equations with nonlocal condition	241
S18	ADIL ZIRAOU: Stability of reinforced concrete structure under seismic loads	242
S18	AYOUB SAKKOU: Discrete mathematical modelling and optimal control of a spatiotemporal prey-predator three species fishery model	243
S18	ALHABIB MOUMNI: Linear boundary stabilization for a degenerate and singular Schrödinger equation	244
S18	ZOUBIDA ECH-CHAFFANI, AHMED ABERQI, TOURIA KARITE: Approximate controllability of fractional neutral evolution systems with Riemann-Liouville fractional derivatives	245
S18	SARA MOUNTASSIR, MAAROUF HAMID, MANIAR LAHCEN: The uniqueness problem of canonical forms for linear multi-variable systems	246
S18	MOHAMED OUHAFSA, EL HASSAN ZERRIK, ABDERRAHMAN AIT AADI: Bilinear boundary optimal control problem of semilinear parabolic equations	247
S18	MOHAMED RIDOUAN AMATTOUCH: A modified fixed point method for the pattern formation model	248
S18	MOHAMED ELYAHYAOU, SAIDA AMINE: Mathematical modelling of unemployment with cyclical reforms	249
S18	AZIZA AIB: Optimal Control of Infinite Dimensional Bilinear Systems and its Relation to Heisenberg Groups	250
S18	SOUFIANE EL YASSARI, ABDELOUAFI EL GHOULBZOURI: Numerical simulation of fiber-reinforced concrete under cyclic loading using XFEM and concrete damaged plasticity	251
S18	ISAAC TAKAIDZA: Modelling and control of workaholism dynamics	252
S18	ABDESSAMAD ELALAMI, ZOUBIDA ECHCHAFFAN, ABERQI AHMED: Stabilization for an infinite-dimensional semilinear system in Banach space	253
S19	SOUFIANE EL KHAIAR: Global dynamics of a generalized SEIR epidemic model	254

S19	HIBA EL ASRAOUI: Non-linear age dependent population dynamics with spatial diffusion	255
S19	ABDERRAHMAN EL GMAIRI: SIR Epidemic Model With Fabrizio Caputo Derivative	256
S19	CHAIMAA RIAHI, IMANE AGMOUR, EL FOUTAYENI YOUSSEF: Impact of Temperature on profit estimation of two fishermen exploiting three competing species using Markov chain	257
S19	YOUSSEF JABRANI: Optimal control of a new corona virus model	258
S19	MOHAMED MEHDAOUI, LAMRANI ALAOUI ABDESSLEM, TILIOUA MOUHCINE: Dynamics of a novel SVIR model with stochastic perturbation and incorporation of vaccine boosters	259
S19	HANANE HMARRASS, REDOUAN QESMI: Impact of Antiretroviral Therapy Strategies against HIV Pathogenesis with Macrophages and CD4+T Reactivation of Latent Reservoirs	260
S19	MOHAMED AALLAM, TAHITI MOSTAFA, MOULAY RCHID SIDI AMMI: Global stability of a diffusion Epidemic	261
S19	ABDERRAHIM EL YAZZAOU, AMINA KHARCAHF, ABDEAALI RAHMOUNI: Feasibility of using a novel shielding design in intensity modulated brachytherapy	262
S19	ZAKARIA YAAGOUB, KARAM ALLALI: Fractional HCV infection model with adaptive immunity and treatment	263
S19	MARYA SADKI, KARAM ALLALI: Stochastic SIR epidemic model with vaccination strategy	264
S19	BILAL HARCHAOUI: Stochastic SIRI epidemic model with global incidence rate and relapse	265
S19	SALOUA BOUTOUIL: Stochastic SIRS model with jump perturbation	266
S19	LOTFI NOHAIR, ABDERRAHIM EL ADRAOUI, ABDELWAHID NAMIR: Solving Job-Shop Scheduling Problems by new metaheuristics	267
S19	RACHID EL IDRISSE, LAFHIM LAHOUSSE, OUAKRIM YOUSSEF: Optimality conditions for non-convex generalized bilevel optimal control problems	268
S20	EL HASSAN AATIF, EL MOUATASIM ABDELKARIM: American option pricing under generalized Black-Sholes type model	269
S20	MOHAMED EL MAAZOUZ, SANI AHMED: Time dependent copula for stochastic processes	270
S20	CHEIKH GUEYE, TOUMBOU BABACAR, DIOUF ABDOULAYE: Mathematical modeling of the demographic dividend capture applied in economy	271
S20	AYOUB KYOUD, CHERIF EL MSIAH, JAOUAD MADKOUR: Modelling Systemic Risk: The case of Moroccan banks	272
S20	SOUMAYA BIDAHA: Oil price prediction using machine learning models	273
S20	NEZHA MOHAOUI, MONIR ABDELILAH, MRAOUI HAMID: Probability Density Function estimation based on local spline method	274

S20	MOHAMMED ALAMI CHENTOUFI, ANISS AIT ALLA, JAOUAD LAAMIRE, OMAR ZIRARI: L'impact de l'ISR sur l'indice composite de performance financière	275
S20	MOURAD MAAROUF: Study of the volatility and the phenomenon of persistence of shocks in the Moroccan financial market: Model ARFIMA (p; d; q)-EGARCH (p; q)-M	276
S20	EDI SUPRIYADI, TURMUDI, JARNAWI AFGANI DAHLAN, DADANG JUANDI: Bibliometric Analysis of Ethnomathematics in Classroom	277
S20	YASSIR MATA, AQALMOUN MOHAMED: The Homogeneous Spectrum of A G-graded Commutative Ring	278
S20	AKRAM CHAHID BAGY: Tikhonov regularization of heavy ball method driven by a hessian term. New results of convergence	279
S20	RIM GOUIA: Inversion of a class of parabolic Radon transforms	280
S20	MOUSSA FALL, CAMARA MOUSTAPHA, SALL OUMAR: Algebraic points of degree at most 14 on the Fermat septic	281
S20	CHERIF MAMINA COLY, MOHAMADOU MOR DIOGOU DIALLO, OUMAR SALL: Points algébriques de degré donné quelconque sur la courbe d'équation affine: $y^2=6x(x^4+3)$.	282
S20	ABDESSMAD FADIL, BOUFI KARIMA, ROUBI AHMED: A Sequential Upper Parametric Approximation Method for Generalized Fractional Programs	283
S21	YOUNES ABOUELHANOUNE: Mathematical modeling of a fractal contact law in granular materials	284
S21	NAJAT CHEFNAJ, KHALID HILAL, AHMED KAJOUNI: Existence and Uniqueness of Mild Solution to Nondense Impulsive Conformable-Fractional Cauchy Problems with Nonlocal Condition	285
S21	SALOUA CHOINGOU: A survey on derivations of a Sullivan model	286
S21	FARID AFKIR, ELBOUR AZIZ: Weak limited sets and operators on Banach lattices	287
S21	NADIA ASSILA, SAMIR KABBAJ: Some results about operator perturbation of fusion frame	288
S21	ROUMAISAE EL JAZZAR: Douglas' Factorization theorem and atomic system in Hilbert pro-C*-modules	289
S21	HAFIDA MASSIT, ROSSAFI MOHAMED: Fixed point theorem for (ϕ, f) contraction on C*-algebra valued partial metric spaces	290
S21	SANAA BOUMNIDEL, A.ELKADDOURI, K.BOURAS, O.ABOUTAFAIL: A Study on uaw weak*-DUNFORD-PETTIS operators	291
S21	ALI OUKHOUYA: On Local Topological Algebras	292
S21	HASSAN KHABAOU: Contribution on L-weakly compact sets and operators	293
S21	DJALAL OUNADJELA: The Perturbation Classes Problem of Left (resp. right) g-Drazin Invertible Operators	294

S21	KENZA BENKIRANE, ABDERRAHIM ELADRAOUI, SAMIA BENNANI: Fixed point theorem in the variable sequence spaces with graph	295
S21	ABDELHAK EL HADDOUCHI, ESSAADAOU MUSTAPHA, MARZOUKI BRAHIM: A generalized common fixed point theorem in modular b-metric spaces and application	296
S21	ADIL EL-GHABI: Random Fixed Point Theorems for Monotone Random Operator with Application to Random Differential Equations in Ordered Banach Spaces	297
S22	NORDINE LATIFI, EL HARAMI MOHAMED: on representation and convergence of set-valued Aumann-Pettis integrable martingales	298
S22	NADIA MAKHLOUKI, NAFIDI AHMED, ACHCHAB BOUJEMÂA: Statistical inference for a new inhomogeneous Gompertz diffusion process with application	299
S22	ABDENBI EL AZRI, NAFIDI AHMED: A link between the Gompertz and Vasicek Interest Rate Diffusion Models	300
S22	DRISS EL AMALKI, KADDAR ABDELILAH, BENIICH NADIA: A Comparative Analysis of SEM Software and packages: An evaluation of Amos, SmartPLS, Semopy, Mplus, and R packages Sem and Lavaan	301
S22	CRISTINA DIAS: STATIS Method: application to different types of data	302
S22	ZAKARIYAE TAJANI, CHAKIR TAJANI, MOHAMED SABBANE: Application of AHP Procedure for measuring the Security of Energy Supply - case of Morocco	303
S22	MARIAM AARRAS, EL MEROUANI MOHAMED: Inférence statistique pour des processus stochastiques markoviens de diffusion	304
S22	MOHAMMED BENMOUMEN, SALHI IMANE: Machine Learning for forecasting some stock market index	305
S22	MARIE REINE ANGELE KAKPO , MAMADOU ABDOUL DIOP, MARIAM B TRAORE, CARLOS OGOUYANDJOU: Existence results for Infinite Delays Neutral Stochastic Integro-differential System with Poisson Jumps	306
S22	ZAFER BEKIRYAZICI: Investigation of COVID-19 Dynamics in Turkey with Real Data and Stochastic Simulations	307
S22	YASSINE CHAKROUNE: A Stochastic Rayleigh diffusion process: Parameters estimation and simulation.	308
S22	HADJER KEBIR: The Recursive Conditional Hazard Function Estimator For Censored Functional Ergodic data	309
S22	ABBASSIA BENCHIHA: Functional regression and their estimation with missing data at random	310
S22	ADITYA CHAKRABORTY: A Simulation based Empirical Bayesian Approach for Breast Cancer Patients	311
S23	ABDELLAH AIT ELOULI, EL MEHDI CHERRAT, HASSAN OUAHI: Sentiment Analysis from texts written in standard Arabic and Moroccan dialect	312
S23	JAAFAR JAAFARI, DOUZI SAMIRA, DOUZI KHADIJA: Accurate and Efficient Breast Cancer Prediction using a Lightweight Deep Learning Model with Spatial Attention	313
S23	FATIMA ZAHRAE EL-HASSANI, KHALID HADDOUCH: A New Model Based on Genetic Algorithms for Multilayer Perceptron Neural Network Hyper-parameters Optimization	314

S23	MERYAM BENLAHLAL, KARIMA AISSAOUI, MOHAMMED BERRADA: Educational Data Mining and Learning Analytics: Literature review	315
S23	EL MEHDI CHOUIT, MOHAMED RACHDI, MOSTAFA BELLAFKIH, BRAHIM RAOUYAN: COVID-19 in Morocco: an epidemiological case study	316
S23	SOUKAINA MIHI: An improved ACO algorithm for multi-dialectal sentiment analysis	317
S23	SOUMAYA EL JANOUS: Etude De La Vulnérabilité Sismique Des Bâtiments Dans La Zone D'Al Hoceima	318
S23	MERYEM AMEUR, DAOUI CHERKI, IDRISSE NAJLAE: Medical images segmentation	319
S23	DJALAL RAFIK HAMMOU, AKRAM RAIS, SANAA CHABANE: Detect Plant Diseases In Smart Farms Using The Deep Learning Tool	320
S23	IMANE BENALLOU, ABDELLAH AZMANI, MONIR AZMANI: Analyse prédictive du risque d'apparition de troubles psychiatriques chez les chauffeurs de poids lourds à l'aide d'un approche bayésienne floue	321
S23	ISMAIL ASSOJAA: Multi users pairing based cryptography with diffie-Hellman key exchange	322
S23	HASSAN BENNANI, SAOULI AZIZ: Exploring new strategies to improve data centers efficiency: A survey	323
S23	FATIMAEZZAHRA LAGHRISSE, DOUZI SAMIRA, DOUZI KHADIJA: Investigating the Effectiveness of Transformer-Based Intrusion Detection Systems through Advanced Feature Engineering Techniques: A PCA and SHAP Values Analysis	324
S23	ABDELLATIF BEKKAR, BADR HSSINA, SAMIRA DOUZI, KHADIJA DOUZI: Low-cost air pollution monitoring IoT platform: A Case Study of Inezgane-Ait Melloul (Southwestern Morocco)	325
S23	YOUSRA AMAZOU, ABDELLAH AZMAN, MONIR AZMANI: Using NLP for the design of a legal contract processing model	326
S23	MOHAMED-AKRAM LAMHOUR, MSALEK MOHAMED, GHAZOUANI MOHAMED, ARDCHIR SOUFIANE; AZZOUAZI MOHAMED: Toward smart irrigation systems using IoT and AI	327
S23	MOHAMED MEFTAH, SOUMAYA OUNACER, MOHAMED AZZOUAZI : Association Rules for Understanding Consumer Behavior: A Comparative Analysis	328
S23	FATIMA ZAHRA FANDI, GHAZOUANI MOHAMED, MOHAMED AZZOUAZI: Detection and diagnosis of leaf Diseases in plants	329
S23	KHALIL NAMIR, EL HABIB BENLAHMAR: Big Data : Graphes, Web et Sécurité des données	330

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Entropy solutions for strongly nonlinear elliptic problems having large monotonicity with measure data in weighted Orlicz-Sobolev spaces

Communication Info

Authors:

Nourdine EL AMARTY¹
Badr EL HAJI²
Mostafa EL MOUMNI¹

¹ EDP-CS, Faculty of sciences,
Chouaib Doukkali university,
El Jadida -Morroco

² Laboratoire LaR2A, Faculty
of sciences, Abdelmalek
Essaadi university, Tétouan –
Morroco

Keywords:

(1) Entropy solutios

(2) Orlicz-Sobolev

Abstract

We prove in weighted Orlicz-Sobolev spaces, the existence of entropy solution for a class of strongly nonlinear elliptic equations of the type

$$-div(\rho(x)a(x, u, \nabla u)) + g(x, u) = f - div F$$

where $(u) = -div(\rho(x)a(x, u, \nabla u))$ is a Leray-Lions type, with large monotonicity condition, ρ be a weight function on Ω , g is a Carathéodory function, $F \in (C^0(\mathbb{R}))^N$ and $f \in L^1(\Omega)$.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] R. Adams; *Sobolev spaces*, Academic Press, NewYork 1975.
- [2] E. Azroul and A. Benkirane; *Existence result for a second order nonlinear degenerate elliptic equation in weighted Orlicz-Sobolev spaces*. Lecture Note in Pure and Applied Mathematics, Vol 229,111-124 (2002).
- [3] A. Benkirane, M. El Moumni and K. Kouhaila; *Solvability of strongly nonlinear elliptic variational problems in weighted Orlicz-Sobolev spaces* SeMA Journal, 1-24.(2020),77:119-142.
- [4] N. El Amarti and B. El Haji and M. El Moumni; *Existence of renormalized solution for nonlinear Elliptic boundary value problem without Δ_2 -condition*, SeMA Journal. Vol 77, Issue 4 December(2020), pp 389 - 414.
- [5] G.J Minty; *On a monotonicity method for the solution of non-linear equations in Banach spaces*, Proc. Nat. Acad. Sci. U.S.A. 50 (1963), 1038-1041.
- [6] J.-P. Gossez, *Some approximation properties in Orlicz-Sobolev spaces*, Studia Math. 74 (1982), no. 1, 17-24.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Isogeometric Analysis of 3D Heat Conduction

Communication Info

Authors:

Rachid BOUNA¹

Nouh IZEM¹

M Shadi MOHAMED²

Mohammed SEAID³

¹Laboratory of Mathematical Engineering and Computer Science, Faculty of Science, University Ibn Zohr, Agadir, Morocco.

²School of Energy, Geoscience, Infrastructure and Society, Heriot-Watt University, Edinburgh, UK.

³School of Engineering and Computing Sciences, University of Durham, Durham, UK.

Keywords:

(1) Heat conduction

(2) Finite element method

(3) Isogeometric analysis

(4) Implicit Runge-Kutta schemes

Abstract

We propose a high-order isogeometric analysis of 3D heat conduction problems which occur in many applications in structural engineering. The geometry is constructed exactly using high-order Non-Uniform Rational B-spline functions which are integrated in finite element analysis to represent the temperature. An implicit Runge-Kutta scheme is used for the time integration eliminating restrictions related to the explicit time stepping. The combined techniques ensure high accuracy for the thermal distributions in the 3D heat conduction problems. We examine the performance of the proposed method for solving a heat conduction problem in a solid shaft and the obtained results demonstrate that our method is stable, efficient, simple and strongly reduces the number of degrees of freedom to achieve a prescribed accuracy with a reasonably large time step.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] T.J.R. Hughes, J. A Cottrell, and Y. Bazilevs. Isogeometric analysis: CAD, finite elements, NURBS, exact geometry and mesh refinement. *Computer methods in applied mechanics and engineering*, 194(39-41):4135–4195, 2005.
- [2] A.V. Vuong, Ch. Heinrich, and B. Simeon. ISOGAT: A 2D tutorial MATLAB code for Isogeometric Analysis. *Computer Aided Geometric Design*, 27(8):644–655, 2010.
- [3] R. Bouna, N. Izem, M. Seaid, and M.S. Mohamed. High-order methods for thermal behaviour of plate structures with internal heat sources. *Proceedings of the Institution of Mechanical Engineers, Part C: Journal of Mechanical Engineering Science*, 2022.
- [4] R. Santos and L. Alves. A comparative analysis of explicit, IMEX and implicit strong stability preserving Runge-Kutta schemes. *Applied Numerical Mathematics*, 159:204–220, sep 2021.
- [5] L. Piegl and W. Tiller. *Nurbs Book*. 1997.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Interpolation of Scattered Data Sets on a surface through a Shepard-like technique

Communication Info

Authors:

Benaissa ZERROUDI¹

¹ *Laboratory of Engineering Sciences,
Faculty of Science, Ibn Zohr
University, Agadir, Morocco*

Keywords:

- (1) Scattered data interpolation
- (2) Multivariate Approximation
- (3) Manifolds approximation

Abstract

This research contributes to the literature on scattered interpolation on general surfaces through Shepard-like techniques. Where, we present an interpolation problem of a function given on arbitrarily distributed points on the general surfaces in R^3 , by proposing an extension to the Shepard method and its modified version to surfaces. Each proposed operator is a linear combination of basis functions whose coefficients are the values of the function or its Taylor of first-order expansions at the interpolation points using both functional and derivative data. Numerical tests are given to show the interpolation performance, where several numerical results show the good approximation accuracy of the proposed operator.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Francesco Dell'Accio, Filomena Di Tommaso, Otheman Nouisser, and Benaissa Zerroudi. Fast and accurate scattered hermite interpolation by triangular shepard operators. *Journal of Computational and Applied Mathematics*, 382:113092, 2021.
- [2] Peter Alfeld, Marian Neamtu, and Larry L Schumaker. Fitting scattered data on sphere-like surfaces using spherical splines. *Journal of Computational and Applied Mathematics*, 73(1-2):5-43, 1996.
- [3] William I. Thacker, Jingwei Zhang, Layne T. Watson, Jeffrey B.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Study of Numerical STABILITY AND BIFURCATION ANALYSIS IN A SYSTEM OF NEUTRAL DIFFERENTIAL EQUATIONS

Communication Info

Authors:

Ahmed Moussid¹

¹Laboratoire des Sciences Appliquées (LSA) de l'école nationale des sciences appliquées d'Al Hoceima, de l'Université Abdelmalek Essaâdi Maroc.

Keywords:

- (1) Neutral differential equation
- (2) system neutral delay differential equations
- (3) Asymptotic stability and Hopf bifurcation

Abstract

Neutral Delay Differential Equations (NDDEs) is a natural generalization of Delay Differential Equations (DDE) and, also there is a wide classes of partial Differential Equations witch can be transformed as a NDDEs (for example [1] and the references therein). In this communication, we a present studies numerical asymptotic and Hopf bifurcations occurs at the origin in certain system neutral delay differential equations by θ -Method discretization for θ in $(0,1)$. We give necessary and sufficient conditions on the parameters, to obtain the numerical asymptotic stability, preserving the theories asymptotic stability conditions in [2] and [3]. Finally, some numerical simulations examples are carried out to support the analytic results.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Rodrigues SA. Stabilité des systèmes à retard de type neutre. Institut National Polytechnique de Grenoble, 2003.
- [2] M. Liu and X. Xu, Bifurcation Analysis in a Two-Dimensional Neutral Differential Equation, Hindawi Publishing Corporation Abstract and Applied Analysis Volume 2013, Article ID 367589.
- [3] A Moussaid, T A Hamad Stability and Bifurcation Analysis in a Two-Dimensional Neutral Differential Equation. Discontinuity, Nonlinearity, and Complexity 8(4) (2019) 391--402 | DOI:10.5890/DNC.2019.12.004.
- [4] C. Wang and J. Wei, "Hopf bifurcation for neutral functional differential equations", Nonlinear Ana-lysis : Real World Applications, vol. 11, no. 3, (2010) 1269-1277.
- [5] Y. Qu, M. Y. Li, and J. Wei, "Bifurcation analysis in a neutral differential equation", Journal of Mathematical Analysis and Applications, vol. 378, no. 2, (2011) 387-402.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023,| Casablanca, Morocco



Numerical modelling of the flow of a resin through a fibrous media: application to the RTM process

Communication Info

Authors:

Hamza BOULLOUZ¹
Imad KISSAMI¹
Imad El MAHI^{1,2}

¹*MSDA, Mohammed VI
Polytechnic University Lot 660,
43150 Ben Guerir, Morocco*
²*ENSAO, LMCS, Complexe
Universitaire, B.P. 669, 60000
Oujda, Morocco*

Keywords:

- (1) RTM process
- (2) Numerical simulation
- (3) VOF, FVM
- (4) HPC-programming.

Abstract

In this study, a new simulation method for modelling the resin transfer molding (RTM) process has been developed by utilizing the Finite Volume Method and the Volume of Fluid (VOF) method. The RTM process is widely used to produce fiber-reinforced materials. The proposed method utilizes Manapy which is a parallel-based framework to solve partial differential equations using finite-volume on unstructured grids to accurately predict the resin filling and curing behavior. The simulation results are validated against analytical solutions and show excellent agreement. This simulation method provides valuable insights into the RTM process, allowing for optimization of process parameters, reducing the need for physical prototypes, and improving the efficiency of the RTM process.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] J. A. Garcia, Ll. Gascón, and F. Chinesta. "A fixed mesh numerical method for modelling the flow in liquid composites moulding processes using a volume of fluid technique". In: *Computer Methods in Applied Mechanics and Engineering* 192 (Feb. 2003), 877–893. DOI: 10.1016/S0045-7825(02)00604-7.
- [2] I.Kissami, A.Ratnani: Manapy: MPI-Based framework for solving partial differential equations using finite-volume on unstructured-grid. arXiv:2203.00925, (2022)

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



On the existence of a weak solution for a nonlinear elliptic system involving the $(p(x), q(x))$ -Laplacian-like operators

Communication Info

Authors:

Soukaina YACINI¹

Khalid HILAL¹

Chakir ALLALOU¹

*1 Laboratory LMACS, FST of
Beni Mellal, Sultan Moulay
Slimane University, Beni
Mellal, Morocco*

Keywords:

(1) $(p(x), q(x))$ -Laplacian-like operators;

(2) Variable-exponent Sobolev spaces

(3) Topological degree methods.

Abstract

The study of the partial differential and variational problems with nonstandard $p(x)$ -growth conditions has been an interesting topic, which arises from nonlinear electrorheological fluids, image processing and mathematical biology [2,3].

In this communication, we discuss the existence of at least one weak solution. For a class of nonlinear elliptic system with $(p(x), q(x))$ -Laplacian-like operators. Using the Topological degree method introduced by Berkovits in [1].

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] J. Berkovits, Extension of the Leray–Schauder degree for abstract Hammerstein type mappings. *J Differ Equ.* 2007;234:289-310.
- [2] Y. Chen, S. Levine, M. Rao. Variable exponent, linear growth functionals in image restoration. *SIAM J. Appl. Math.* 2006;66:1383-1406.
- [3] M. Ruzicka, Electrorheological fluids: modeling and mathematical theory. *Lecture Notes in Mathematics*, Berlin Springer Verlag; 2000.
- [4] S.Yacini, A. Abbassi, C. Allalou and A. Kassidi, (2023). On a Nonlinear Equation $P(x)$ - Elliptic Problem of Neumann Type by Topological Degree Method. In *International Conference on Partial Differential Equations and Applications, Modeling and Simulation* (pp. 404-417). Springer, Cham
- [5] S. Heidari, A. Razani, Infinitely many solutions for $(p(x), q(x))$ -Laplacian-like systems. *Communications of the Korean Mathematical Society*, (2021). 36(1), 51-62.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Solving second-order differential equations with fuzzy boundary conditions

Communication Info

Authors:

Tarik Aslaoui¹
Bouchra BEN AMMA²
Said MELLIANI¹
Lalla Saadia CHADLI¹

¹LMACS, Faculty of Sciences
and Technologies, Sultan
Moulay Slimane University,
Beni Mellal, Morocco.

²LMACS, Higher School of
Education and Training, Sultan
Moulay Slimane University,
Beni Mellal, Morocco.

Keywords:

- (1) Fuzzy solution.
- (2) Fuzzy initial value
problem.
- (3) Fixed Point.

Abstract

In this paper, second-order fuzzy differential equations with initial value conditions are considered. The sufficient conditions are provided to establish the existence results of fuzzy solutions for second order differential equations and an example is provided to illustrate the result.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] K. T. Atanassov, Intuitionistic fuzzy sets. VII ITKR's session, Sofia (deposited in Central Science and Technical Library of the Bulgarian Academy of Sciences 1697/84), (1983).
- [2] K. T. Atanassov, Intuitionistic fuzzy sets, Fuzzy Sets and Systems, Vol.20, pp.87-96 (1986).
- [3] B. Ben Amma, S. Melliani & L. S. Chadli, Intuitionistic Fuzzy Functional Differential Equations, Fuzzy Logic in Intelligent System Design : Theory and Applications, Ed. Cham : Springer International Publishing, pp.335-357 (2018).
- [4] Ceylan T., Altın, sık N., Eigenvalue problem with fuzzy coefficients of boundary conditions, Scholars Journal of Physics, Mathematics and Statistics, 5(2), pp.187-193(2018).
- [5] N. Gasilov, S. E. Amrahov, A. G. Fatullayev and A. Khastan, A new approach to fuzzy initial value problem, 18 (2), pp.217-225 (2014).
- [6] S L. Jamshidi and L. Avazpour, Solution of the Fuzzy Boundary Value Differential Equations under Generalized Differentiability by Shooting Method, pp.1-19(2012).
- [7] L. A. Zadeh, Fuzzy sets, Inf. Control, 8(3), pp.338-353 (1965).

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



On new solutions of intuitionistic fuzzy differential equations

Communication Info

Authors:

Bouchra BEN AMMA¹

Said MELLIANI²

Lalla Saadia CHADLI²

¹LMACS, Higher School of Education and Training, Sultan Moulay Slimane University, Beni Mellal, Morocco.

²LMACS, Faculty of Sciences and Technologies, Sultan Moulay Slimane University, Beni Mellal, Morocco.

Keywords:

(1) Intuitionistic fuzzy number.

(2) Intuitionistic fuzzy solutions.

(3) Fixed Point.

Abstract

In this paper, we consider the intuitionistic fuzzy differential equations with boundary conditions using the concept of generalized differentiability. The necessary and sufficient conditions for the existence of intuitionistic fuzzy solutions are presented. A numerical example is provided to show the effectiveness of the proposed theory.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] K. T. Atanassov, Intuitionistic fuzzy sets. VII ITKR's session, Sofia (deposited in Central Science and Technical Library of the Bulgarian Academy of Sciences 1697/84), (1983).
- [2] K. T. Atanassov, Intuitionistic fuzzy sets, Fuzzy Sets and Systems, Vol.20, pp.87-96 (1986).
- [3] B. Ben Amma, S. Melliani & L. S. Chadli, Intuitionistic Fuzzy Functional Differential Equations, Fuzzy Logic in Intelligent System Design : Theory and Applications, Ed. Cham : Springer International Publishing, pp.335-357 (2018).
- [4] S. Melliani, L. S. Chadli, Introduction to intuitionistic fuzzy partial differential equations, Notes on Intuitionistic Fuzzy Sets 7, pp.39-42 (2001).
- [5] A. Norazrizal, A. R. and M. Zaini, A.: Solution of fuzzy partial differential equations using fuzzy Sumudu transform. AIP Conference Proceedings 1775 (2016).
- [6] L. A. Zadeh, Fuzzy sets, Inf. Control, Vol.8, No.3, pp.338-353 (1965).

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



On Newton's law of cooling with time delay and Ψ Caputo fractional derivatives

Communication Info

Authors:

Naoufel Hatime¹
Said Melliani¹
M'hamed Elomari¹
Ali El Mfadel¹

¹Laboratory of Applied
Mathematics and Scientific
Computing, Sultan Moulay
Slimane University, Beni Mellal,
Morocco

Keywords:

- (1) Newton's law of cooling
- (2) Ψ -Caputo fractional derivative
- (3) modelling nature
- (4) delay

Abstract

For decades, ordinary differential equations (ODEs) have been efficiently and frequently used to model many real world phenomena.

In this work we study a delayed Newton's Law of Cooling [4,9] involving Ψ -Caputo fractional derivative [1] of lower limit zero and of order α belong to $(0, 1)$, we prove the existence and uniqueness of solution via two different methods: using fixed point theory [3] and a recent constructive approach [7,8], that help us to derive a sufficient condition for finite time stability [5] of our model. More importantly, the comparison of model predictions versus experimental data [6], classical model and non-delayed model [2] show the effectiveness of our proposed model with a reasonable precision.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Almeida, R.: Caputo fractional derivative of a function with respect to another function. Commun. Nonlinear Sci. Numer. Simul.44, 460– 481(2017)
- [2] Almeida, R.: What is the best fractional derivative to fit data?. Applicable Analysis and Discrete Mathematics. 11(2), 358–368 (2017)
- [3] Almeida, R.: Functional differential equations involving the Ψ -Caputo fractional derivative, Fractal and Fractional. 4(2), 1–10 (2020)
- [4] Davidzon, M.I.: Newton's law of cooling and its interpretation. Int J Heat Mass Transf. 21(55), 5397-5402 (2012)
- [5] Dorato, P.: Short time stability in linear time-varying systems. In: Proceedings of the IRE International Convention Record, Part. 5,83–87 (1961)
- [6] Giesecking, F.: Newton's Law of Cooling An Experimental Investigation, The University of Georgia, Mathematics Education, EMAT 4680/6680 Mathematics with Technology, Jim Wilson (2014)
- [7] Khusainov, D., Shuklin, G.: Relative controllability in systems with pure delay. Int. Appl. Mech.41(2), 210–221(2005)
- [8] Li, M., Wang, J. Finite time stability of fractional delay differential equations. Appl. Math. Lett. 64,170–176 (2017)
- [9] Newton, I.: The Mathematical Beginnings of Natural Philosophy Optics. Optical Lectures, (Selected Topics) Leningrad (1929)

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Sur certaine classe des équations de Navier-Stokes stochastiques avec la force de Coriolis

Communication Info

Authors:

Hassan KHAIDER¹
Chakir ALLALOU¹
Achraf AZANZAL,¹

¹LMACS, Sultan Moulay
Slimane University, FST, Beni
Mellal Morocco

Keywords:

- (1) équations de Navier-Stokes stochastiques avec la force de Coriolis
- (2) l'espace de Fourier-Besov
- (3) l'existence globale de la solution
- (4) l'intégrale d'Itô

Abstract

Les équations de Navier-Stokes est l'un des équations qui décrivent le mouvement des fluides. Les composants stochastiques dans les équations des mouvements sont couramment utilisés pour modéliser des petites perturbations ou fluctuations thermodynamiques présentes dans les écoulements de fluides. Dans ce travail, on va obtenir l'existence globale de la solution de certaine classe des équations de Navier-Stokes stochastiques avec la force de Coriolis dans les espaces de Fourier-Besov. Premièrement on va définir l'espace de Fourier-Besov et après dans le deuxième pas on donne l'estimation linéaire et bilinéaire de la solution avons d'appliquer l'intégrale d'Itô pour estimer la partie stochastique, et finalement on applique le théorème de point fixe de Banach qui garantit l'existence et l'unicité de la solution du problème considéré.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Azanzal, Achraf, llalou, Chakir, et Abassi, Adil. Well-posedness and analyticity for generalized Navier-Stokes equations in critical Fourier-Besov-Morrey spaces. *J. Nonlinear Funct. Anal.*, 2021, vol. 2021, p. 24 .
- [2] Breit, D. (2018). An Introduction to Stochastic NavierStokes Equations. In : Bulířek, M. Feireisl, E., Pokorný, M. (eds) *New Trends and Results in Mathematical Description of Fluid Flows*. NeEas Center Series. Birkhäuser, Cham.
- [3] J.-M. Bony. Calcul symbolique et propagation des singularités pour les équations aux dérivées partielles non linéaires. *Ann. Sci. École Norm. Sup. (4)*, 14(2) :209246, 1981.
- [4] Tissot, G., Cavalieri, A. Mémin, É. (2021). Stochastic linear modes in a turbulent channel flow. *Journal of Fluid Mechanics*, 912, A51. doi :10.1017/jfm.2020.1168.
- [5] Toumliline, Mohamed et AL-Abidine, Muhammad Zain. Well-posedness of the 3D Stochastic Generalized Rotating Magnetohydrodynamics Equations. *Advances in the Theory of Nonlinear Analysis and its Application*, vol. 6, no 4, p. 513-527.
- [6] Wang, W., Wu, G. : Global mild solution of the generalized Navier-Stokes equations with the Coriolis force. *Appl. Math. Lett.*, 76, 181-186 (2018).

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Global existence theorem for the generalized micropolar fluid system in the variable exponents Fourier-Besov spaces

Communication Info

Authors:

Fatima OUIDIRNE¹
Chakir ALALLOU²
Mohamed OUKESSOU³

¹LMACS, Sultan Moulay
Slimane University, Béni
Mellal, Morocco

²LMACS, Sultan Moulay
Slimane University, Béni
Mellal, Morocco

³LMACS, Sultan Moulay
Slimane University, Béni
Mellal, Morocco

Keywords:

- (1) Fourier-Besov spaces with variable exponents
- (2) Generalized micropolar fluid system
- (3) Global existence.

Abstract

The micropolar fluid system was first proposed by A.C. Eringen [2] in 1996. It is an essential modification to the Navier-Stokes equations in order to better describe the motion of real-world fluids consisting of rigid but randomly oriented particles by examining the influence of micro-rotation of the particles suspended in a viscous medium and it can describe many phenomena such as animal blood and liquid crystals. The micropolar fluid system has recently attracted much attention, and many interesting results have been established. In this work we obtain the global existence for the generalized micropolar fluid system in critical Fourier-Besov spaces with variable exponents, by using the Littlewood-Paley theory.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

- [1] A. Almeida, P. Hästö, Besov spaces with variable smoothness and integrability. *J. Funct. Anal.* 258(5), 1628-1655 (2010).
- [2] A.C. Eringen, Theory of micropolar fluids, *J. Math. Mech.* 16 (1966) 1-18.
- [3] W. Zhu, Sharp well-posedness and ill-posedness for the 3-D micropolar fluid system in Fourier-Besov spaces. *Nonlinear Analysis: Real World Applications* 46 (2019) 335-351.
- [4] L.C. Ferreira, E.J. Villamizar-Roa, Micropolar fluid system in a space of distributions and large time behavior, *J. Math. Anal. Appl.* 332 (2) (2007) 1425-1445.
- [5] Q. Chen, C. Miao, Global well-posedness for the micropolar fluid system in critical Besov spaces, *J. Differential Equations* 252 (3) (2012) 2698-2724.
- [6] W. Zhu, J. Zhao, Existence and regularizing rate estimates of solutions to the 3-D generalized micropolar system in Fourier- Besov spaces. *Math. Methods Appl. Sci.* 41 (4) (2018) 1703-1722.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Solving Linear Fractional Differential Equations

Communication Info

Authors:

Abdellatif SEMMOURI¹
Mostafa JOURHMANE²

¹FST, Sultan Moulay Slimane
University University, Beni
Mellal, Morocco

²FST, Sultan Moulay Slimane
University University, Beni
Mellal, Morocco

Keywords:

- (1) Fractional calculus
- (2) Cauchy sequence
- (3) Fixed point
- (4) Numerical solution

Abstract

Fractional differential equations (FDEs) have been used to mathematically model situations in various fields such as engineering and physics. Recently, fractional calculus is endowed with considerable popularity. This framework succeeded in attracting the attention of many interested researchers in this literature.

In this work, we will study FDEs where the derivatives present are taken in the Riemann-Liouville fractional sense. To do this, we must construct a sequence of functions which converges towards the exact solution of the problem posed. This approach requires necessary conditions to guarantee convergence. This proves the existence and the uniqueness of the solutions of this kind of differential equations of fractional order. To demonstrate our contribution on a practical level, we will give a numerical experiment using a tool of the machinery of numerical analysis to determine an approximate solution of the fractional differential equation in question.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] K.S. Miller, B. Ross, An Introduction to the Fractional Calculus and Fractional Differential Equations, Wiley, New York, 1993.
- [2] I. Podlubny, Fractional Differential Equations, Academic Press, California, 1999.
- [3] A. Kilbas, H.M. Srivastava, J.J. Trujillo, Theory and Applications of Fractional Differential Equations, Elsevier, Amsterdam, 2006.
- [4] Sun, Q., Ji, H., Cui, Y., Positive solutions for boundary value problems of fractional differential equation with integral boundary conditions, Journal of Function Spaces, 2018.
- [5] Bhrawy, A. H., Tharwat, M. M., Alghamdi, M. A., A new operational matrix of fractional integration for shifted Jacobi polynomials, Bull. Malays. Math. Sci. Soc, 37(4), (2014) 983-995.
- [6] Arshad, M. S., Baleanu, D., Riaz, M. B., Abbas, M., A novel 2-stage fractional Runge-kutta method for a time-fractional logistic growth model, Discrete Dynamics in Nature and Society, (2020), 1-8.
- [7] Zhang, X., Su, Y., Kong, Y., POSITIVE SOLUTIONS FOR BOUNDARY VALUE PROBLEM OF FRACTIONAL DIFFERENTIAL EQUATION IN BANACH SPACES, Dynamic Systems and Applications, 30(9), (2021) 1449-1462.
- [8] Babakhani, A., Daftardar-Gejji, V., Existence of positive solutions of nonlinear fractional differential equations, Journal of Mathematical Analysis and Applications, 278(2), (2003) 434-442.
- [9] Cui, Y., Uniqueness of solution for boundary value problems for fractional differential equations, Applied Mathematics Letters, 51, (2016) 48-54.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



A shape-preserving approximation problem for filling holes of generalized offset surfaces

Communication Info

Authors:

Abdelouahed KOUIBIA¹
Miguel PASADAS²

^{1,2}Departamento de
Matemática Aplicada, Facultad
de Ciencias,
Universidad de Granada,
(Spain)

Keywords:

- (1) Preserving the shape
- (2) Generalized offset surfaces, filling holes
- (3) Spline interpolation, variational splines

Abstract

A generalized offset surfaces are widely used in various practical applications such as CAGD, CAD, tolerance analysis, geometric optics and robot path-planning.

An approximation method of filling holes of the generalized offset of some surfaces is presented in [1] and [3]. We focus to resolve a complex problem due to the mixture of many criteria and conditions, first it is an interpolation problem of offset surfaces with holes and second the shape of this type of surfaces must be preserved, see [4]. We propose and analyze different methods to reconstruct a function that is defined outside a sub-domain (hole) of a given domain. The reconstructed function is parameterized by an interpolating variational spline that is defined also inside this hole, filling then this lack of information, and, at the same time, fulfills certain shape considerations and constraints on the hole. The shape preserving condition that we consider here is the positivity of the derivative function of an adequate order. We highlight the advantages of this work with respect to those that exist in the literature by, first we present an algorithm to compute the resulting function and we show its convergence; second some convergence theorems and errors estimation results are carefully established, see for example [2] and [5].

Finally, in order to prove the usefulness and the effectiveness of our method we analyze several examples.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] R. Akhrif, A. Kouibia, M. Pasadas, Approximation of generalized offset surfaces by bicubic splines, *Journal of Mathematical Chemistry* 58 (2020) 647 - 662.
- [2] M.A. Fortes, P. Gonz'alez, A. Palomares, M. Pasadas, Filing holes with shape preserving conditions, *Mathematics and Computers in Simulation* 118 (2015) 198 - 212.
- [3] A. Kouibia, M. Pasadas, Reconstruction approximating method by biquadratic splines of offset surfaces holes, *Journal of Mathematical Chemistry* 60(2) (2022) 423 - 439.
- [4] A. Kouibia, M. Pasadas, Variational bivariate interpolating splines with positivity constraints, *Applied Numerical Mathematics* 44 (2003), 507 - 526.
- [5] W. Wang, Q. Fan, G. Zhao, New algorithm for local shape preserving T-spline surface skinning, *Journal of Computer and Communications* 6 (2018) 80 - 90.

ICRAMCS 2023



Intuitionistic Fuzzy Symmetric Solutions of Linear Systems

Communication Info

Authors:

Hafida ATTI¹
Bouchra BEN AMMA²
Said MELLIANI³
Lalla Saadia CHADLI³

¹LAGA, National Higher School of Chemistry(ENSC), Ibn Tofail University, Kenitra, Morocco.

²LMACS, Higher School of Education and Training, Sultan Moulay Slimane University, Beni Mellal, Morocco.

³LMACS, Faculty of Sciences and Technologies, Sultan Moulay Slimane University, Beni Mellal, Morocco.

Keywords:

(1) Symmetric triangular intuitionistic fuzzy numbers
(2) Inverse matrix
(3) Intuitionistic fuzzv

Abstract

The purpose of this paper is to develop a simple method for solving intuitionistic fuzzy linear systems $AX=B$, where A is crisp matrix and the coefficients of the unknown vector X and the vector B are symmetric triangular intuitionistic fuzzy numbers. A numerical example is given to illustrate the presented method.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] S. Abbasbandy, T. Allahviranloo, R. Ezzati, A Method for Solving Fuzzy General Linear System, The Journal of Fuzzy Mathematics Vol. 15, No.4,2007.
- [2] T. Allahviranloo, S. Salahshour, Fuzzy symmetric solutions of fuzzy linear systems, Journal of Computational and Applied Mathematics volume 235, Issue 16, 15 June 2011, Pages 4545-4553.
- [3] K. T. Atanassov, Intuitionistic fuzzy sets, Fuzzy Sets and Systems, 20, (1986), 87-96.
- [4] B. Asady , S. Abbasbandy , M. Alavi , Fuzzy general linear systems, Applied Mathematics and Computation 169 (2005) 34-40.
- [5] M. Friedman, Ma. Min and A. Kandel, Fuzzy linear systems, Fuzzy Sets and Systems, 96, (1998) 201-209.
- [6] L. A. Zadeh, Fuzzy sets, Inf. Control, 8(3), (1965), 338-353 .

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Optimization method based on bio-inspired approaches for solving a Robin inverse problem

Communication Info

Authors:

Jamal DAOUDI¹

Chakir TAJANI¹

¹Polydisciplinary Faculty of
Larache, Abdelmalek Essaadi
University, Morocco

Keywords:

- (1) Inverse problem
- (2) Robin coefficient
- (3) Optimization approach
- (4) Finite element method

Abstract

This work presents numerical optimization algorithm based on metaheuristic approaches [1], to solve an inverse problem to reconstruct the Robin coefficient in boundary value problem [2]. It consists of identifying the Robin coefficient on the inaccessible part of the boundary representing the corrosion damage of some specimen material. This problem is known to be severely ill-posed in Hadamard sense. Metaheuristics are methods inspired by natural phenomena which have shown their effectiveness in solving several optimization problems in different domains. Thus, two well-known methods are proposed particle swarm optimization (PSO) [3] and bat algorithm (BA) [4], by formulating the problem into an optimization one. Numerical results are presented to illustrate and evaluate the efficiency and the robustness of the proposed algorithm.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] F. Bennis, R. Bhattacharjya. Nature-Inspired Methods for Metaheuristics Optimization: Algo App Sci Eng. Springer Nature, 2020.
- [2] C. Tajani, J. Abouchabaka, On the data completion problem for Laplace's equation. Anal. Univ Craio. Math. Comp. Sci. Ser., 45(1) (2018) 11-36.
- [3] J. Kennedy, R. Eberhart, Particle swarm optimization. In Proc. ICNN'95-inter. Conf. neur. Net., 4 (1995) 1942-1948. IEEE.
- [4] X. S. Yang, A new metaheuristic bat-inspired algorithm. Nat. insp. Coop. stra. opt. (NICSO 2010) (2010) 65-74.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Discreet mathematical modelling and optimal control of a spatiotemporal tuberculosis model

Communication Info

Authors:

Hamza TOUFGA¹

Mustapha Lhous¹

Ayoub SAKKOU²

Lahbib BENHAMADI²

¹FAML, Hassan II University of

Casablanca, Casablanca,

Morocco

²FAML, Hassan II University of

Casablanca, Casablanca,

Morocco

Keywords:

(1) Tuberculosis

(2) Discrete model

(3) optimal control

Abstract

This paper is devoted to the study of an optimal control problem for optimal chemoprophylaxis and treatment control for a spatiotemporal tuberculosis discrete model. This model assumes that individuals can be classified as Susceptible, Exposed, Infected, and Recovered (SEIR). The system describes the dynamics of tuberculosis disease by taking into consideration the spatial heterogeneity. Based on an existing model, the objective of this work is to introduce a strategy of control which will reduce exposed individuals and actively infected individuals. To achieve this, two controls are determined: the first control begins chemoprophylaxis efforts for individuals who are latently infected and the second control characterizes the treatment effort of individuals actively infected. The existence of the optimal control is proved, and its characterization is obtained by using the Pontryagin's Maximum Principle. To illustrate the obtained results, some numerical simulations are given.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] El Bhih, Amine & el Alami Laaroussi, Adil & Ghazzali, Rachid & Rachik, Mostafa. (2021). An optimal chemoprophylaxis and treatment control for a spatiotemporal tuberculosis model. Communications in Mathematical Biology and Neuroscience. 2021.
- [2] KAgusto, Folashade B.. (2009). Optimal chemoprophylaxis and treatment control strategies of a tuberculosis transmission model. ISSN UK World Journal of Modelling and Simulation.
- [3] Pontryagin, LS, Boltyanskii, VG, Gamkrelidze, RV, Mishchenko, EF: The Mathematical Theory of Optimal Processes. Wiley, New York (1962)

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Hybridization of Air Quality Forecasting Models Using deep-learning and Holt Winters method: An Original Approach to Detect Ozone Concentration Peaks

Communication Info

Authors:

Nisrine MARRAKCHI¹
Amal BERGAM¹
Hanane FAKHOURI¹

¹ SMAD, Polydisciplinary
Faculty of Larache (FPL),
University of Abdelmalek
Essaadi, Morocco

Keywords:

- (1) Air quality forecasting
- (2) Ozone (O₃)
- (3) Long Short-Term Memory (LSTM)
- (4) Holt Winters method

Abstract

The tropospheric ozone (O₃) is among the pollutants That has a strong effect on air pollution in the city of Tanger[1]. Prediction for this pollutant can have positive improvements on air quality[2]. This paper presents a new approach combining deep-learning algorithms and The Holt Winters method in order to detect pollutant peaks and obtain more accurate forecasting model[3]. As the Long Short-Term Memory (LSTM) is the most efficient, we hybridized with The Holt Winters method in order to improve the model. The performances of the models are compared using different accuracy measurement methods. The empirical results show the superiority of the hybrid by providing forecasts that are more accurate with an index of agreement equal to 0,91.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] C. C. Lim et al., "Long-term exposure to ozone and cause-specific mortality risk in the United States," *Am. J. Respir. Crit. Care Med.* (2019), P. 1022–1031.
- [2] A. C. Comrie, "Comparing Neural Networks and Regression Models for Ozone Forecasting," *J. Air Waste Manag. Assoc.* (1997). P. 653–663.
- [3] T. M. Dantas, F. L. Cyrino Oliveira, and H. M. Varela Repolho, "Air transportation demand forecast through Bagging Holt Winters methods," *J. Air Transp. Manag.* (2017). P. 116–123.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



A novel combined regularization algorithm for solving an inverse problem for Helmholtz equation

Communication Info

Authors:

Chakir TAJANI¹
Jamal DAOUDI¹

¹*Polydisciplinary Faculty of
Larache, Abdelmalek Essaadi
University, Morocco*

Keywords:

- (1) Inverse problem
- (2) Helmholtz equation
- (3) Optimization approach
- (4) Genetic algorithm

Abstract

This work presents numerical optimization algorithm based on genetic algorithm to solve the data completion problem for the Helmholtz equation [1]. It consists of covering the missing data on the inaccessible part of the boundary from measurements on the accessible part. This problem is known to be severely ill-posed in Hadamard sense [2]; then, regularization methods must be exploited. Metaheuristics [3] are methods inspired by natural phenomena and which have shown their effectiveness in solving several optimization problems in different domains. Thus, adapted genetic operators for real coded genetic algorithm is proposed by formulating the problem into an optimization one. Numerical results are presented showing the efficiency of the proposed algorithm.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] C. Tajani, J. Abouchabaka, On the data completion problem for Laplace's equation. *Anal. Univ. Craio. Math. Comp. Sci. Ser.*, 45(1) (2018) 11-36.
- [2] J. Hadamard, *Lectures on the Cauchy Problem in Linear Partial Differential Equations*, Yale University Press, New Haven, 1923.
- [3] Z. Michalewicz, *Genetic algorithms + data structures = evolution programs*, Berlin: Springer, 1992.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Weak compactness of almost L-weakly and almost M-weakly compact operators

Communication Info

Authors:

Safae EL FILALI¹

Khalid BOURAS¹

¹ Department of Mathematics,
Faculty Polydisciplinary of
Larache, Abdelmalek Essaadi
University P.O. Box 745,
Larache 92004.

Keywords:

- (1) Almost L-weakly compact operator, Almost M-weakly compact operator
- (2) M-weakly compact operator, L-weakly compact operator
- (3) Banach lattice

Abstract

Linear operators have been studied in various contexts and settings in the past. Their study is a subject of great importance both to mathematics and to its applications. It is well known that many linear operators between Banach spaces arising in classical analysis are in fact positive operators. For this reason, we are studied in the setting of Riesz spaces and Banach lattices. In this communication, we study some classes of operators in the framework of Banach lattices, we investigate conditions on a pair of Banach lattices E and F that tells us when every positive almost L-weakly compact (resp. almost M-weakly compact) operator T from E into F is weakly compact. Also, we present some necessary conditions that tells us when every weakly compact operator T is almost M-weakly compact (resp. almost L-weakly compact). In particular, we will prove that if every weakly compact operator from a Banach lattice E into a Banach space X is almost L-weakly compact, then E is a KB-space or X has the Dunford-Pettis property and the norm of E is order continuous.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] C. D. Aliprantis and O. Burkinshaw. Positive operators. Springer, Berlin (2006)
- [2] K. Bouras, D. Lhaimer, and M. Moussa. On the class of almost L-weakly and almost M-weakly compact operators. Positivity, 22, 1433–1443 (2018)
- [3] P. Meyer-Nieberg. Banach lattices. Springer, Berlin (1991)
- [4] W. Wnuk. Banach lattices with order continuous norms. Polish Scientific Publishers PWN, Warszawa (1999)
- [5] Zaanen, A.C.: Riesz Spaces II. North Holland Publishing Company, Amsterdam (1983)

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



New Finite Volume Scheme for Advection-Dominated Problems: Application to Air Quality Problem

Communication Info

Authors:

Abdelaziz CHAHED^{1,2}
Amal BERGAM¹
Anouar EL HARRAK²

¹SMAD, FPL, Abdelmalek
Essaadi University, Tetouan,
Morocco.

²MMA, FPL, Abdelmalek
Essaadi University, Tetouan,
Morocco

Keywords:

- (1) Finite Volume methods
- (2) Advection-Diffusion - Reaction
- (3) Advection dominant
- (4) Air Quality
- (5) Advection scheme

Abstract

Advection-Diffusion-Reaction problems are the most common outcomes of applied science and engineering research. There are many discretization schemes to solve such problems using the finite volume methods [1, 3]. The advection term in the problem poses a significant challenge in the discretization process as it can lead to uncertainty in the accuracy and stability of the numerical solution. In this study, we propose a new scheme and a comparison result between many schemes used to discretize the advection term of advection-dominated problems. In fact, we compare its behavior and accuracy for two-dimensional using vertex-centered finite volume method with dominant advection process [2, 4]. Finally, we validate the effectiveness of that approach through numerical simulations of air quality problems that involve dominant advective terms.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] B Amaziane, A Bergam, M El Ossmani, and Z Mghazli. A posteriori estimators for vertex cent red finite volume discretization of a convection-diffusion-reaction equation arising in flow in porous media. *International journal for numerical methods in fluids*, 2009.
- [2] Arti Kaushik. Critical evaluation of four differencing schemes for a steady convection diffusion problem. *Research Journal of Mathematical and Statistical Sciences*, 2016.
- [3] NISHIKAWA, Hiroaki. First, second, and third order finite-volume schemes for advection-diffusion. *Journal of Computational Physics*, 2014.
- [4] FERREIRA, Valdemir Garcia, DE QUEIROZ, R. A. B., LIMA, Giseli Aparecida Braz de, *et al.* A bounded upwinding scheme for computing convection-dominated transport problems. *Computers & Fluids*, 2012.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Optimization of a two-dimensional mesh generator

Communication Info

Authors:

Mohamed MRINI^{1,2}

Amal BERGAM¹

Anouar EL HARRAK²

¹SMAD, FPL, Abdelmalek
Essaadi University, Tetouan,
Morocco,

²MMA, FPL, Abdelmalek
Essaadi University, Tetouan,
Morocco.

Keywords:

(1) Mesh generation

(2) Node placement

(3) Distmesh

Abstract

Many applications require mesh generation as the first step in mathematical processes, including scientific computing. Therefore, we propose in this work an algorithm for the generation of unstructured triangular meshes in two dimensions, based on the mesh generator, Distmesh [1]. In practice, the Distmesh algorithm has limitations when attempting to create a non-uniform triangular mesh according to a user-defined size function [2-3]. For example, in order to achieve a high-quality mesh with the desired edge lengths, a significant number of iterations may be required to adjust the positions of the nodes. Additionally, the connectivity of the mesh may change over time. In this work, we enhance the Distmesh algorithm by introducing a new method for placing nodes in unstructured mesh generators, which ensures that the connectivity remains stable. This approach guarantees that after each improvement step, the mesh remains a valid triangulation.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

[1] Per-Olof Persson and Gilbert Strang. A simple mesh generator in matlab. SIAM review, 46(2) :329–345, (2004).

[2] Jonas Koko. A matlab mesh generator for the two-dimensional finite element method. Applied Mathematics and Computation, 250 :650–664, (2015).

[3] Zönnchen, B., & Köster, G.. A parallel generator for sparse unstructured meshes to solve the eikonal equation. Journal of Computational Science, 32, 141-147, (2019).



Overcoming convergence problems in PLS path modelling

Communication Info

Authors:

Sahli Abderrahim¹

El hadri Zouhair²

Hanafi Mohammed³

^{1,2} Faculty of Sciences,
Mohammed V University in
Rabat, Rabat, Morocco

³Research Unit in Statistics,
Sensometrics and
Chemometrics, Oniris, Nantes,
France

Keywords:

(1) Partial Least Squares Path
Modeling

(2) Hanafi-Wold procedure

(3) Lohmöller procedure

Abstract

The Partial Least Squares Path Modeling (PLS-PM) is one of the methods most widely used in the Structural Equation Modeling (SEM). PLS-PM aims to study the relationships among several blocks of observed variables, usually called Manifest Variables (MVs), where each block is assumed to measure a construct defined as a latent variable. Hanafi (2007) points out that there are two procedures for calculating the latent variable scores : the original procedure as proposed by Wold, and extended by Hanafi (2007) called the Hanafi-Wold procedure (2020), and an alternative procedure introduced by Lohmöller called the Lohmöller procedure. The systematic use of the Lohmöller procedure for computing the latent variable scores can be ineffective. The contribution of this article is to remedy the issue of non-convergence of the Lohmöller procedure. Consequently, a new procedure for computing the latent variable scores, called Signless Laplacian Matrix (SLM) will be introduced, the main difference between the two procedures (SLM and Lohmöller) lies in the use of two different matrices to perform their iterations, both monotony and error convergence for this new procedure will be established.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Hanafi, M., El Hadri, Z., Sahli, A. *et al.* Overcoming convergence problems in PLS path modelling. *Comput Stat* 37, 2437–2470 (2022). <https://doi.org/10.1007/s00180-022-01204-9>
- [2] Hanafi M (2007) PLS path modelling: computation of latent variables with the estimation mode b. *Comput Stat* 22(2):275–292. <https://doi.org/10.1007/s00180-007-0042-3>
- [3] Hanafi M, Dolce P, El Hadri Z (2021) Generalized properties for Hanafi-Wold's procedure in partial least squares path modeling. *Comput Stat* 36:603–614. <https://doi.org/10.1007/s00180-020-01015-w>
- [4] Henseler J (2010) on the convergence of the partial least squares path modeling algorithm. *Comput Stat* 25(1):107–120

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE

March 16-17-18, 2023 | Casablanca, Morocco



Existence and comparison results for nonlinear parabolic equations having a natural growth terms

Communication Info

Authors:

Amine Marah¹

Hicham Redwane²

¹University of Chouaib

Doukkali, El jadida, Morocco

²LAMS, Hassan I University of

Settat, Settat, Morocco

Keywords:

(1) Nonlinear parabolic equations

(2) Natural growth terms

(3) Comparison principle

(4) L^1 data

Abstract

We will study the existence of solutions for a class of nonlinear parabolic equations having a lower order terms with natural growth under a Dirichlet boundary condition, and the data are only assumed to be integrable.

Moreover, we will prove a comparison principle for solutions of this problem and, as a consequence, uniqueness of positive solution. In order to prove the existence result of solution by adapting the technique used for the elliptic case in ([1], [2]) to the parabolic case. As regards the uniqueness result, motivated by ([3], [4]), we are going to prove it under some additional assumption on the data.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

[1] L. Boccardo, A contribution to the theory of quasilinear elliptic equations and application to the minimization of integral functionals, Milan J. Math. 79 (2011), 193-206.

[2] A. Porretta, Existence for elliptic equations in L^1 having lower order terms with natural growth, Port. Math. 57 (2000), 179-190.

[3] D. Arcoya, S. Segura de Le'on, Uniqueness of solutions for some elliptic equations with a quadratic gradient term, ESAIM Control Optim. Calc. Var. 16 (2)(2010) 327-336.

[4] P. J. Martinez-Aparicio, F. Petitta, Parabolic equations with nonlinear singularities, Nonlinear Anal. 74 (2011), 114-131.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



The Moving Least Square Method for Solving the nonlinear Hyperbolic Equation

Communication Info

Authors:

Said EL BOSTANI¹

Rachid EL JID¹

¹MISI, Hassan I University of
Settat, Settat, Morocco

Keywords:

(1) Moving least squares

(MLS) method

(2) Nonlinear hyperbolic
equation

(3) Finite difference method

(FDM)

Abstract

In this work, a numerical scheme based on the MLS approximation and FDM is proposed for solving a class of the nonlinear hyperbolic equation with variable coefficients. In the new developed scheme, we use collocation points and approximate solution of the problem under study by using MLS approximation. The MLS method is a meshless approach and does not need any background mesh structure. A time stepping approach is employed for the first and second-order time derivatives. The proposed method provides a semi-discrete solutions for the problems under study. In space domain, the MLS approximation and in time domain. This method after discretization leads to a linear system of algebraic equations. Some numerical results are given and compared with analytical solutions to demonstrate the validity and efficiency of the proposed technique.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] M. G. Armentano, Error estimates in sobolev spaces for moving least square approximations, SIAM J. Numer. Anal. 39(1), 38-51.
- [2] C. Zuppa, Error estimates for moving least square approximations, Bull. Braz. Math. Soc. 34(2), 231-249, 2003a.
- [3] C. Zuppa, Good quality point sets and error estimates for moving least square approximations, Appl. Numer. Math. 47(3-4), 575-585, 2003b.
- [4] D. Mirzaei Analysis of moving least squares approximation revisited, Journal of Computational and Applied Mathematics 282 (2015) 237-250
- [5] Hongping Ren, Kaiyan Pei, Liping Wang, Error analysis for moving least squares approximation in 2D space, Applied Mathematics and Computation 238 (2014) 527-546

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Weak solutions to quasilinear elliptic obstacle Problems via Young measures

Communication Info

Authors:

Hasnae El Hammar
Said Melliani
Farah Balaadich

Laboratory LMACS, FST of
Beni-Mellal, Sultan Moulay
slimane University,

Keywords:

(1) obstacle problem
(2) Young measures
(3) theorem of Kinderlehrer
and Stampacchia

Abstract

This paper is concerned with the existence of weak solutions for quasilinear elliptic obstacle.

By means of the Young measure theory and a theorem of Kinderlehrer and Stampacchia, we obtain the needed result.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] E. Azroul, F. Balaadich, Weak solutions for generalized p-Laplacian systems via Young measures, Moroccan J. of Pure and Appl. Anal. (MJPA) 4(2) (2018) 76-83.
- [2] E. Azroul, F. Balaadich, Quasilinear elliptic systems in perturbed form, Int. J. Nonlinear Anal. Appl. 10 (2019) No. 2, 255-266.
- [3] J. M. Ball, A version of the fundamental theorem for Young measures In: PDEs and Continuum Models of Phase Transitions (Nice, 1988). Lecture Notes in Phys, 344(1989) 207-215.
- [4] El Hammar, H., Ait Temghart, S., Allalou, C., and Melliani, S. (2022). Existence results of quasilinear elliptic systems via Young measures. *International Journal of Nonlinear Analysis and Applications*..
- [5] Kinderlehrer, D., Stampacchia, G., An Introduction to Variational Inequalities and Their Applications, Academic Press, New York, (1980).

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Study of some elliptic system of $(p(x),q(x))$ - Kirchhoff type with convection

Communication Info

Authors:

Noureddine Moujane¹
Chakir Allalou¹
Said Melliani¹

¹Laboratory LMACS, Faculty
of Science and Technology,
Sultan Moulay Slimane
University, Beni Mellal,
Morocco

Keywords:

- (1) Sobolev space with variable exponent
- (2) topological degree theory
- (3) $(p(x),q(x))$ -Kirchhoff-Laplacian operators
- (4) Weak solution
- (5) Convection

Abstract

In this paper, we study the existence of weak solutions for a nonlocal elliptic system involving the $(p(x),q(x))$ -Kirchhoff-Laplacian operators with Dirichlet boundary conditions, in the case of a reaction term depending also on the gradient (convection). Using a topological degree for a class of demi-continuous operators of generalized $(S+)$ type and the theory of the Sobolev space with variable exponent, we obtain the existence result of weak solutions of the considered problem. To our best knowledge, this paper is the first attempt in the study of nonlocal elliptic system of $(p(x),q(x))$ -Kirchhoff type with convection via topological degree theory. Our results extend and generalize some recent works in the existing literature.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Taghavi, A., Ghorbani, H.: Existence of a solution for a nonlocal elliptic system of $(p(x), q(x))$ -Kirchhoff type. *Advances in Pure and Applied Mathematics*, 9(3), 221-233 (2018).
- [2] El Ouaarabi, M., Allalou, C., & Melliani, S.: Weak solutions for double phase problem driven by the $(p(x), q(x))$ -Laplacian operator under Dirichlet boundary conditions. *Boletim da Sociedade Paranaense de Matemática*, 41, 1-14 (2023).
- [3] Allalou, C., El Ouaarabi, M., Melliani, S.: Existence and uniqueness results for a class of $p(x)$ -Kirchhoff-type problems with convection term and Neumann boundary data. *Journal of Elliptic and Parabolic Equations*, 8(1), 617-633 (2022).
- [4] Berkovits, J. : Extension of the Leray–Schauder degree for abstract Hammerstein type mappings. *J Differ. Equ.* 234 (2007). 289-310.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Existence result for a Dirichlet problem dominated by nonlinear degenerate elliptic equation in Weighted variable exponent spaces

Communication Info

Authors:

Youssef Fadil
Chakir Allalou
Mohamed Oukessou

Laboratory LMACS, FST of Beni Mellal, Sultan Moulay Slimane University, Beni-Mellal, Morocco

Keywords:

- (1) Dirichlet problem
- (2) Degenerate quasilinear elliptic equations
- (3) Weighted variable exponent spaces

Abstract

In this abstract, we prove the existence and uniqueness of solution to a Dirichlet boundary value problems for the following nonlinear degenerate elliptic equation in Weighted variable exponent spaces, to study the existence of the weak solutions of our problem, we introduce some hypotheses. The basic idea to demonstrate this result is to reduce our problem to the equation operator $Au = T$ and apply the browder-minty theorem.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Ouaarabi, ME, Abbassi, A., & Allalou, C. (2021). Résultat d'existence pour un problème de Dirichlet régi par une équation elliptique dégénérée non linéaire dans des espaces de Sobolev pondérés. *Journal des équations elliptiques et paraboliques*, 7 (1), 221-242.
- [2] Bresch, D., Lemoine, J., Guillen-Gonzalez, F.: A note on a degenerate elliptic equations with applications to lake and seas. *Electron. J. Differ. Equ.* 2004(42), 1–13 (2004)
- [3] Franchi, B., Serapioni, R.: Pointwise estimates for a class of strongly degenerate elliptic operators: a geometrical approach. *Annali della Scuola Normale Superiore di Pisa-Classe di Scienze* 14(4), 527–568 (1987).
- [4] Kufner, A., Opic, B.: How to define reasonably weighted Sobolev spaces. *Comment. Math. Univ. Carol.* 25(3), 537–554 (1984).
- [5] J. Comput. Appl Zeidler, E.: *Nonlinear Functional Analysis and its Applications*, vol. II/B. Springer, New York (1990b).

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Overlapping domain decomposition level set method for magnetic resonance images

Communication Info

Authors:

Khalid BELLAJ¹
Mohammed BENMIR¹

¹LMAF, Hassan II University of
Casablanca, Casablanca,
Morocco

Keywords:

- (1) Domain Decomposition
- (2) Level Set Method
- (3) Partial differential

Abstract

The Overlapping Domain Decomposition Level Set Method (ODDLs) is a computational technique that combines the ideas of level set methods and overlapping domain decomposition to segment magnetic resonance images [1], [2], [3]. It involves dividing the image into overlapping sub-regions or domains, processing each domain separately, and then combining the results to get the final segmentation. Motivated by the idea that the ODDLs could be an efficient solution for this purpose [4], [5], in this paper, we propose a framework that employs a deep artificial neural network-based approach and Domain decomposition methods for partial differential. Quantitative and qualitative evaluations of the results show that the proposed framework performs well.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Khosravanian, Asieh, et al. "A level set method based on domain transformation and bias correction for MRI brain tumor segmentation." *Journal of Neuroscience Methods* 352 (2021): 109091.
- [2] Roy, Sudipta, et al. "An iterative implementation of level set for precise segmentation of brain tissues and abnormality detection from MR images." *IETE Journal of Research* 63.6 (2017): 769-783.
- [3] Gou, Shuiping, et al. "Feasibility of automated 3-dimensional magnetic resonance imaging pancreas segmentation." *Advances in radiation oncology* 1.3 (2016): 182-193.
- [4] Bellaj, K., S. Boujena, and E. EL Guarmah. "An Improved Approach for Image Segmentation and Three-Dimensional Reconstruction." *Discontinuity, Nonlinearity, and Complexity* 9.2 (2020): 199-215.
- [5] Bellaj, K., et al. "One approach for image denoising based on finite element method and domain decomposition technique." *International Journal of Applied Physics and Mathematics* 7.2 (2017): 141.



Existence of results for some parabolic equations having nonlinear boundary

Communication Info

Authors:

Abdelghani AZ-EDINE¹
Mostafa EL MOUMNI²

¹Department of Mathematics,
Faculty of Science, UCD
University, El Jadida, Morocco
²Department of Mathematics,
Faculty of Science, UCD
University, El Jadida, Morocco

Keywords:

- (1) Weak periodic solution
- (2) Parabolic equation
- (3) Nonlinear boundary conditions

Abstract

We give the existence of a weak periodic solution for nonlinear parabolic equations with nonlinear boundary conditions and without sign condition of the following problem :

$$\begin{cases} \frac{\partial u}{\partial t} - \Delta u + H(x, t, u, \nabla u) = f & \text{in } Q = \Omega \times]0, T[, \\ u(x, T) = u(x, 0) & \text{in } \Omega, \\ -\frac{\partial u}{\partial \nu} = \beta(x, t)u + h(x, t, u) & \text{in } \Sigma = \partial\Omega \times]0, T[. \end{cases}$$

where $\Omega \subset \mathbb{R}^N$ bounded open domain with smooth boundary denoted by $\partial\Omega$. We assume that :

- f is a periodic function such that $f \in L^2(Q)$.
- β is a periodic positive continuous and bounded function.
- h is a Carathéodory function periodic in time, $s \rightarrow h(x, t, s)$, is no decreasing for a.e. $(x, t) \in \Sigma$, $h(x, t, s) \geq 0$ and $|h(x, t, u)| \leq \xi(x, t) + |s|$ where $\xi \in L^2(\Sigma)$.
- $H: Q \times \mathbb{R} \times \mathbb{R}^N \rightarrow \mathbb{R}$ is a Carathéodory function such that $H(x, t, s, \xi) \in L^1(Q) \forall s \in \mathbb{R}, \forall \xi \in \mathbb{R}^N$ and a.e $(x, t) \in Q$.
- $|H(x, t, s, \xi)| \leq \gamma(x, t) + g(s)|\xi|^2$ a.e $(x, t) \in Q, \forall s \in \mathbb{R}, \forall \xi \in \mathbb{R}^N$, where $g: \mathbb{R} \rightarrow \mathbb{R}^+$ is a

continuous positive function which belong to $L^1(R)$ and $\gamma \in L^1(Q)$

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] A. Elaassri, N. Alaa, A.Charkaoui, S. Mesbahi and L. Kaoutar; Existence of weak periodic solution for quasilinear parabolic problem with nonlinear boundary conditions. International Journal of Applied Mathematics and Computer Science. 46, 2019. 1-13.
- [2] M. Badii; Periodic solutions for a nonlinear parabolic equation with nonlinear boundary conditions, Rend. Sem. Mat. Univ. Pol. Torino, Vol. 67, 3 (2009), 341-349.
- [3] J. Simon; Compact sets in the space $L^p(0, T; B)$, Ann. Mat. Pura Appl. 146 (1987) 65-96.
- [4] A. Benkirane and B. El Haji; On the existence of solutions for degenerate parabolic equations with singular terms. Pure and Applied Mathematics Quaterly. Volume 14, Number 3-4, 591-606, (2018).
- [5] M. El Moumni; Nonlinear elliptic equations without sign condition and L^1 -data in Musielak-Orlicz-Sobolev spaces, Acta. Appl. Math. 159:95-117(2019).

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Some main properties of Musielak spaces with only the log-Hölder continuity condition and application

Communication Info

Authors:

Mustafa AIT KHELLOU¹
Abdelmoujib BENKIRANE²
Sidi Mohamed DOUIRI^{*3}

¹ Higher Normal School,
Moulay Ismail University of
Meknes, Meknes, Morocco

² LAMA, Sidi Mohamed Ben
Abdellah University, Fez,
Morocco

³MAIS, Moulay Ismail
University of Meknes, Meknes,
Morocco

Keywords:

- (1) Musielak–Orlicz spaces
- (2) Poincaré type inequality
- (3) Log-Hölder continuity
- (4) Nonlinear parabolic problem

Abstract

An important part of the analysis on the Orlicz spaces and variable exponent Lebesgue spaces, which generalize the classical Lebesgue space by two distinct extensions, is based on the density of smooth functions with respect to the modular topology and the problem of Poincaré inequality. These spaces are special kinds of Musielak spaces. In this work, we prove a density and a duality results in Musielak spaces, as well as an inequality of type Poincaré, assuming only the log-Hölder continuity condition. We will apply these results to give in non-reflexive Musielak spaces the existence of solutions for some nonlinear parabolic problems with no continuous lower order terms.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Y. Ahmida, I. Chlibecka, P. Gwiazda, A. Youssfi, Gossez's approximation theorems in Musielak–Orlicz–Sobolev spaces, *J. Funct. Anal.*, 275(9), (2018) 2538–2571.
- [2] M. Ait Khellou, A. Benkirane, S.M. Douiri, Strongly non-linear elliptic problems in Musielak spaces with L^1 data, *Nonlinear Stud.*, 23(3), (2016) 491–510.
- [3] M. Costabel, A. McIntosh, On Bogovskii and regularized Poincaré integral operators for de Rham complexes on Lipschitz domains, *Math. Zeits.* 265(2), (2010) 297–320.
- [4] X.L. Fan, An imbedding theorem for Musielak–Sobolev spaces. *Nonlinear Anal.*, 75 (2012) 1959–1971.
- [5] Samko, S.: Denseness of $C_0^\infty(\mathbb{R}^n)$ in the generalized Sobolev spaces $W^{k,p(x)}(\mathbb{R}^n)$, *Int. Soc. Anal. Appl. Comput.* 5 (2000) 333–342.
- [6] A. Świerczewska-Gwiazda, Nonlinear parabolic problems in Musielak–Orlicz spaces, *Nonlinear Anal.* 98 (2014) 48–65.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Infinitely many solutions for an elliptic equation in divergent form with critical Sobolev exponent and concave-convex nonlinearity

Communication Info

Authors:

Rachid ECHARGHAOUI ¹

Mohamed MASMUDI ¹

Zakaria ZAIMI ¹

¹ Department of Mathematics,
Faculty of Sciences, Ibn Tofail
University, Kenitra B. P. 133,
Morocco.

Keywords:

Infinitely many solutions
semilinear elliptic equations
Concave-convex
Fountain Theorem
Dual fountain Theorem.

Abstract

In this paper, we are concerned with the problem

$$\begin{cases} -\operatorname{div}(a(x)Du) = Q(x)|u|^{2^*-2}u + \lambda|u|^{q-2}u & x \in \Omega, \\ u = 0 & \text{on } \partial\Omega. \end{cases}$$

where Ω is a bounded domain in \mathbb{R}^N , $2^* := \frac{2N}{N-2}$, $1 < q < 2$, $a, Q \in C^4(\bar{\Omega})$, $a(x) \geq a_0 > 0$, $Q(x) \geq Q_0 > 0$, and $\lambda > 0$ is a positive constant. By using concentration estimates, Fountain Theorem and its Dual form we prove the existence of two disjoint and infinite sets of solutions for the above problem. Here, we give a positive answer to one open problem proposed by Ambrosetti, Brezis and Cerami in [1] for the case of an elliptic equation in divergent form with critical growth and concave-convex nonlinearities.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

[1] A. Ambrosetti, H. Brezis, G. Cerami, Combined effects of concave-convex nonlinearities in some elliptic problems, *J. Funct. Anal.*, 122, 519–543 (1994).



A new network architecture model for deep learning to solve an inverse source problem for a one-dimensional linear and nonlinear degenerate/singular hyperbolic problem

Communication Info

Authors:

Khalid ATIFI

*FSTG, Cadi ayyad University of
Marrakech, Marrakech*

Keywords:

- (1) Deep learning
- (2) Inverse problem
- (3) EDP
- (4) Optimization

Abstract

The main purpose of this work is to propose a new network architecture model for deep learning, applied to solve an inverse source problem for linear and nonlinear degenerate/singular hyperbolic equation, with degeneracy and singularity occurring at the boundary of the spatial domain.

This new deep neural network is trained to satisfy the differential operator, initial condition, boundary, and observability conditions. Our algorithm is mesh-free. We start by treating theoretically the linear case. In the nonlinear case, numerical modeling is very difficult to apply, especially for evolution problems. To my knowledge, there is no numerical method based on discretization that is effective to solve this kind of problem. However, in the numerical part, we show that our method resolves effectively and with good precision this non-linear problem.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] K.Atifi and E.-H.Essoufi, An inverse backward problem for degenerate two-dimensional parabolic, *Opuscula Mathematica*. DOI :10.7494/opmath.2020.40.4.427,(2020).
- [2] J. Pierre and Dussault, La différentiation automatique et son utilisation en optimisation, *RAIRO-Operations Research*, volume 155, pages 141–155, (2008).
- [3] Y. Le Cun, Y. Bengio, and G. Hinton, Deep learning, *Nature* 521(7553), 436–444, (2015).
- [4] Justin, Sirignano and Konstantinos and Spiliopoulos, DGM : A deep learning algorithm for solving partial differential equations, *Journal of computational physics*, Elsevier, (2018).
- [4] A. Moumni B. Allal and J. Salhi. Degenerate and singular wave equation. arXiv:2108.04159, 2021.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Renormalized solution to nonlinear elliptic equations with measure data in Musielak

Communication Info

Authors:

Mustafa Ait Khellou

Department of Sciences, Higher

Normal School, Moulay Ismail

University of Meknes, P.O. Box

3104, Toulal, Meknes 50000,

Morocco.

Keywords:

(1) Musielak-Orlicz spaces

(2) Nonlinear elliptic problems

(3) log-Holder continuity condition

(4) Renormalized solution.

Abstract

This article is concerned with the existence of renormalized solution for an elliptic equation having two lower order terms and measure data in Musielak-Orlicz spaces.

The concept of renormalized solutions was introduced by Diperna and Lions in [16] for the study of the Boltzmann equations, this notion was then adapted to the study of the problem (P) by Boccardo et al. in [12] when the right hand side is in usual Sobolev space and in the case where the nonlinearity g depends only on x and u ; this work was then studied by Rakotoson in [22] when the right hand side is in L^1 and finally by DalMaso et al. in [14] when the right hand side is general measure data.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

[1] R.A. Adams: Sobolev spaces, Academic Press, New York, (1975).

[2] L. Aharouch, J. Bennouna and A. Touzani: Existence of Renormalized Solution of Some Elliptic Problems in Orlicz Spaces, Rev. Mat. Complut. 22, N1, pp. 91-110 (2009).

[3] A. Aissaoui Fqayeh, A. Benkirane, M. El Mounni and A. Youss: Existence of renormalized solutions for some strongly nonlinear elliptic equations in Orlicz spaces, Georgian Mathematical Journal. Volume 22, Issue 3, pp. 305-321 (2015).

[4] M. Ait Khellou and A. Benkirane: Renormalized solution for nonlinear elliptic problems with lower order terms and L^1 data in Musielak-Orlicz spaces, Annals of the University of Craiova, Mathematics and Computer Science Series Volume 43(2), pp. 164-187 (2016).

[5] M. Ait Khellou, A. Benkirane and S. M. Douiri: Some main properties of Musielak spaces with only the log-Holder continuity condition, Ann. Funct. Anal. Vol. 11, pp. 1062-1080 (2020).

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Formulation discrète non standard des problèmes inverses des EDP

Communication Info

Auteurs :

Mahamat Saleh Daoussa
Haggar¹
Cyr.S. Ngamouyih Moussata²
Déryl Nathan Bonazebi-
Yindoula²
Benjamin Mampassi²

¹ D'Jamena University, Chad
² Marien N'Gouabi University,
Brazzaville, Congo

Mots clés:

- (1) Problème mal pose
- (2) Formulation inverse non standard
- (3) Discrétisation colocale
- (4) Contrôlabilité discrète
- (5) Schéma numérique d'Euler progressif

Résumé

Dans cette communication, nous nous intéressons au calcul de l'état initial inconnu pour la simulation et la prédiction des systèmes d'EDPs où les mesures des solutions sont partiellement connues sur un intervalle de temps. Un tel problème est généralement résolu via un problème de contrôle optimal mal posé [5, 6]. En se base sur une approximation de colocale appropriée, nous obtenons un problème inverse discret. Pour résoudre ce problème, une approche discrète non standard est alors utilisée [1]. Ceci permet d'obtenir une transformation du problème originel en un problème bien posé sans processus de régularisation [2, 3, 4]. Ceci est basé sur la contrôlabilité à zéro d'un système discret [7]. Le contrôle souhaité est alors calculé ainsi que l'approximation discrète des valeurs de l'état initial.

La solution calculée par cette approche développée est facilement implémentée et parfaitement adaptée aux problèmes de grande envergure que l'on peut rencontrer par exemple en océanographie.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Clason C. and Heppenger P. , A forward approach to numerical data assimilation, SIAM Journal on Scientific Computing, 31 (4) 3090 – 3115 (2009).
- [2] Engl. H. W., Hanke M., Neubauer A., Regularization of inverse problems, Kluwer Academic Publisher, (1996).
- [3] Engl. H., Kunisch K., Neubauer A., convergence rates for Tikhonov regularization of non-linear ill-posed problems, Inverse problems, 5, pp. 523 – 540, (1989).
- [4] Groetsch C. W., The theory of Tikhonov regularization for Fredholm equation of the first kind, Research Notes in Mathematics 105, Pitman, (1984).
- [5] Kalnay E., Atmospheric modeling, Data Assimilation and Predictability, Cambridge University Press, 2002.
- [6] Le Dimet F.X. and Talagrand O., Variational algorithms for analysis and assimilation of meteorological observations: theoretical aspect, Tellus Series A, 38, pp. 97 +, (1996).
- [7] Lions J. L., Exact controllability, stabilization and perturbations for distributed systems, SIAM, Rev. 30, pp. 1 – 68, (1988).

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Existence and multiplicity of solutions for a singular problem involving the $p(x)$ -triharmonic operator in Ω

Communication Info

Authors:

Adnane BELAKHDAR¹
Hassan BELAOUIDEL²
Mohammed FILALI¹
Najib TSOULI¹

¹LaMAO, Faculty
of Science,
Mohammed I University, Oujda,
Morocco

²LaMAO, ENCGO,
Mohammed I University, Oujda,
Morocco

Keywords:

- (1) weak solutions
- (2) Navier boundary condition
- (3) $p(x)$ -triharmonic operator
- (4) singular problem

Abstract

In this study, we investigate the existence of solutions for a nonlinear singular equation involving the $p(x)$ -triharmonic under certain conditions. By extending the results of Keffi (2017)[5] and Keffi (2019) [5] to the $p(x)$ -triharmonic, we employ the Ekeland's variational principle and the theory of generalized Lebesgue-Sobolev spaces to find solutions. To the best of our knowledge, this is the first research to address singularity for this type of problem.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] A. Ayoujil and A.R El. Amrouss, On the spectrum of a fourth order elliptic equation with variable exponent. *Nonlinear, Analysis : Theory, Methods and Applications*, 71(10) :4916-4926, 2009
- [2] I. Ekeland. On the variational principle, *Journal of Mathematical Analysis and Applications*, 47(2) :324-353, 1974
- [3] X. Fan , D. Zhao, On the spaces $L_{p(x)}(\Omega)$ and $W_{m,p(x)}(\Omega)$, *Journal of Mathematical Analysis and Applications*, 263(2) :424-446, 2001. 1
- [4] B. Ge, Q-M. Zhou, Y-H. Wu, Eigenvalues of the $p(x)$ -biharmonic operator with indefinite weight. *Zeitschrift für angewandte Mathematik und Physik*, 66(3) :1007-1021, 2015
- [5] K. Kefi, V. D. Rădulescu , On a $p(x)$ -biharmonic problem with singular weights, *Zeitschrift für angewandte Mathematik und Physik* 68.4,1-13, 2017
- [6] K. Kefi , K. Saoudi, On the existence of a weak solution for some singular $p(x)$ -biharmonic equation with navier boundary conditions, *Advances in Nonlinear Analysis*, 8(1) :1171-1183, 2019

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Generalized study of the operator $\alpha\partial^k\bar{\partial}^k + \beta\bar{\partial}^k + \gamma\partial^k + c$ in the weighted Hilbert space

Communication Info

Authors:

Eramane BODIAN¹

Winnie Ossete INGOBA²

Souhaibou SAMBOU³

Papa BADIANE⁴

Salomon SAMBOU⁵

¹LMA, Assane SECK University of Ziguinchor, Senegal

²Marien N'Gouaby University of Brazzaville, Congo

³LMA, Assane SECK University of Ziguinchor, Senegal

⁴LMA, Assane SECK University of Ziguinchor, Senegal

⁵LMA, Assane SECK University of Ziguinchor, Senegal

Keywords:

(1) Operator

(2) Weighted Hilbert space

(3) Hormander L^2 method

Abstract

In [1], Shoayu DAI and Yifei PAN studied the right inverse of the differential operator $\frac{d^k}{dx^k} + a$ in the weighted Hilbert space $L^2(\mathbb{R}, e^{-x^2})$ and then in [2] they study the result to the complex case, namely $\bar{\partial}^k + a$ in the weighted Hilbert space $L^2(\mathbb{C}, e^{-|z|^2})$. In the same perspective Biodian and al in [3] study the operator $\partial^k\bar{\partial}^k + c$ in the weighted Hilbert space $L^2(\mathbb{C}, e^{-|z|^2})$, therefore in this paper, we generalize the study on the operator $\alpha\partial^k\bar{\partial}^k + \beta\bar{\partial}^k + \gamma\partial^k + c$ in the weighted Hilbert space $L^2(\mathbb{C}, e^{-|z|^2})$ while noting that we do not consider the powers of the Laplacian in the complex plane in the case of the L^2 -estimate. Under certain hypothesis, we prove the existence of a weak solution of the equation

$$(\alpha\partial^k\bar{\partial}^k + \beta\bar{\partial}^k + \gamma\partial^k + c)u = f \text{ with } f \in L^2(\mathbb{C}, e^{-\varphi}).$$

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] S. Dai, Y. Pan a right inverse of differential operator $\frac{d^k}{dx^k} + a$ in a weighted Hilbert space $L^2(\mathbb{R}, e^{-x^2})$, J. Math. Anal. Appl. 486 (2020) 123-890.
- [2] S. Dai, Y. Pan, A right inverse of Cauchy-Riemann operator $\bar{\partial}^k + a$ in a weighted Hilbert space $L^2(\mathbb{C}, e^{-|z|^2})$, Annales de la Facult des Sciences de Toulouse volume XXX, n3, 2021 pp.619-632.
- [3] E. Bodian, S. Sambou, W. O. Ingoba, P. Badiane, S. Sambou, Study of the operator $\partial^k\bar{\partial}^k + c$ in a weighted Hilbert space $L^2(\mathbb{C}, e^{-|z|^2})$, Complex Analysis and Operator Theory (2023) <https://doi.org/10.1007/s11785-022-01325-5>.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Study Of Mathematical Model For Association of Diabetes and Coronaviru

Communication Info

Authors:

Imken Ikram¹
Nadia Fatmi Idrissi²
Saloua El amari³

¹ *LIPIM Ensak, Sultan
Moulay Slimane, BeniMellal*

² *LIPIM Ensak, Sultan
Moulay Slimane, BeniMellal*

³ *Department of
Endocrinology, Diabetology,
Metabolic Disease and
Nutrition, Mohammed VI
University of Health Sciences,
Casablanca.*

Keywords:

- (1) Mathematical Model
- (2) Corona Virus , Diabetes
- (3) local stability
- (4) optimal control

Abstract

In this work we study an original real first mathematical model describing the association of Diabetes and Corona. The aim of this paper is to reduce the number of infected with complication by control strategies using three variables of controls that represent respectively, the awareness program to diabetic people, also also the permanent glycemc control in hospital, the early diagnostic of diabetic people in the first step of transmission of the virus. Theoretically, we have proved the existence of optimal controls [1] Kouidere A, Khajji B, Balatif O, et al. A multi-age mathematical modeling of the dynamics of population diabetics with effect of lifestyle using optimal control. J Appl Math Comput (2021), and a characterization of the controls in terms of states and adjoint functions principally based on Pontryagin's maximum principle [2] Khajji B, Kouidere A, Elhia M, Balatif O, Rachik M. Fractional optimal control problem for an age-structured model of COVID-19 transmission. Chaos, Soli- tons and Fractals (2020) and the optimality system is solved by an iterative method Khajji B, Kouidere A, Elhia M, Balatif O, Rachik M. Fractional optimal control problem for an age-structured model of COVID-19 transmission. Chaos, Soli- tons and Fractals 2020. . Finally, to clarify the efficiency of our theoretical results, we provide numerical simulations for numerous scenarios. Therefore, the obtained results affirm the performance of the optimization approach.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Kouidere A, Khajji B, Balatif O, et al. A multi-age mathematical modeling of the dynamics of population diabetics with effect of lifestyle using optimal control. J Appl Math Comput (2021) p19-p34
- [2] Khajji B, Kouidere A, Elhia M, Balatif O, Rachik M. Fractional optimal control problem for an age-structured model of COVID-19 transmission. Chaos, Soli- tons and Fractals (2020)

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



MATHEMATICAL STUDY OF SEIRS EPIDEMIC MODEL UNDER BILINEAR INCIDENCE RATE

Communication Info

Authors:

Yassine BABRHOU

Laboratory LMACS, FST of Beni-Mellal,

Sultan Moulay slimane
University, Morocco.

Keywords:

Epidemic Model; global
analysis; SEIRS model; Basic
Reproduction number;
Lyapunov function.

Abstract

In this manuscript. We first formulate the **SEIRS** model [1]. Further, we develop some sufficient analysis to examine the dynamical behavior of the model under consideration. We compute the basic reproductive number R_0 [2], also by analyzing the corresponding characteristic equations, the local stability of the disease-free equilibrium and the endemic equilibrium is established. By using suitable Lyapunov functionals and LaSalle's invariance principle, the global stability of the disease-free equilibrium and the endemic equilibrium are established for the **SEIRS** epidemic model [3]. In the end we establish a Numerical Simulation of SEIR Model for pandemic COVID-19 spread in Morocco. [4,5,6]

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] W. O. KERMACK AND A. G. MCKENDRICK, "A contribution to the mathematical theory of epidemics.", In: Proceedings of the Royal Society of London A: mathematical, physical and engineering sciences. Vol. 115.772. The Royal Society. 1927, pp. 700721.
- [2] VAN DEN DRIESCHE, P., WATMOUGH, J. (2002), "Reproduction numbers and sub-threshold endemic equilibria for compartmental models of disease transmission." Math. Biosci. 180, 29-48
- [3] KOROBENIKOV, A. (2006), "Lyapunov functions and global stability for SIR and SIRS epidemiological models with non-linear transmission.", Bull. Math. Biol, 68, 61526
- [4] Hesperess newspaper, Situation of covid-19 in morocco. <https://covid.hesperess.com/>
- [5] WHO, Coronavirus disease (covid-19) dashboard. <https://covid19.who.int/region/amro/country/us>
- [6] Khalid El Hail, Mohamed Khaladi and Aziz Ouhinou "Early-confinement strategy to tackling COVID-19 in Morocco; a mathematical modelling study" RAIRO-Oper. Res. 56 (2022) 4023-4033

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



A priori estimates for solutions of regular elliptic system

Communication Info

Authors:

Halima SRHIRI¹
Chakir Allalou²
Khalid Hilal³

¹LMCS, Sultan Moulay Slimane
University of Beni Mellal, Beni
Mellal, Morocco

²LMACS, Sultan Moulay
Slimane University of Beni
Mellal, Beni Mellal, Morocco

³LMACS, Sultan Moulay
Slimane University of Beni
Mellal, Beni Mellal, Morocco

Keywords:

- (1) Besov type spaces
- (2) A priori estimates
- (3) elliptic system

Abstract

The purpose of this work is to give the regularity for the solutions of regular elliptical systems in the type-Besov space $B^{s,\tau}_{p,q}$. This work is the general of scalar case, where the author obtained the regularity for the solutions of regular elliptic boundary value problems in the scalar case in this spaces.

Note also that this work generalizes the case where author s shows a priori estimates for solutions of regular elliptic systems in BMO spaces and its local version Campanato spaces.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] P. Acquistapace, *On BMO regularity for linear elliptic systems*, *Ann. di Matematica pura ed applicata (IV)*, Vol. CLXI (1992), pp. 231-269.
- [2] A. El Baraka, *Optimal BMO and $L_{p,\lambda}$ estimates for solutions of elliptic boundary value problems*, *Arab. J. Sci. Eng., Sect. A Sci.*, Vol. 30 (2005), No. 1, pp. 85-116. at: <http://www.kfupm.edu.sa/publications/ajse/articles/301A07P.pdf>
- [3] A. El Baraka, M. Masrour, *A-priori estimates near the boundary for solutions of a class of degenerate elliptic problems in Besov-type spaces*. *Moroc. J. Pure Appl. Anal.* 3(2), 149-172 (2017).

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



MATHEMATICAL ANALYSIS OF AN AGE STRUCTURED SIR EPIDEMIC MODEL WITH CONFORMABLE FRACTIONAL DERIVATIVE

Communication Info

Authors:

Fatima CHERKAOUI¹
Khalid HILAL¹
Aziz QAFFOU¹

**Laboratory LMACS, FST
of Beni-Mellal,**
Sultan Moulay slimane
University, Morocco.

Keywords:

- (1) Age structure
- (2) Fractional epidemic model
- (3) Steady states

Abstract

In this paper, we consider a mathematical model with conformable fractional with respect to time. We interest by an SIR model for a vertically as well as horizontally transmitted disease when the force of infection of proportionate mixing assumption type. We formulate the basic model as an abstract fractional Cauchy problem on a Banach space to prove the existence, uniqueness of local mild solution and ensure global

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Inaba, H: Age structured population dynamics in demography and epidemiology. Springer, Singapor (2017).
- [2] Inaba, H: On a new perspective of the basic reproduction number in heterogeneous environment. J. Math. Biol. 65, 309-348 (2012).
- [3] Iannelli, M., Milner, F.A., Pugliese, A.: Analytical and numerical results for the age-structured S-I-S epidemic model with mixed inter-intracohort transmission. SIAM J. Math. Anal. 23, 662-688 (1992).
- [4] Kermack, W.O., McKendrick, A.G.: Contribution to the mathematical theory of epidemics I. Proc. R. Soc. 115, 700-721 (1927).
- [5] Inaba, H: Threshold and stability results for an age structured epidemic model. J. Math. Biol. 28, 411-434 (1990).

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Stability and Hopf Bifurcation Analysis of SIQR Model with Time Delay

Communication Info

Authors:

Fatima Ezzahrae FADILI¹
Chakir ALLALOU²
Khalid HILLAL³

¹LMACS, FST of Beni-Mellal,
Sultan Moulay slimane
University, Beni Mellal,
Morocco

²LMACS, FST of Beni-Mellal,
Sultan Moulay slimane
University, Beni Mellal,
Morocco

³LMACS, FST of Beni-Mellal,
Sultan Moulay slimane
University, Beni Mellal,
Morocco

Keywords:

(1) SIQR epidemic model
(2) time-delay

Abstract

In this paper, the effect of time delay on an SIQR epidemic model is investigated. The model has two equilibria, namely, a disease-free equilibrium and an endemic equilibrium. First, we obtain the basic reproduction number. Afterward, we regard time delay as a bifurcation parameter and investigate the local stability and Hopf bifurcation of the equilibria by discussing the distribution of the eigenvalues of the corresponding characteristic equation.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] B.D. Hassard, N.D. Kazarino, Y.H. Wan, Theory and Applications of Hopf Bifurcation, Cambridge University Press, Cambridge, 1981.
- [2] H. Lu, Y. Ding, S. Gong and S. Wang, Mathematical modeling and dynamic analysis of SIQR model with delay for pandemic COVID-19. Volume 18, Issue 4, 3197-3214. (2021)
- [3] J.K. Hale, Theory of Functional Differential Equations, Springer-Verlag, New York, 1977.
- [4] Xu, Rui, Zhien Ma, Global stability of a delayed SEIRS epidemic model with saturation incidence rate. *Nonlinear Dynamics* 61.1-2, 229-239. (2010)

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



MEASURE OF NONCOMPACTNESS FOR SOLVING ψ -CAPUTO-TYPE FRACTIONAL EVOLUTION EQUATIONS

Communication Info

Authors:

¹M'HAMED ELOMARI

¹SAID MELLIANI

¹CHAIMA EL MAGHRAOUI

¹ALI EL MFADEL

¹LMACD, Laboratoire Des
Mathématiques Appliquées et
Calcul Scientifique

Keywords:

(1) Fractional integral

(2) ψ - Caputo fractional
derivative

(3) Carathéodory function,

(4) Mönche's fixed point.

Abstract

In this manuscript, we establish a new solution existence theorem for evolutionary differential equations involving a fractional ψ -Caputo derivative of order $0 < q < 1$ with nondense domain. The existence result is proved using Mönche fixed point. As application, we conclude this paper by giving an illustrative example to demonstrate the applicability of the obtained result.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] M. Abdo, S. Panchal, A. Saeed, Fractional boundary value problem with ψ -Caputo fractional derivative, *Proc. Indian Acad. Sci*, 129, 65, 2019.
- [2] R. Agarwal, M. Benchohra, D. Seba, On the application of measure of non-compactness to the existence of solutions for fractional differential equations, *Results Math*, 55 (34), 221-230.
- [3] R. Agarwal, M. Benchohra, S. Hamani, A survey on existence results for boundary value problems of nonlinear fractional differential equations and inclusions, *Acta Appl. Math*, 109, 2010, 973-1033.
- [4] R. Agarwal, S. Hristova, D. O'Regan, *Non-Instantaneous Impulses in Differential Equations*, Springer, 2017.
- [5] A. Aghajani, E. Pourhadi, J. Trujillo, Application of measure of non-compactness to a Cauchy problem for fractional differential equations in Banach spaces, *Fract. Calc. Appl. Anal*, 16 (4), 962-977, 2013.
- [6] R. Almeida, A Caputo fractional derivative of a function with respect to another function, *Commun. Nonlinear Sci. Numer. Simul*, 44, 2017, 460-481.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



ON THE INVERSION OF LAPLACE TRANSFORM AND ADMISSIBILITY FOR A CLASS OF VOLTERRA INTEGRODIFFERENTIAL PROBLEMS.

Communication Info

Author:

Ahmed FADILI
LIMATI, Sultan Moulay Slimane
University of Béni Mellal
Morocco

Keywords:

- (1) Volterra equation
- (2) UMD property
- (3) Laplace transform
- (4) Admissibility

Abstract

The notion of admissible control operators for Volterra systems is well studied in [3]. The admissibility of control operators for linear Volterra systems is linked with the UMD property of Banach spaces. In this communication, we are concerned with a class of non-scalar integrodifferential Volterra equations (see. [5]). First we embed this class in a larger Cauchy system, a technique originating in [1, 4]. In order present some new results concerning the inversion of the Laplace transform of the resolvent for a Volterra integrodifferential system with infinite dimension generalizing some results in [2] and finally we establish some characterizations of admissibility for resolvent operators (see.[6]).

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

- [1] K. J. Engel and R. Nagel, One-parameter semigroups for linear evolution equations, New York, Berlin, Heidelberg, 2000.
- [2] A. Fadili and H. Bounit, On the complex inversion formula and admissibility for a class of volterra systems, International Journal of Differential Equations, Article ID 948597, 13 pages, (2014).
- [3] M. Jung, Admissibility of control operators for solution families to Volterra integral equations, SIAM J. Control. Optim, 38, 1323–1333, (2000).
- [4] J. Prüss, Evolutionary Integral Equations and Applications, Birkhäuser-Verlag, Basel, 1993.
- [5] R. Grimmer and J. Prüss, On linear Volterra equations in Banach spaces, Comp & Maths with Appls, 11,(1), 189–205, (1985).
- [6] M, Tismane, H. Bounit and A. Fadili, On the inversion of Laplace transform and admissibility for a class of Volterra integrodifferential problems, IMA Journal of Mathematical Control and Information, Volume 39, Issue 2, June 2022, Pages 643-674.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



The Asymptotic Stability Of A Fractional Epidemiological Model "All Coronavirus Mutations" with Caputo Derivative

Communication

Authors:

Khadija CHANNAN¹
Khalid HILAL²
Ahmed KAJOUNI³

¹LMACS, Sultan Moulay
Slimane University of Béni
Mellal, Morocco

²LMACS, Sultan Moulay
Slimane University of Béni
Mellal, Morocco

³LMACS, Sultan Moulay
Slimane University of Béni
Mellal, Morocco

Keywords:

- (1) Fractional epidemiology model
- (2) equilibrium point
- (3) Mittag-Leffler
- (4)

Abstract

We have all been injured by corona and its mutations, not just us but the whole world; because of this we have created a new epidemiological model which models all the mutations of covid 19 (Omicron, the English variant, delta,...). This paper is concerned with a fractional order model involving the caputo fractional derivative. The equilibrium points and the basic reproduction number are computed. An analysis of the asymptotic stability at the disease free equilibrium is given; Next, we study the stability of the equilibrium points in the sense of mittag-Leffler.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Shaher Momani, Samir Hadid, Lyapunov stability solutions of fractional integrodifferential equations, International Journal of Mathematics and Mathematical Sciences 47 (2004) 25032507.
- [2] Z. Cheng, D.J. Horn, R.K. Lindquist and R. A.J. Taylor, Fuzzy analysis for a greenhouse spider mite management system, Ecological Modelling 90,111-121(1996).
- [3] Mathematical modeling of Covid 19 transmission dynamics with a case study of wuhan 135 (2020).
- [4] Kermack WO, McKendrick AG (1927) A contribution to the mathematical Theory of epidemics. Proc R Soc Lond A 115 :700_721
- [5] Ricardo Almeida¹ · Artur M. C. Brito da Cruz^{1,2} · Natália Martins¹ · M. Teresa T. Monteiro³ An epidemiological MSEIR model described by the Caputo fractional derivative 2018

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Existence of optimal controls for semilinear systems with a nonreflexive control space

Communication Info

Authors:

Nihale EL BOUKHARI¹
El Hassan ZERRIK²

¹Multidisciplinary Research and Innovation Laboratory, Polydisciplinary Faculty of Khouribga, Sultan Moulay Slimane University, Morocco
²MACS Laboratory, Department of Mathematics, University of Moulay Ismail, Meknes, Morocco

Keywords:

- (1) Semilinear systems
- (2) Optimal control
- (3) Existence theory

Abstract

In this work, we study an optimal control problem, governed by a class of infinite-dimensional semilinear systems. The problem consists in finding a control that minimizes a given cost functional, over a convex bounded set of a nonreflexive control space. Sufficient conditions for the existence of optimal controls are formulated. Then the optimality conditions previously developed in [6] are extended to the present problem. The obtained results are illustrated through examples of semilinear partial differential equations.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] A. Addou, A. Benbrik, Existence and uniqueness of optimal control for a distributed parameter bilinear systems, *J. Dyn. Control Syst.*, 8 (2002) 141-152.
- [2] N. U. Ahmed, X. Xiang, Optimal control of infinite-dimensional uncertain systems, *J. Optimiz. Theory Appl.*, 80 (1994) 261-272.
- [3] D. Deng, W. Wei, Existence and stability analysis for nonlinear optimal control problems with 1-mean equicontinuous controls, *J. Ind. Manam. Optim.*, 11 (2015) 1409-1422.
- [4] H. O. Fattorini, *Infinite Dimensional Optimization and Control Theory*, Encyclopedia Math. Appl., Cambridge Univ. Press, Cambridge, 1999.
- [5] X. Li, J. Yong, *Optimal Control Theory for Infinite Dimensional Systems*, Systems & Control: Foundations & Applications, Birkhauser Basel, 1995.
- [6] E. Zerrik, N. El Boukhari, Regional optimal control for a class of semilinear systems with distributed controls, *Int. J. Control*, 92 (2019) 896-907.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



On the Observability of A Class of Linear Time-Fractional Systems.

Communication Info

Authors:

Hamza BEN BRAHIM ¹
Fatima Zahrae EL ALAOUI¹

¹*TSI Team Moulay Ismail
University, Meknes, Morocco*

Keywords:

- (1) Fractional Calculus
- (2) Control Theory
- (3) Initial State
Reconstruction
- (4) HUM Approach
- (5) Numerical Approach
- (6) Simulations

Abstract

In this work we present the notion of global observability developed for a class of fractional linear-time systems with Caputo derivative of order $\alpha \in]1, 2[$. This notion is common in the control theory literature and consists of finding and reconstructing the initial state of a given system either over the entire evolution domain (global observability) or only in a given (desired) subregion within it (regional observability) [1;2]. First, we give definitions and some properties of this notion, and then we describe a method for finding the state of the system using the Hilbert uniqueness method (HUM) [3]. We finish this work with some successful numerical examples to see the effectiveness of the proposed approach.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] K. Zguaid, F. Z. El Alaoui, Ali Boutoulout. Regional Observability of Linear Fractional Systems Involving Riemann-Liouville Fractional Derivative. Faculty of Sciences, Moulay Ismail University, Mekens, Morocco.
- [2] K. Zguaid, F. Z. El Alaoui, Delm F. M. Torres. Regional Gradient Observability for Fractional Differential Equations with Caputo Time-Fractional Derivatives. 2022. Faculty of Sciences, Moulay Ismail University, Mekens, Morocco.
- [3] J.L. Lions, Controlabilité exacte, perturbations et stabilisation de systèmes distribués. Paris ,(1997).



Nanofluid Natural Convection in a Square Cavity Including a Heated Obstacle Using Lattice Boltzmann Method

Communication Info

Authors:

Younes OULAHOU¹
Youssef EL GUENNOUNI¹
Mohamed HSSIKOU²
Jamal BALITI²
Mohamed ALAOUI¹

¹Faculty of Sciences, Moulay
Ismail University, Meknes,
Morocco

²LPolydisciplinary Faculty,
Hassan II University of Sultan
Moulay Slimane, Beni Mellal,
Morocco

Keywords:

- (1) Natural convection
- (2) Nanofluids
- (3) Lattice Boltzmann method
- (4) Heat transfer

Abstract

A numerical investigation of laminar natural convection in square enclosure, filled with the TiO₂-Watre nanofluid, having a centrally placed heated obstacle has been studied using lattice Boltzmann method (LBM). The effects of the Rayleigh number ($10^3 \leq R_a \leq 10^6$), the aspect ratio of the heated obstacle ($0.2 \leq A_o \leq 0.8$), and the nanoparticles volume fraction ($0 \leq \varphi \leq 0.06$) on the fluid flow and heat transfer are examined. The results show that the average Nusselt number increases for a particular range of aspect ratio of the heated obstacle. Also, it augments with increase of Rayleigh numbers R_a and with enhancement of nanoparticles volume fraction φ . It is also found that the size of the heated obstacle does affect the flow structure of the fluid and so, the heat transfer distribution. Comparisons with previously published studies are performed and found the accuracy of the present results.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] A. Arefmanesh, M. Amini, M. Mahmoodi, and M. Najafi, "European Journal of Mechanics B / Fluids Buoyancy-driven heat transfer analysis in two-square duct annuli filled with a nanofluid," *Eur. J. Mech. B/Fluids*, vol. 33, pp. 95-104, 2012, doi: 10.1016/j.euromechflu.2011.11.004.
- [2] J. BALITI, Y. ELGUENNOUNI, M. HSSIKOU, M. ALAOUI, Simulation of Natural Convection by Multirelaxation Time Lattice Boltzmann Method in a Triangular Enclosure, *Fluids*, 7(2) (2022) 74.
- [3] Hssikou, M., Elguennouni, Y., Baliti, J., & Alaoui, M. (2019, December). Lattice Boltzmann method for natural convection in a square cavity with a heated chip. In *2019 International Conference on Intelligent Systems and Advanced Computing Sciences (ISACS)* (pp. 1-7). IEEE.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Analytical solution of a fractional logistic model for a population with Allee effect

Communication Info

Authors:

Abdelati EL ALLAOUI¹
Said MELLIANI²
Youssef Allaoui²

¹MISCOM, National School of Applied Sciences, Cadi Ayyad University, Safi, Morocco.

²LMACS, Sultan Moulay Slimane University, BP 523, 23000 Beni Mellal, Morocco.

Keywords:

- (1) Fractional logistic equation
- (2) Fractional Calculus
- (3) Non-singular kernel

Abstract

In this paper, we propose a fractional logistic model with Allee effect. First we construct the analytical solution in an implicit form of a model with non singular kernel. Further we study a model with singular kernel where we express the solution as a series of fractional powers. Some graphical representations are given to illustrate the two proposed approaches and to compare them.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] P. Amarasekare, Allee Effects in Metapopulation Dynamics.vol. 152, no. 2 American naturalist, 1998.
- [2] M. Arfan, K. Shah, A. Ullah, M. Shutaywi, P. Kumam, Z. Shah, On fractional order model of tumor dynamics with drug interventions under nonlocal fractional derivative Results Phys, 21 (2021), Article 103783.
- [3] Baleanu, D., Mohammadi, H. & Rezapour, S. A fractional differential equation model for the COVID-19 transmission by using the Caputo–Fabrizio derivative. Adv Differ Equ 2020, 299 (2020). <https://doi.org/10.1186/s13662-020-02762-2>
- [4] F. Braue, C. C. Chavez, Mathematical models in population biology and epidemiology, 2nd Ed. Springer, 2011.
- [5] Caputo, M., Fabrizio, M.: On the singular kernels for fractional derivatives. Some applications to partial differential equations. Prog. Fract. Differ. Appl. 7, 79-82 (2021).
- [6] Caputo, M., Fabrizio, M.: A new definition of fractional derivative without singular kernel. Prog. Fract. Differ. Appl. 1, 73-78 (2015).
- [7] A. El Allaoui, S. Melliani and L. S. Chadli, A mathematical fuzzy model to giving up smoking, 2020 IEEE 6th International Conference on Optimization and Applications (ICOA), Beni Mellal, Morocco, 2020, pp. 1-6, doi: 10.1109/ICOA49421.2020.9094470.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Quasi-linear elliptic equations with data in L^1 on a compact Riemannian manifold

Communication Info

Authors:

E. AZROUL, A. ABNOUNE ¹
M.T.K. ABBASSI ²

Supervising by:
CHAKIR ALLALOU
Presented by:
WAFIA NABLAOUI

LMACS, Sultan Moulay
Slimane University of Beni
Mellal, Morocco

Keywords:

- (1) Quasi-linear elliptic equations
- (2) variational methods
- (3) functional spaces
- (4) entropy solution
- (5) Riemannian manifold
- (6) space Marcinkiewicz

Abstract

This work is dedicated to the study of quasi-linear elliptic problems with L^1 data, the simple model will be the next equation on (M, g) a compact Riemannian manifold.

$$-\Delta p u = f$$

Where $f \in L^1(M)$

Our goal is to develop the functional framework and tools that are necessary to prove the existence and the uniqueness of the solution for the previous problem. Notice that our argument can be used to deal with a more general class of quasi-linear equations.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] P. Benilan, L. Boccardo, T. Gallouet, R. Gariepy, M. Pierre, J. Vazquez, An L^1 -theory of existence and uniqueness of solutions of nonlinear elliptic equations, *Annali della Scuola Normale Superiore di Pisa, Classe di Scienze* 4th serie, vol 22, n 2, p. 241 - 273, (1995).
- [2] L. Boccardo, T. Gallouet, Nonlinear elliptic and parabolic equations involving measure data, *J. Funct. Anal.* 87 (1989), no. 1, 149–169.
- [3] G. Stampacchia, *Elliptic Equations of the Second Order with Discontinuous Coefficients*, The Press of the Montreal University, 1966.
- [4] Serrin, J. Pathological solutions of elliptic differential equations. *Ann. Scuola Normale Sup. Pisa Cl. Sci.* 1964, 18 (3), 385–387.
- [5] Brezis, H. Kamin, S. Sublinear equations in IRN . *Mauscripta Math.* 1992, 74 (1), 87–106.
- [6] B. Abdellaoui, I. Peral, Existence and nonexistence results for quasilinear elliptic equations involving the p -Laplacian with a critical potential, *Annali di Matematica* 182, p. 247 –270, (2003).

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



A high-order continuation-based Spectral approach for bifurcation analysis within

Communication Info

Authors:

Mohamed Drissi¹
Mohamed Mansouri¹
Said Mesmoudi²
Soumaya Nouna¹

¹Hassan First University of
Settat, ENSA Berrechid,
LAMSAD Laboratory, Morocco
²Hassan First University of
Settat, ENSA Berrechid, LISA
Laboratory, Morocco

Keywords:

- (1) High Order Continuation
- (2) Meshless Spectral
- (3) Bifurcation analysis

Abstract

In this work, we propose to study the bifurcation analysis of nonlinear bi-harmonic and Poisson problems using a High Order Continuation Spectral approach (HOC-SA). This approach is developed by using a discretization technique with meshless spectral approximation, a Taylor series development, and a continuation technique [1,2]. The strong formulation of nonlinear partial differential equations is applied. The main key of the HOC-SA solver is to transform the nonlinear equations into a sequence of linear ones using a Taylor series development [3,4]. The resulting continuous linear systems are solved using the spectral technique and a continuation procedure is introduced to calculate the complete solution. The advantage of the reliable path-following of the present approach is highlighted by a comparative study using the weak form by the finite element method [5] as a reference.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Drissi, M., Mansouri, M., Mesmoudi, S., & Saadouni, K. (2022). On the use of a Pseudo-spectral method in the Asymptotic Numerical Method for the resolution of the Ginzburg–Landau envelope equation. *Engineering Structures*, 262, 114236.
- [2] Drissi, M., Mansouri, M., & Mesmoudi, S. (2022). Fluid–structure interaction with the spectral method: application to a cylindrical tube subjected to transverse flow. *International Journal of Dynamics and Control*, 1-7.
- [3] Trefethen, L. N. (2000). *Spectral methods in MATLAB*. Society for industrial and applied mathematics.
- [4] Cochelin, B., & Vergez, C. (2009). A high order purely frequency-based harmonic balance formulation for continuation of periodic solutions. *Journal of sound and vibration*, 324(1-2), 243-262.
- [5] Dhatt, G., & Touzot, G. (1981). *Une présentation de la méthode des éléments finis*. Presses Université Laval.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Strong and total Fenchel dualities for robust composed convex optimization problems in locally convex spaces

Communication math

Authors:

Ahmed RIKOUNE¹

Mohamed LAGHDIR²

M'hamed MABROUK³

¹Department of Mathematics,
Faculty of Sciences, Ibn Zohr
University, B.P. 8106, Agadir,
Morocco

²Department of Mathematics,
Faculty of Sciences, Chouaib
Doukkali University, BP. 20, El
Jadida,
Morocco

³Department of Mathematics,
Faculty of Sciences, Chouaib
Doukkali University, BP. 20, El
Jadida,
Morocco

Abstract

In this paper, by using the properties of the epigraph of conjugated functions, we first present some new robust-type constraint qualifications of composite functions. Then, by using these new robust-type constraint qualifications, we obtain some necessary and sufficient conditions which characterizing the stable strong and total dualities for an uncertain composed convex optimization problem.

Keywords:

- (1) Conjugate function
- (2) Fenchel-Lagrange dual
- (3) strong sub-differential
- (4) convex optimization in locally convex spaces

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] M. Wang, D. Fang and Z. Chen: Strong and total Fenchel dualities for robust composed convex optimization problems, *J. Inequalities and Applications*, 70(2015),
- [2] C. Combari, M. Laghdir et L. Thibault, Sous-différentiel de fonctions convexes composées, *Ann. Sci. Math. Québec*, 18(1994), 119-148.
- [3] C. Combari, M. Laghdir et L. Thibault, A note sub-differential of convex composite functional, *Arch. Math. (Basel)* 67, No. 3, 239-252 (1996).
- [4] Y. Zhou and G. Li: The tolant-Fenchel-Lagrange duality of DC programs for composite convex functions, *J. Numerical Algebra, Control and Optimization* 4, No. 1, 9-23 (2014)
- [5] X. K. Sun, X. J. Long and J. Zeng: Constraint qualifications characterizing Fenchel duality in composed convex optimization, *J. Nonlinear and convex Analysis* 17 No. 2, 325-347 (2016).
- [6] G. Y. Li, V. Jeyakumar and G. M. Lee: Robust conjugate duality for convex optimization under uncertainty with application to data classification. *Nonlinear Anal.* 74, 2327-2341 (2011).
- [7] R. I. Bot, S. M. Grad, and G. Wanka, A weaker regularity condition for sub-differential calculus and Fenchel duality in infinite dimensional spaces, *Nonlinear Anal., Theory Methods Appl.* 64, No. 12, 2787-2804 (2006).
- [8] C. Z. alinescu, *convex Analysis in General Vector Spaces*, World Scienti_c, Singapore, 2002.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Positive state controllability of discrete linear time-invariant systems

Communication Info

Authors:

Mourad Ouyadri¹
Mohamed Laabissi¹

¹University Chouaib Doukkali
Faculty of Science, El Jadida,
Morocco

Keywords:

- (1) Discrete linear systems
- (2) Controllability
- (3) Reachability
- (4) Positive System
- (5) Positive State Reachability
- (6) Positive State Controllable

Abstract

Controllability is one of the fundamental concepts in control theory. Positive state controllability is the controllability of systems with positive states and inputs remains in R^n (the input can take negative value). For this type of system, we cannot apply the theory of positive systems, because it needs the non-negativity of both the state and input [2]. There are many papers, where the system is suitable for describing the addition or removal of individuals from a population and for a full description of these actions; we require that the control u can take negative values [3, 4]. Guiver et al [1] introduced this concept for discrete time-invariant linear systems. Guiver et al [1] shows that under certain assumptions, the positive state controllability is equivalent to positive input controllability of a related positive system. In this communication, we present a new interior-point method to study the Positive state Controllability using the reachability map of the linear discrete time-invariant systems. Using a relation between systems where only the state is positive and a related positive system, sufficient conditions are held for this concept. These conditions are evaluated over numerical examples, which supports the theoretical results.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] C. Guiver, D. Hodgson, S. Townley, Positive state controllability of positive linear systems, *Systems and Control Letters* 65 (2014) 23-29.
- [2] L. Farina, S. Rinaldi, *Positive Linear Systems*, in: *Pure and Applied Mathematics (New York)*, Wiley-Interscience, New York, 2000.
- [3] R. E. Kalman, Y. C. Ho, K. S. Narendra, Controllability of linear dynamical systems. In *Contributions to Differential Equations*, 1 (1962) 189–213.
- [4] J. Lubben, B. Tenhumberg, A. Tyre, R. Rebarber, Management recommendations based on matrix projection models: the importance of considering biological limits, *Biol. Conserv*, 141 (2) (2008) 517–523.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Analytical solution of the simple shear flow of a Johnson-Segalman fluid with slip along the fixed wall

Communication Info

Authors:

Meryieme El Farragui¹
Georgios C. Georgiou²
Otmame Souhar¹

¹*Department of Mathematics ,
University Chouaib Doukkali, El
Jadida, Morocco*

²*Department of Mathematics
and Statistics, University of
Cyprus, Nicosia, Cyprus*

Keywords:

- (1) Analytical solution
- (2) Matrix exponential
- (3) Shear flow
- (4) Fluid models

Abstract

The objective of this work is to solve analytically time-dependent shear flow of a Johnson-Segalman/Gordon-Schowalter fluid with slip at the wall, and with added Newtonian viscosity [1]. Unlike most other fluid models, the Johnson-Segalman fluid allows for a non-monotonic relationship between the shear stress and rate of shear in a simple shear flow for certain values of the material parameters. Here, we study a simple shear flow of a Johnson-Segalman/Gordon-Schowalter fluid with a view towards understanding its response characteristics [2]. We use the linear Navier-slip model relating the shear stress to the velocity at the wall, We show that, the boundary conditions can have a very interesting effect on the regularity of the solution.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] G.C. Georgiou, D. Vlassopoulos. On the stability of the simple shear flow of a Johnson-Segalman fluid, J. non-Newton. Fluid Mech.75 (1998) 77–97
- [2] P.S. Stephanou, Quantifying the oscillatory behavior in start-up shear by analytically solving the Johnson-Segalman/Gordon-Schowalter model, J. non-Newton. Fluid Mech. 312 (2023) 104966.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Network-based deep transfer learning Applied to pneumonia detection

Communication Info

Authors:

Otmane MALLOUK¹
Mohamed ETTAOUIL¹

¹Modelling and Mathematical Structures Laboratory,
Department of Mathematics,
Faculty of Science and Technology of Fez, Sidi Mohamed Ben Abdellah University,
Fez, Morocco

Keywords:

(1) Transfer learning
(2) Deep learning
(3) Convolutional neural networks

Abstract

Machine learning [1-2] and deep learning [3-4] algorithms typically require abundant data. In addition, the training and test data are drawn from the same feature space and the same distribution. When the distribution changes, most models need to be rebuilt from scratch using newly collected training data. This can be more expensive or impossible in many real world applications. In such case transfer learning [5-6] would be desirable. In this communication, we are going to give a review on transfer learning. Then we will use transfer learning in convolutional neural networks, based on the parameter transfer approach for pneumonia detection in chest X-ray images.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] R.W. Cottle, J.S. Pang, R.E. Stone, The linear complementarity problem, Academic Press, 1992.
- [2] H Wang, Z Lei, X Zhang, B Zhou, and J Peng. Machine learning basics. *Deep learning*, pages 98–164, 2016.
- [3] Hssayni, El & Joudar, Nour-Eddine & Ettaouil, Mohamed. (2022). Convolutional Neural Networks: Architecture Optimization and Regularization. 10.1007/978-3-031-01942-5_18..
- [4] Yann LeCun, Yoshua Bengio, and Geoffrey Hinton. Deep learning. *nature*, 521(7553) :436–444, 2015.
- [5] Lisa Torrey and Jude Shavlik. Transfer learning. In *Handbook of research on machine learning applications and trends : algorithms, methods, and techniques*, pages 242– 264. IGI global, 2010
- [6-7] Sinno Jialin Pan and Qiang Yang. A survey on transfer learning. *IEEE Transactions on knowledge and data engineering*, 22(10) :1345–1359, 2009..

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



On a new fractional Sobolev space with variable exponent on complete manifolds

Communication Info

Authors:

Ahmed Aberqi¹

Omar Benslimane²

Abdesslam Ouaziz²

Dusan D. Repovš³

1 Sidi Mohamed Ben Abdellah
university, ENSA-Fez, Morocco

2 Sidi Mohamed Ben Abdellah
university, FSDM-Fez, Morocco.

3 University of Ljubljana
Slovenia

Keywords:

Fractional $p(z)$ -Laplacian, Existence of
solutions, Fractional Sobolev space
with variable exponent on complete
manifolds, Variational method

Abstract

We present the theory of a new fractional Sobolev space in complete manifolds with variable exponent. As a result, we investigate some of our new space's qualitative properties, such as completeness, reflexivity, separability, and density. We also show that continuous and compact embedding results are valid. We apply the conclusions of this study to the variational analysis of a class of fractional $p(z)$ -Laplacian problems involving potentials with vanishing behavior at infinity as an application.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Adams, R, and Fournier, J. F. *Sobolev spaces*, Acad, Press, New York. 19, (1975)
- [2] Benslimane, O. and Aberqi, A. and Bennouna, J. *Existence and uniqueness of entropy solution of a nonlinear elliptic equation in anisotropic Sobolev Orlicz space*, Rend. Circ. Mat. Palermo, II. Ser. 70, (2021) 1579-1608. <https://doi.org/10.1007/s12215-020-00577-4>
- [3] Bahrouni, A. and Radulescu, V. D. *On a new fractional Sobolev space and applications to nonlocal variational problems with variable exponent*, Discrete & Continuous Dynamical Systems-S. 11, (2018) 379–389.
- [4] Aberqi, A. and Bennouna, J. and Benslimane, O. and Ragusa, M. A. *Existence Results for double phase problem in Sobolev-Orlicz spaces with variable exponents in Complete Manifold*, accepted in Mediterranean Journal of Mathematics. (2022)
- [5] Y. El foutayeni, M. Khaladi, Using vector divisions in solving the linear complementarity problem, J. Comput. Appl. Math., 236 (2012) 1919-1925.



High-Order Scheme For Solving The Nonlinear Diffusion Equation

Communication Info

Authors:

Salma MOUJID¹
Hicham AMRANI SOUHLI¹
Abdelilah KADDAR¹

¹ LabSIPE, Université Chouaib
Doukkali, El Jadida, Morocco

Keywords:

(1) Nonlinear Diffusion
Equation
(2) High-Order Scheme
(3) Finite Difference
method

Abstract

In this work, we propose the nonlinear diffusion equation, of the form :

$$\frac{\partial u}{\partial t} = \frac{\partial}{\partial x} \left(k(u) \frac{\partial u}{\partial x} \right) \quad x \in \Omega \quad t > 0 \quad (1)$$

This equation is found in fluid mechanics, heat and moisture transfer [1].

The main role of solving the equation (1) is to obtain a very reliable and accurate solution. In order to deal with this matter, we shall put our interest in higher-order numerical method [2-3] to solve the desired equation.

This study aims to present a new high-order scheme based on finite difference formula, by replacing the space derivative in the PDE (1), we obtain a system of first-order ODE. And finally, we will test the numerical solution by some examples of exact solution [4-5] of the nonlinear diffusion equation with the use of the l^∞ norm of the error.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] S. Gasparin, J. Berger, D. Dutykh, N. Mendes, An adaptive simulation of nonlinear heat and moisture transfer as a boundary value problem. *Int. J. of Therm. Sci.* (2018), 133, 120-139.
- [2] D. Yambangwai, N. P. Moshkin. Fourth-order deferred correction scheme for solving heat conduction problem. *Math. Prob. in Eng.* (2013).
- [3] T. A. Cheema, (1997). Higher-order finite-difference methods for partial differential equations, *Comp. and Math.* (1997).
- [4] A. D. Polyanin, V. F. Zaitsev, *Handbook of Nonlinear Partial Differential Equations: Exact Solutions, Methods, and Problems.* Chapman and Hall/CRC (2003).
- [5] A. M. Wazwaz, Exact solutions to nonlinear diffusion equations obtained by the decomposition method. *Applied mathematics and computation*, (2001). 123(1), 109-122.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



LES COURBES ELLIPTIQUES SUR L'ANNEAU

$$A_n = F_{2^d}[\epsilon]; \epsilon^n = 0$$

Communication Info

Auteurs :

NAJAT RAFI
KHADIJA BOUZKOURA

LAMS, Université Hassan II
Casablanca, faculté des
sciences Ben M'sick.

MOTS CLÉS :

- (1) COURBES ELLIPTIQUES
- (2) CRYPTOGRAPHIE
- (3) ANNEAU QUASI-GALOISIEN

Abstract

Les courbes elliptiques définies sur un anneau ont été étudié sous différents aspects. En géométrie algébrique, c'est exposé dans le livre de Silverman qui les a étudié dans le cas d'un anneau local. En théorie des nombres, étudié sur l'anneau $\mathbb{Z}_{p,q}$ où p et q sont des nombres premiers distincts. En cryptographie, l'utilisation de ces courbes pour la création d'un système cryptographique à clés publiques étudié par de nombreux spécialistes par exemple la thèse de A. Chillali qui généralise l'étude des courbes elliptiques définies sur l'anneau $F_q[\epsilon]; \epsilon^n = 0$ avec q un nombre premier et aussi dans la thèse de A. Tadmori et A. Chillali [3]. Dans cette présentation, nous donnerons une étude sur les courbes elliptiques définies sur un anneau commutatif fini en particulier sur l'anneau Quasi-Galoisien $A_n = F_{2^d}[\epsilon]; \epsilon^n = 0$ et certaines propriétés et exemples.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] L. Washington. Elliptic curves, Number theory and Cryptography. Chapman and all, 2003
- [2] N.KOBLITZ., Elliptic curves Cryptosystems. Mathematics of computation. 48,203- 209.
- [3] A.Tadmori, A.Chillali, Courbes elliptiques sur des anneaux commutatifs finis et applications, 2016.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Machine Learning and Causal Inference Methods for Health Services Research Services Research

Communication Info

Authors:

Sahar ECHAJEI¹
Hanane FERJOUCHIA¹
Mostafa RACHIK¹

¹Faculty of Sciences Ben M'sik,
Hassan II University of
Casablanca, Morocco

Keywords:

- (1) Machine Learning
- (2) Causal Inference
- (3) Precision medicine
- (4) Statistics
- (5) Epidemiology

Abstract

In artificial intelligence, in many fields of applications, statistical learning methods have demonstrated their high level of performance. One of the tasks often performed by this type of method consists in studying the statistical dependence between variables for improved classification or prediction. A considerable amount of research is also being carried out, in order to evaluate the performance of machine learning methods through the angle of causality, and their use in particular in epidemiology.

This paper presents the results of many selected research articles that focuses on the usage of machine learning and causal inference in general healthcare and particularly in diabetology, namely: (i) predictive systems for estimation and early detection of diabetes and its complications, and, (ii) causal systems able to predict patient response to targeted therapies.

In light of the complexity of the human body structure, of its physical constraints as well as its big variability, models combining Machine Learning and causal inference thus lead to optimal decision-making, to identify new morbidity factors associated with diabetes, to customize treatment for an individual's specific needs and to anticipate and reduce the risks of diabetes complications.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] J. Pearl, Causality: Models, reasoning, and inference, Cambridge University Press, 2nd edition, 2009.
- [2] C. Tortù, Machine Learning Algorithms for Causal Inference Studies, Machine Learning journal club, 2021.
- [3] W. Crown, Real-World Evidence, Causal Inference, and Machine Learning, Value Health, (2019) 22(5): 587-592
- [4] I. Kavakiotis, O. Tsave, A. Salifoglou, N. Maglaveras, I. Vlahavas, Machine Learning and Data Mining Methods in Diabetes Research, Published by Elsevier B.V, on behalf of Research Network of Computational and Structural Biotechnology, 2017.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



The Deep Learning Solution of the Helmholtz Equations

Communication Info

Authors:

Soumaya Nouna¹
Mohamed Mansouri¹
Boujamaa Achchab¹
Assia Nouna¹

¹Hassan First University
of Settat, ENSA Berrechid,
Laboratory LAMSAD,
Morocco.

Keywords:

(1) Deep Learning
(2) Helmholtz Equations
(3) Neural Networks
(4) Artificial Neural
Networks

Abstract

The purpose of the paper is to suggest the use of the Deep Learning (DL) [1-2] technique, NeuroDiffEq, for solving the Helmholtz equations [3-4] in two dimensions. The technique is suitable for a variety of physics problems. In this approach, Artificial Neural Networks (ANN) [5] are utilized for approximating the solution and satisfying the boundary conditions of the equations. Also, NeurodiffEq's goal has been to apply available approaches to the use of artificial neural networks for resolving partial differential equations such that the package can be sufficiently flexible to handle problems of various definitions. Thus, the effectiveness of the neural network proposed is demonstrated numerically.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] J. Schmidhuber, Deep learning in neural networks: An overview, *Neural networks* 61 (2015) 85–117.
- [2] J. Berg, K. Nyström, A unified deep artificial neural network approach to partial differential equations in complex geometries, *Neurocomputing* 317 (2018) 28–41.
- [3] Y. S. Wong, G. Li, Exact finite difference schemes for solving Helmholtz equation at any wavenumber, *International Journal of Numerical Analysis and Modeling, Series B* 2 (1) (2011) 91–108.
- [4] G. Sutmann, Compact finite difference schemes of sixth order for the Helmholtz equation, *Journal of Computational and Applied Mathematics* 203 (1) (2007) 15–31.
- [5] Y. Khoo, J. Lu, L. Ying, Solving parametric pde problems with artificial neural networks, *European Journal of Applied Mathematics* 32 (3) (2021) 421–435.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Minimizing total weighted tardiness for the permutation flow shop scheduling problem, under the constraint of sequence independent setup time

Communication Info

Authors:

Abdelouahed MIRI¹
Karam ALLALI¹

¹Laboratory of Mathematics,
Computer Science and
Applications, University Hassan
II of Casablanca, FST,
Mohammedia, PO
Box 146, Morocco

Keywords:

- (1) Flow shop
- (2) Scheduling
- (3) Optimization
- (4) Mathematical modeling
- (5) Total weighted tardiness

Abstract

The permutation flow shop scheduling problem is considered as one of the most important issues encountered in production management and is classified as NP-hard problem to be solved in operation research. In the present paper, we will study it under the constraint of sequence independent setup time and with the optimization criterion consisting in minimizing the total weighted tardiness of jobs. To better deal with this issue, first, we mathematically model it as a mixed integer linear program (MILP) and we solve it with LINGO software. Then, we develop three heuristics based on Johnson and NEH procedures and we compare the results obtained by these heuristics to the optimal solution got by MILP. The computation experiments show that the heuristic, relied on NEH procedure and using the rule consisting in sorting jobs in non-decreasing order of their weighted due date, is the best to approximately solve this problem in terms of solution quality.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] A. Allahverdi, H. Soroush, The significance of reducing setup times/setup costs. *European Journal of Operational Research*, 35 (2008) 1350-1373.
- [2] J Belabid, S. Aqil, K. Allali, Solving permutation flow shop scheduling problem with sequence-independent setup time. *Journal of Applied Mathematics*, 2020.
- [3] L. A. Hall, Approximability of flow shop scheduling. *Mathematical Programming*, 82 (1988) 175-190

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Discrete Energy Behavior of thermoelastic Timoshenko System with Cattaneo's Law

Communication Info

Authors:

Ali SMOUK¹
Atika RADID¹

¹LMFA, Faculty of Sciences Ain
Chock, Hassan II University of
Casablanca, Casablanca,
Morocco

Keywords:

- (1) Numerical analysis
- (2) Timoshenko system with Cattaneo's law
- (3) Numerical stability
- (4) Discrete energy
- (5) Finite element method

Abstract

In this work, we consider a one dimensional thermoelastic Timoshenko system where the thermal coupling is acting on both the shear force and the bending moment, and the heat flux is given by Cattaneo's law.

Our contribution will consist in studying the numerical stability of a Timoshenko system with Cattaneo's law. We introduce a P_1 finite element method for space discretization and implicit Euler scheme for time discretization. Then we prove that the associated discrete energy decreases and we establish a priori error estimates. Finally, we obtain some numerical simulations.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] F. Djellali, S. Labidi, F. Taallah. Exponential stability of thermoelastic Timoshenko system with Cattaneo's law, ANNALI DELL'UNIVERSITA' DI FERRARA (2021) 67:43–57.
- [2] Luci Harue Fatori, Rodrigo Nunes Monteiro, Hugo D. Fernández Sare, The Timoshenko System with history and Cattaneo law. Applied Mathematics and Computation. 228(2014), 128-140.
- [3] Belkacem Said-Houari, Aslan Kasimov. Damping by heat conduction in the Timoshenko system: Fourier and Cattaneo are the same. J. Differential Equations 255(2013) 611-632.
- [4] M.A. Jorge Silva and R. Racke. Effects of history and heat models on the stability of thermoelastic Timoshenko systems. Journal of Differential Equations, 275:167–203, 2021.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



FIXED POINTS OF FUZZY MONOTONE MAPS

Communication Info

Authors:

Amine FAIZ¹

Khadija BOUSKOURA²

¹Doctorant, Hassan II
University of Casablanca,
Casablanca, Morocco

²LAMS, Hassan II University of
Casablanca, Casablanca,
Morocco

Keywords:

- (1) Fuzzy sets theory
- (2) Fuzzy ordered sets
- (3) Fuzzy monotone maps

Abstract

In his seminal paper Zadeh [11] introduced the notion of fuzzy set. During last three decades the fuzzy set theory has rapidly developed into an area which scientifically as well as from the application point of view, is recognized as a very valuable contribution to the existing knowledge (see [3,9,13]). Recently Heilpern [7], Hadzic [6], Fang [5], Jung, Cho and Kim [8] and many other authors have started to study fixed points in fuzzy setting. The aim of this note is to prove the existence of fixed points of fuzzy monotone maps on fuzzy ordered set. Let X be a space of points (objects), with a generic element of X denoted by x . A fuzzy set B of X is characterized by a membership function ' b ' which associated with each element in X a real number in the interval $[0,1]$, with the value of $b(x)$ at x representing the grade of membership of x in B . For details see Zimmermann [13].

Zadeh [11] gave the definition of fuzzy ordered relations which was subsequently used by Vanugopalan [9] and Beg and Islam [2] in their recent papers. Zadeh's definition has a binary inspiration. In this paper we follow the following definition of order relation due to French school lead by Prof. Claude Ponsard (see Billot [3]).

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Beg, I., On fuzzy Zorn's lemma, Fuzzy Sets and Systems 101(1999), 181-183.
- [2] Beg, I., Islam, M., Fuzzy ordered linear spaces, Jour. Fuzzy Math. 3(3)(1995), 659-670.
- [3] Billot, A., Economic theory of fuzzy equilibria, Lecture Notes in Economics and Mathematical systems -373, Springer-Verlag, Berlin 1992.
- [4] Chapin, E. W., Set-valued set theory: Part One, Notre Dame Journal of Formal Logic XV (4)(1974), 619-634.
- [5] Fang, J. X., On fixed point theorems in fuzzy metric spaces, Fuzzy Sets and Systems 46(1992), 107-113.
- [6] Hadzic, O., Fixed point theorems for multivalued mappings in some classes of fuzzy metric spaces, Fuzzy Sets and Systems 29(1989), 115-125.
- [7] Heilpern, S., Fuzzy mappings and fixed point theorem, Jour. Math. Anal. Appl. 83(1981), 566-569.
- [8] Jung, J. S., Cho, Y. J., Kim, J. K., Minimization theorems for fixed point theorem in fuzzy metric spaces and applications, Fuzzy Sets and Systems 61(1994), 119-207.
- [9] Li, H. X., Yen, V. C., Fuzzy Sets and Fuzzy Decision Making, CRC Press, New York 1995.
- [10] Venugopalan, P., Fuzzy ordered sets, Fuzzy Sets and Systems 46(1992), 221-226.
- [11] Zadeh, L. A., Fuzzy sets, Information & Control 8(1965), 338-353.
- [12] Zadeh, L. A., Similarity relations and fuzzy orderings, Info. Sci. 3(1971), 177-200.
- [13] Zimmermann, H. J., Fuzzy Set Theory and its Applications, Kluwer Academic Pub. - Dordrecht 1991.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Solutions for the fractional Heisenberg-viscoelasticity equations

Communication Info

Authors:

Mohamed EL IDRISSE¹
El-Hassan ESSOUFI²

^{1,2} *MISI, Hassan First University
of Settat, Settat, Morocco*

Keywords:

- (1) ferromagnetics
- (2) Landau Lifshitz
équation
- (3) weak solutions
- (4) Galerkin Penalty-
method
- (5) Commutator estimates

Abstract

In this work, we study the existence of global weak solutions for a model described by the fractional Heisenberg equation for the magnetization field and the viscoelastic integro-differential equation for the displacements. We study the three-dimensional case. The existence of weak solution is proved by using the Faedo-Galerkin Penalty-methods; and to get the convergence of the nonlinear terms, we introduce the commutator estimates.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] F. Alouges and A. Soyeur. On global weak solutions for Landau-Lifshitz equations: Existence and non uniqueness. *Nonlinear Anal.*, 18:1071–1084, (1992)
- [2] Carillo, S, Valente, V, Vergara-Caffarelli, G: An existence theorem for the magneto-viscoelastic problem. *Discrete Contin. Dyn. Syst., Ser. S* 5(3), 435-447 (2012)
- [3] F. Demengel and G. Demengel. *Espaces Fonctionnels, utilisation dans la résolution des équations aux dérivées partielles.* EDP Sciences, Les Ulis; CNRS Editions, Paris, (2007)
- [4] I. Ellahiani, E.H. Essoufi and M. Tilioua. Global existence of weak solutions to a threedimensional fractional model in magneto-viscoelastic interactions. *Bound. Value Probl.*, Paper No. 122, 20 pp. (2017)
- [5] B. Guo and M. Zeng. Solutions for the fractional Landau-Lifshitz equation. *J. Math. Anal. Appl.*, 361(1): 131–138, (2010)

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Global weak solution for the compressible Landau-Lifshitz-Bloch-Heisenberg equation

Communication Info

Authors:

Benmouane Mohamed¹
El Hassan Essoufi²
Chahid Ayouch³

¹ MISI, Hassan First University
of Settat, Settat, Morocco

² MISI, Hassan First University of
Settat, Settat, Morocco

³ LAMAI, Cadi Ayyad University,
Marrakesh, Morocco

Keywords:

- (1) Landau-lifshitz-Bloch equation
- (2) The compressible Heisenberg chain equation
- (3) The difference differential method

Abstract

In magnetism, Landau and Lifshitz proposed an equation that describes the evolution of magnetic moment at low temperature. For higher temperatures Garanin proposed another equation interpolated between the Landau-Lifshitz equation and the Bloch equation. This equation is called the Landau-Lifshitz-Bloch equation and is written in the following form:

$$u_t = k_1 \Delta u + \gamma u \times \Delta u - k_2 (1 + \mu |u|^2) u. \quad (1)$$

Where k_1, k_2, γ et μ are constants.

Also, Fizez proposed an equation of motion derived from the classical compressible Heisenberg chain equation. This equation can be written in dimension one as follows:

$$u_t = (G(u_x) u \times u_x)_x. \quad (2)$$

Where $G(u_x) = A + B |u_x|^2$. A, B are two constants.

In this communication, we will take this equation:

$$u_t = k_1 \Delta u + (G(u_x) u \times u_x)_x - k_2 (1 + \mu |u|^2) u.$$

Which generalizes simultaneously (1) and (2), and by the difference differential method we prove that it admits at least one weak solution. We will finish by a numerical simulation of the solution of (1).

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] C. Ayouch, M. Benmouane, and El-H. Essoufi, *Regular solution for the compressible Landau-Lifshitz-Bloch equation in a bounded domain of R^3* , *Journal of Elliptic and Parabolic Equations* (2022).
- [2] S. Ding, B. Guo and F. Su, *Measure-valued solution to the strongly degenerate compressible Heisenberg chain equations*. *Journal of Mathematical Physics*, 1999, 40(3), 1153-1162.
- [3] J. Fizez: *On the continuum limit of a classical compressible Heisenberg chain*. *J. Phys. C: Solid State Phys.*, 15 (1982) L641-L643.
- [4] D. A. Garanin, *Generalized equation of motion for a ferromagnet*. *Physica A Statistical Mechanics and Its Applications*, 1991, 172(3), 470-491.
- [5] B. Guo and F. Li: *Global smooth solution for the compressible Landau-Lifshitz-Bloch equation*. *Journal of Applied Analysis and Computation* Volume 9, Number 6, December 2019, 2454-2463.
- [6] K. Hamdache and D. Hamroun: *Existence of large solutions to the Landau-Lifshitz-Bloch equation*. *Communications in Mathematical Sciences*, 18 (2020) 487 - 513.
- [7] J. Huang: *Global Well-Posedness for a Viscosity Problem of the Compressible Heisenberg Chain Equations*. *Filomat* 30:12 (2016), 3317-3327.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



A comparative study of iterative reconstruction algorithms for Electrical Impedance Tomography(EIT)

Communication Info

Authors:

Soumaya IDAAMAR¹
Mohamed LOUZAR²
Abdellah LAMNII³

¹MISI, Hassan I University of
Settat, Morocco

²MISI, Hassan I University of
Settat, Morocco

³MISI, Hassan I University of
Settat, Morocco

Keywords:

- (1) Electrical impedance tomography
- (2) Inverse problem
- (3) Total variation
- (4) Gauss-Newton
- (5) Conjugate gradient

Abstract

Electrical Impedance Tomography (EIT) is a non-invasive imaging technique used to determine the electrical conductivity distribution of a biological tissue. It works by applying small electrical current electrodes on the surface of the tissue and measuring the voltages at the other electrodes to generate impedance measurements. These measurements are then used to reconstruct the conductivity distribution using inverse algorithms [1–3]. EIT has been widely applied in medical imaging for various purposes, including brain imaging breast cancer detection [4–5].

This paper aims to compare the behavior of three algorithms Total variation, Gauss-Newton and conjugate gradient on solving the EIT inverse problem.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] A. Lyazidi · J.-C. Richard · J. Dellamonica · C. Guérin · J.C.M. Richard(2011).Perspectives in respiratory monitoring © SRLF et Springer-Verlag France .
- [2] Webster, J. G., Electrical Impedance Tomography, Adam Hilger Series of Biomedical Engineering, Adam Hilger, New York, USA, 1990.
- [3] M. Hadinia, R. Jafari, 2015 . An element-free Galerkin forward solver for the complete-electrode model in electrical impedance tomography, Elsevier.
- [4] Andy Adler and William R B Lionheart(2006), Uses and abuses of EIDORS: an extensible software base for EIT, IOPscience,Ottawa Canada
- [5] K.G. Binning and J.G. Webster, "History of electrical impedance tomography and the development of its clinical applications," Clinical Radiology, vol. 67, no. 4, pp. 273-280, 2012.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Modeling of Freight International Transport with Uncertainties

Communication Info

Author:

Abderrahman ABBASSI ¹

¹ LMDP, Cadi Ayad University,
Marrakech, Morocco.

Keywords:

- 1) Multi-objective optimization
- 2) Mathematical programming
- 3) Uncertainty
- 4) International transport

Abstract

The international freight transport is an important pillar for the national economy of any country; it is a key to maintain economic growth and improve international trade competitiveness [1-2]. A successful transportation strategy requires well-connected terminals empowered by efficient supply chains so as to optimize many criteria such as transportation cost and shipping time [3-4]. However, modeling and solving this problem is complicated when the involved data is unknown beforehand [5]. The core idea of this communication is to mathematically formulate the problem of international transportation with uncertain data such as costs, capacities, and modes of transport. The solution obtained is efficient and compromising even if the concerned parameters are unknown.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] D. Rondinelli, M. Berry, Multimodal transportation, logistics, and the environment: managing interactions in a global economy, *Eur. Manage. J.* 18 (2000) 398–410.
- [2] V. Reis, Analysis of mode choice variables in short-distance intermodal freight transport using an agent-based model, *Transp. Res. Part A: Pol. Pract.* 61(2014) 100–120.
- [3] F.H. Boukani, B.F. Moghaddam, M.S. Pishvae, Robust optimization approach to capacitated single and multiple allocation hub location problems, *Comput. Appl. Math.* 35 (2016) 45–60.
- [4] S.A. Alumur, S. Nickel, F. Saldanha-da-Gama, Hub location under uncertainty, *Transp. Res. Part B: Methodolog.* 46 (2012) 529–543.
- [6] A. Abbassi, A.E. Alaoui, J. Boukachour, Modelling and solving a bi-objective intermodal transport problem of agricultural products, *Int. J. Ind. Eng. Comput.* 9 (2018) 439–460.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Modeling Decision Making to control the Allocation of Virtual Machine in a Cloud Computing System with Reserve Machines

Communication Info

Authors:

Abdellah OUAMMOU¹
Hamid TARAMIT¹
Adnane EL HANJRI²

¹FSTS, Hassan I University of
Settat, Settat, Morocco

²Moroccan School of Engineering
Sciences (EMSI), Tangier,
Morocco

Keywords:

- (1) Resources allocation
- (2) Mathematical programming
- (3) Dynamic programming

Abstract

The complicated and sensitive nature of virtual machine allocation in the cloud causes challenges in controlling and allocating resources or selecting the optimal allocation of such resources. We propose in this talk an optimal computing resource assignment model to assess the better management of the system resources where a set of physical machines are defined as "reserves." The scheduler will turn them on individually when the system has an enormous task number. The aim is to maximize the reward of the cloud computing system. This reward is calculated based on the energy and execution time of each client and the characteristics of the system. Finding the best allocation for such a complex system is a challenge. For this, we used a heuristic algorithm and a dynamic programming approach. The analysis of the results showed the advantage of using our model to control the utilization of the spare machines to achieve high quality of service and low energy consumption.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References:

- [1] S. Mustafa, B. Nazir, A. Hayat, S. A. Madani et al., "Resource management in cloud computing: Taxonomy, prospects, and challenges," *Computers & Electrical Engineering*, vol. 47, pp. 186–203, 2015.
- [2] A. Ouammou, A. BenTahar, M. Hanini, and S. El Kafhali, "Modeling and analysis of quality of service and energy consumption in cloud environment," *International Journal of Computer Information Systems and Industrial Management Applications*, vol. 10, 2018
- [3] X. Liu, Y. Zhang, and K. Zhang, "Optimization control of energy consumption in tunneling system of earth pressure balance shield tunneling machine." *Engineering Letters*, vol. 28, no. 2, pp. 551–558, 2020.
- [4] H. El Ghor and M. Chetto, "Energy guarantee scheme for real-time systems with energy harvesting constraints," *International Journal of Automation and Computing*, vol. 16, no. 3, pp. 354–368, 2019.
- [5] A. Ouammou, M. Hanini, A. B. Tahar, and S. El Kafhali, "Analysis of a m/m/k system with exponential setup times and reserves servers," in *Proceedings of the 4th International Conference on Big Data and Internet of Things*, 2019, pp. 1–5.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Generalized weak ϵ -sub-differential and applications

Communication Info

Authors:

Abdelghali AMMAR¹
Mohamed Laghdir²
Ahmed RIKOUANE³

¹MISCOM, Cadi Ayyad
University, Marrakech,
Morocco

²Chouaib Doukkali University,
El Jadida, Morocco

³IMI, Ibn Zohr University,
Agadir, Morocco

Keywords:

- (1) weak ϵ -subdifferential
- (2) Vector optimization
- (3) DC objective

Abstract

A concept of subdifferential of a vector valued mapping is introduced, called generalized weak ϵ -subdifferential. Some existence theorems and properties are discussed. We establish some formulas of the generalized weak ϵ -subdifferential for the sum and the difference of two vector valued mappings. A relationship between the generalized weak ϵ -subdifferential and a directional derivative is presented. We discuss the positive homogeneity of the generalized weak ϵ -subdifferential. As application of the calculus rules, we establish necessary and sufficient optimality conditions for a constrained vector optimization problem with the difference of two vector valued mappings.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] J. B. Hiriart-Urruty, From Convex Optimization to Nonconvex Optimization. Necessary and Sufficient Conditions for Global Optimality, In : Clarke, F.H., Dem'yanov, V.F., Giannessi, F. (eds) Nonsmooth Optimization and Related Topics. Ettore Majorana International Science Series, 43 Springer, Boston, 1989.
- [2] J. E. Martinez-Legaz and A. Seeger, A formula on the approximate subdifferential of the difference of two convex functions, Bull. Austral. Math. Soc. 45 (1992), 37-42.
- [3] M. El Maghri, Pareto-Fenchel ϵ -subdifferential sum rule and ϵ -efficiency, Optim. Lett. 6 (2012), 763-781.
- [4] M. El Maghri and M. Laghdir, Pareto subdifferential calculus for convex vector mappings and applications to vector optimization, SIAM J. Optim. 19 (2009), 1970-1994.
- [5] M. Laghdir and A. Rikouane, A Note on Approximate Subdifferential of Composed Convex Operator, Applied Mathematical Sciences, Vol. 8 (2014), 2513-2523.
- [6] M. Théra, Calcul ϵ -sous-différentiel des applications convexes, C. R. Acad. Sci. Paris 290 (1980), 549-551.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Modeling mathematical and Analysis of an Alcohol drinking with n complications

Communication Info

Authors:

Abdelhak ESSOUNAINI¹
Bouchaib Khajji¹
Hassan
LAARABI¹
Mostafa
RACHIK¹

¹LAMS, Hassan II University of
Casablanca, Casablanca,
Morocco

Keywords:

(1) mathematical model
(2) Stability Analysis
(3) Locally and Globally
stable

Abstract

In this work, we propose a continuous mathematical model of excessive alcohol consumption. In order to study the dynamics and development of this model and to explain the impact of variations in alcohol consumption on the different diseases influenced, we discuss the basic properties of the system and its basic reproduction number, R_0 . We also examine the sensitivity analysis of the model parameters to determine which parameters have a strong influence on the reproduction number R_0 . The stability analysis of the model shows that the alcohol-free equilibrium system E_0 is locally and globally asymptotically stable for $R_0 \leq 1$. When $R_0 > 1$, an equilibrium with excessive alcohol consumption appears and the system is both locally and globally stable with equilibrium alcohol consumption E^*

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Organization W. H. Global status report on alcohol and health 2018: Executive summary. Technical report, World Health Organization (2018)
- [2] Boujallal L., Balatif O., Elhia M. A set-valued approach applied to a control problem of tuberculosis with treatment. IMA Journal of Mathematical Control and Information. 38 (3), 1010–1027 (2021)
- [3] Xiang H., Wang Y., Huo H. Analysis of the binge drinking models with demographics and nonlinear infectivity on networks. Journal of Applied Analysis & Computation. 8 (5), 1535–1554 (2018).
- [4] Essounaini A., Labzai A., Laarabi H., Rachik M. Mathematical modeling and optimal control strategy for a discrete time model of COVID-19 variants. Commun. Math. Biol. Neurosci., 2022, vol. 2022, p. Article ID 25
- [4] Y. El foutayeni, M. Khaladi, General Characterization of a Linear Complementarity Problem, Amer. J. Model. Optim., 1 (2013) 1-5.
- [5A. Lahrouz, L. Omari, D. Kiouach, A. Belmaati, Deterministic and stochastic stability of a mathematical model of smoking, Stat. Probab. Lett. 81 (2011) 1276–1284
- [6] Adu I. K., Mojeeb A., Yang C. Mathematical model of drinking epidemic. Journal of Advances in Mathematics and Computer Science. 22 (5), 1–10 (2017).

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Numerical Solution of Volterra Integro-Differential Equation Using Moving Least Square Method

Communication Info

Authors:

Abdelali MOHIB¹

Anas RACHID¹

¹MA, Hassan 2 University of
Casablanca, Casablanca,
Morocco

Keywords:

(1) Moving least squares

(MLS) method

(2) Volterra integro-
differential equation

(3) Interpolating polynomial

Abstract

In this work, we introduce an enhanced MLS method for the solution of Volterra integro-differential equation: an interpolating polynomial. It is a numerical scheme that utilizes a modified shape function of the conventional Moving Least Square (MLS) method to solve fourth order Integro-differential equations. Smooth orthogonal polynomials have been constructed and used as the basis functions. An unrestricted trigonometric weight function, along with the basis function, drives the shape function and facilitates the convergence of the scheme. The choice of the support size and some controlling parameters ensures the existence of the moment matrix inverse and the MLS solution. Valid explanation and illustration were made for the existence of the inverse linear operator. To overcome problems of near-singularity, the singular value decomposition rule is used to compute the inverse of the moment matrix. The integral part is approximated by Gauss quadrature rule. Some tested problems were solved to show the applicability of the method. The results obtained compare favorably with the exact solutions. Finally, a highly significant interpolating polynomial is obtained and used to reproduce the solutions over the entire problem domain.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] M.K.Tavassoli, M.Ghasemi, E.Babolian, Comparison between homotopy perturbation method and sine- cosine wavelets method for solving linear integro-differential equations, *Comput. Math. Appl.* 54, 1162–1168 (2007).
- [2] C. Zuppa, Error estimates for moving least square approximations, *Bull. Braz. Math. Soc.* 34(2), 231–249, 2003a.
- [3] C. Zuppa, Good quality point sets and error estimates for moving least square approximations, *Appl. Numer. Math.* 47(3–4), 575–585, 2003b.
- [4] M. G, Armentano, Error estimates in sobolev spaces for moving least square approximations, *SIAM J. Numer. Anal.* 39(1), 38–51.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



An Analogue of Titchmarsh's Theorem for Laguerre Transforms Using Moduli of

Communication Info

Authors:

Larbi RAKHIMI¹
Radouan DAHER²

¹TAGMD, Hassan II University
of Casablanca, Casablanca,
Morocco

²TAGMD, Hassan II University
of Casablanca, Casablanca,
Morocco

Keywords:

- (1) Laguerre Hypergroup,
- (2) Fourier-Laguerre
transform,
- (3) Titchmarsh theorems,
- (4) Moduli of continuity.

Abstract

A classical theorem of Titchmarsh relates the L^2 -Lipschitz functions and decay of the Fourier transform of the functions. In this paper, we prove the Titchmarsh theorem for Laguerre Hypergroup $K = [0, +\infty[$, via moduli of continuity, of higher orders. We also prove an analogue of another Titchmarsh theorem which provides integrability properties of the Fourier transform for functions in the Hölder Lipschitz spaces.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Titchmarsh E. C. Introduction to the Theory of Fourier Integral, 2nd edition, Oxford University Press, Oxford (1948).
- [2] Nessibi, M.M., Trim_eche, K.: Inversion of the Radon Transform on the Laguerre hypergroup by using generalized wavelets. J. Math. Anal. Appl. 208, 337-363 (1997).
- [3] Rakhimi, L., Daher, R. Equivalence of K-functionals and modulus of smoothness for Laguerre type operator. Doi.org/10.1007/s11868-021- 00424-9 .
- [4] Daher, R.; Fernandez, A.; Restrepo, J. E. Characterising extended Lipschitz type conditions with moduli of continuity. Results Math. 76 (2021),no. 3, Paper No. 125, 18 pp.
- [5] Fernandez, A.; Restrepo, J. E.; Suragan, D. Lipschitz and Fourier type conditions with moduli of continuity in rank 1 symmetric spaces. Monatsh. Math. (2021), <https://doi.org/10.1007/s00605-021- 01621>.
- [6] Daher, R., Delgado, J., Ruzhansky, M. Titchmarsh theorems for Fourier transforms of Hölder-Lipschitz functions on compact homogeneous manifolds. Monatsh. Math. 189 (2019), no. 1, 23-49.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Optimal control in a mathematical model of a spread of the Obesity Epidemic and its impact on Diabetes

Communication Info

Authors:

Abdelbar EL MANSOURI¹
Abderrahim LABZAI¹
Bouchaib KHAJJJI²
Mohamed BELAM¹

¹LMACS, Sultan Moulay
Slimane University,
Beni mellal, Morocco

²LAMS, Hassan II University of
Casablanca, Casablanca,
Morocco

Keywords:

(1) Obesity Epidemic
(2) Optimal control
(3) Pontryagin's maximum
principle

Abstract

The obesity epidemic is associated with several cardiovascular risk factors, including diabetes mellitus, dyslipidemia, and hypertension. Insulin resistance is likely to be an important trigger for the development of most of these abnormalities. Besides genetic causes, obesity, especially abdominal obesity, is one of the most important factors in the development of diabetes. In this work, we propose a mathematical model for the dynamics of how obesity and diabetes prevalence, and then shed light on the negative impact of overweight on the health of diabetic patients. Pontryagin's maximum principle is used to describe the optimal controls, and the optimal system is solved in an iterative manner. Finally, some numerical simulations are performed to verify the theoretical analysis using MATLAB.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1]. BOLES, Annette, KANDIMALLA, Ramesh, et REDDY, P. Hemachandra. Dynamics of diabetes and obesity: epidemiological perspective. *Biochimica et Biophysica Acta (BBA)-Molecular Basis of Disease*, 2017, vol. 1863, no 5, p. 1026-1036.
- [2]Centers for Disease Control Diabetes Translation (2015) Maps in trends of diagnosed diabetes and obesity. Available at: <http://www.cdc.gov/>. January 2015; Accessed 13 Jan 2016
- [3] EL MANSOURI, Abdelbar, et al. Mathematical modeling and optimal control strategy for the obesity epidemic, 2022. *Commun. Math. Biol. Neurosci.* : Article ID 20, 2022.
- [4]EVERT, Alison B., BOUCHER, Jackie L., CYPRESS, Marjorie, et al. Nutrition therapy recommendations for the management of adults with diabetes. *Diabetes care*, 2013, vol. 36, no 11, p. 3821-3842.
- [5]FRANZ, Marion J., BOUCHER, Jackie L., et EVERT, Alison B. Evidence-based diabetes nutrition therapy recommendations are effective: the key is individualization. *Diabetes, metabolic syndrome and obesity: targets and therapy*, 2014, vol. 7, p. 65.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Density functional theory for two dimensional homogeneous materials

Communication Info

Authors:

David GONTIER¹
Salma LAHBABI^{2,3}
Abdallah MAICHINE
Abdelqoddous MOUSSA³

¹CEREMADE, Université Paris-Dauphine, Paris, France

²EMAMI, LRI, ENSEM, Hassan II University of Casablanca, Casablanca, Morocco

³MSDA, UM6P, Benguerir, Morocco

Keywords:

- (1) DFT
- (2) Mathematical modeling
- (3) variational methods
- (4) Euler-Lagrange equation

Abstract

We study Density Functional Theory models for 2D materials in the 3D space. Our interest comes from the recent developments of two-dimensional materials, such as graphene and phosphorene, in the physics community [3]. Such systems, have been studied in [1] in the framework of Thomas-Fermi type models and in [2] in the framework of the reduced Hartree-Fock model.

In this work, we focus on the simple case where the system is homogeneous. We first show that a homogeneous material can be seen as a limit of periodic systems. Next, we derive reduced models in the remaining orthogonal direction, for DFT models with and without magnetic fields [4].

We show how the different terms of the energy are modified and we derive reduced equations in the remaining direction.

We prove some properties of the ground state, such as perfect screening and precise decay estimates in the Thomas-Fermi model, and in Kohn-Sham models, we prove that the Pauli principle is replaced by a penalization term in the energy.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] X. Blanc and C. Le Bris. Thomas-Fermi type theories for polymers and thin films. *Advances in Differential Equations*, 5(7-9):977-1032, 2000.
- [2] E. Cancès, L. Cao, and G. Stoltz. A reduced Hartree-Fock model of slice-like defects in the Fermi sea. *Nonlinearity*, 33:156_195, 01 2020.
- [3] A.K. Geim and I.V. Grigorieva. Van der Waals heterostructures. *Nature*, 499:419-425, July 2013.
- [4] D. Gontier, S. Lahbabi, and Maichine A. Density functional theory for homogeneous two dimensional materials. *Comm. Math. Phys.*, 388:1475-1505, 2021.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Systemic modeling of the innovation process deployed in a mechanical engineering project using Petri nets

Communication Info

Authors:

Imane ZERGOUT^{1,2}
Firdaous ZAIR¹
Souad AJANA²
Soumia BAKKALI²
¹ Mundiapolis University,
Casablanca, Morocco
² LRI, ENSEM, Hassan II
University of Casablanca,
Casablanca, Morocco

Keywords:

(1) Systemic modeling
(2) Innovation process
(3) Petri Nets

Abstract

Complex innovative design processes are characterized by a dynamic during their implementation, which integrates new changes of the results according to the knowledge about the product, the requirements, the adopted technology and other factors [1-2]. Petri Nets based simulation is used to predict and analyze the behaviors and interactions of similar complex systems [3-4]. In this paper, we propose a systemic model of the innovation process deployed in mechanical engineering projects using Petri nets. This modeling has allowed us to address the complexity of the fulfillment of its different steps as well as the relationships between actors, resources, methods and constraints. We simulated our model using CPN tools in order to verify its accuracy, analyze the coherence of the interactions between its components, and plan its activities in time. This study allowed us to understand the innovation process in mechanical engineering projects, to detect possible dysfunctions and to enhance it afterwards.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] A. Karniel & Y. Reich, Process Modeling Using Workflow-Nets, In (New product development processes, A new Product lifecycle management paradigm), (pp. 75-93), Springer, 2011.
- [2] A. Karniel & Y. Reich, Multi-level modelling and simulation of new product development processes. Journal of Engineering Design, 24(3), (2013) 185-210.
- [3] S. Meghzili, A. Chaoui, M. Strecker, & E. Kerkouche, An Approach for the Transformation and Verification of BPMN Models to Colored Petri Nets Models. International Journal of Software Innovation (IJSI), 8(1), (2020) 17-49.
- [4] G. Fleury, P. Lacomme, & A. Tanguy, Simulation à événements discrets, Eyrolles, 2006.



Exploring Real Vector Representations of Simple Graphs

Communication Info

Authors:

SARIR ZAINEB¹

¹FSAC, Hassan II University of
Casablanca, Casablanca,
Morocco

Keywords:

- (1) Graph
- (2) inner products, dimension.
- (3) Vector, representations.
- (4) Hadamard matrices

Abstract

Let G be a simple graph with vertices $1, 2, \dots, n$. We consider representations of G by nonzero vectors $x_1, x_2, \dots, x_n \in R^d$ such that for $i \neq j$ the inner product $x_i \cdot x_j$ is negative or zero based on whether the vertices i and j are adjacent or not in the graph. The objective is to find the smallest possible dimension d in which the graph can be represented, d is studied as a function of G and of various restrictions placed upon the coordinates of the vectors and the values of the inner products as well as the graph itself. Vector representations of graphs, relative to appropriately chosen parameters, are of interest because they allow us to use linear algebra, the theory of bilinear forms, and geometry to study the properties of the represented graphs, and to construct interesting families of graphs. The findings of the study have the potential to enhance our understanding of the relationship between graphs and high-dimensional vector spaces.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] F. Harary, Graph Theory, Addison-Wesley, Reading, MA, 1969.
- [2] M. Hall Jr., Combinatorial Theory (Blaisdell Co., Waltham, MA, 1967).
- [3] T.D. Parsons, T. Pisanski, Inner product representations of graphs, Proceedings of the Sixth Yugoslav Seminar in Graph Theory, Dubrovnik, 1985, Publications of Math. Institute, University of Novi Sad, 1986, pp. 151–157.
- [4] T.D. Parsons, Orthogonality graphs, Ars Combinatoria 3 (1977) 165-208.
- [5] T.D. Parsons and T. Pisanski, Inner product representations of graphs, Proceedings of the Sixth Yugoslav Seminar in Graph Theory, (Dubrovnik, 1985) Publications of Math. Institute, University of Novi Sad, 1986, 151-157.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



A Double Step Size Method for Linear Complementarity Problem

Communication Info

Authors:

Yamna ACHIK¹
Asmaa IDMBAREK¹
Hajar NAFIA¹
Imane AGMOUR¹
Youssef EL FOUTAYENI^{1,2}

¹LAMS, Hassan II University of
Casablanca, Casablanca,
Morocco

²UMMISCO, IRD, France

Keywords:

- (1) Linear Complementarity
- (2) System of nonlinear equations,
- (3) Jacobian matrix

Abstract

Solving a linear complementarity problem remains an NP-hard research topic. In this paper, we present a two-step size algorithm with an accelerated property for solving linear complementarity problems $LCP(q, M)$ with M a positive matrix, in which we reformulate our problem as a system of nonlinear equations $Fp(x) = 0$ where p is large. We use the inexact linear search technique, as well as the approximation of the Jacobian by the acceleration parameter, an efficient accelerated Newton and gradient descent method is developed. It is shown that the proposed method is convergent under some specific conditions. This method is derivative-free, which is advantageous for solving large-scale problems.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] R.W. Cottle, J.S. Pang, R.E. Stone, The linear complementarity problem, Academic Press, 1992.
- [2] K.G. Murty, Linear Complementarity, Linear and Nonlinear Programming, Helderman-Verlag, 1988.
- [3] Y. El foutayeni, M. Khaladi, A Min-Max Algorithm for Solving the Linear Complementarity Problem, J. Math. Sci. Appl, 1 (2013) 6-11.
- [4] A. Halilu, M. Waziri, Y. Musa, Inexact Double Step Length Method for Solving Systems of Nonlinear Equations, Statistics, Optimization and Information Computing, Vol. 8, March 2020, pp 165-174.
- [5] Y. El foutayeni, M. Khaladi, Using vector divisions in solving the linear complementarity problem, J. Comput. Appl. Math., 236 (2012) 1919-1925.
- [6] Y. El foutayeni, H. El bouanani, M. Khaladi, An $(m+1)$ -step iterative method of convergence order $(m+2)$ for linear complementarity problems, Journal of Applied Mathematics and Computing, 54 (2017) 229-242.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Impact of Behavioral Modification on a Periodic Epidemiological Model with delay

Communication Info

Authors:

Khalid EL HAIL¹
Aziz Ouhinou¹
Mohamed KHALADI²

¹ Department of Mathematics,
Faculty of Sciences and
Technology, University of
Sultan Moulay Slimane, Beni-
Mellal, Morocco

² Mathematics and Population
Dynamics Laboratory-
UMMISCO, Faculty of Sciences
of Semlalia of Marrakech, Cadi
Ayyad University, Morocco

Keywords:

- (1) Basic reproduction number
- (2) Delay
- (3) periodic environment
- (4) individual behavior

Abstract

It is clear that our behavior and actions are critical in combating infectious diseases, as shown in studies [1,2,4]. In this work, we present an epidemic model that considers periodic environmental fluctuations, the delay caused by the disease's incubation period, and the self-protective measures implemented by individuals. By computing the basic reproduction number using the method in [3], we can assess the potential for disease transmission. Furthermore, we evaluate the stability of the disease-free equilibrium using methods in [5]. To gain a deeper understanding of the epidemic dynamics, we use numerical simulations to determine if the disease will persist or be eradicated. Our simulations also examine the impact of behavioral changes, such as increased adoption of self-protective measures, on the spread of the disease.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] J. Arino, K. El Hail, M. Khaladi, A. Ouhinou, "A model for the early COVID-19 outbreak in China with case detection and behavioural change", *Biomath* 11 (2022), 2212207.
- [2] K. El Hail, M. Khaladi, A. Ouhinou, "Early-confinement strategy to tackling COVID-19 in Morocco; a mathematical modelling study", *RAIRO-Operations Research*, 56(6):4023-4033, 2022
- [3] N. Bacaer and R. Ouifki, "Growth rate and basic reproduction number for population models with a simple periodic factor", *Mathematical biosciences* 210 19 (2008), 647-658
- [4] S. M. Kassa, A. Ouhinou, "The impact of self-protective measures in the optimal interventions for controlling infectious diseases of human population", *Journal of Mathematical Biology*, 70:213-236, 2015.
- [5]: X-Q. Zhao, *Dynamical systems in population biology*, vol. 16, 01 2003

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Functional Responses: From Individual Processes to Feeding Experiments

Communication Info

Authors:

Gian Marco PALAMARA¹
Jose A. CAPITAN²
David ALONSO³

¹ *Department of Fish Ecology and Evolution, Eawag, Swiss Federal Institute of Aquatic Science and Technology, Kastanienbaum, Switzerland.*

² *Theoretical and Computational Ecology, Center for Advanced Studies of Blanes (CEAB-CSIC), Spain.*

³ *Complex Systems Group, Department of Applied Mathematics, Technical University of Madrid, Spain*

Keywords:

- (1) Stochastic Processes
- (2) Predator-Prey Equations
- (3) Theoretical Ecology

Abstract

Ecological systems are tremendously complex, and are often characterized by different levels of stochasticity, associated to the discrete nature of their components and to the scale at which the system is looked at. At the population level, functional responses are non-linear functions commonly used to describe the variation in the rate of consumption of resources by consumers and have been widely used in both theoretical and empirical studies. To better characterize consumer-resource interactions, we develop a set of stochastic, individual based population models and describe the emergence of functional responses at the population level. We also derive functional responses by focusing on the subset of reactions describing only the feeding process, fixing the total number of consumers and resources, in what we call chemostatic conditions. Building on our theoretical approach, we provide new analytical tools to infer functional response parameters in feeding experiments. In our approach, we give a more rigorous, mechanistic, individual-based characterization of consumer resource dynamics and provide examples of its applications.

© ICRAMCS 2023

References

- [1] Palamara, G. M., Capitan, J. A., Alonso D. The stochastic nature of functional responses. *Entropy* 23 (5), 545
<https://doi.org/10.3390/e23050575>
- [2] Palamara, G. M., Capitan, J. A., Alonso D. The implicit assumptions of classical functional responses and their multispecies extensions. *bioRxiv*, 2022.07.18.500336
<https://doi.org/10.1101/2022.07.18.500336>

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Stability analysis of a delayed COVID-19 transmission model involving immigration and vaccination

Communication Info

Authors:

Mohammed Semlali¹
Khalid Hattaf²
Mohamed El Youssfi El
Kettani¹

¹ Laboratory EDPAGS, Faculty of sciences, Ibn Tofail University, Kenitra, Morocco.
² CRMEF, 20340 Derb Ghalef, Casablanca, Morocco.

Keywords:

- (1) Time delay
- (2) COVID-19
- (3) Immigration
- (4) Vaccination
- (5) General incidence rate
- (6) Stability analysis

Abstract

In this work, we propose and analyze the dynamical behavior of a delayed COVID-19 transmission model with immigration, vaccination and general incidence function. The time delay in the proposed model represents the incubation period. The well-posedness of the model is investigated. Moreover, the basic reproduction number is derived and the stability analysis of equilibria is rigorously established.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] M. Semlali, K. Hattaf, M. E. Y. El Kettani, Modeling and analysis of the dynamics of COVID-19 transmission in presence of immigration and vaccination, *Commun. Math. Biol. Neurosci.* (2022) 1-13.
- [2] K. Hattaf, A. A. Lashari, Y. Louartassi, N. Yousfi, A delayed SIR epidemic model with general incidence rate, *Electron. J. Qual. Theory Differ. Equ.* 2013 (2013) 1-9.
- [3] K. Hattaf, On the stability and numerical scheme of fractional differential equations with application to biology, *Computation* 2021 (2022) 1-12.



A Bioeconomic Model of a Fishery with Variable Market Price: Aggregation, Control and MSY

Communication Info

Authors:

Ismail EL HAKKI¹
Rachid MCHICH²
Amal BERGAM¹

¹ University Abdelmalek
Essaadi, Polydisciplinary
Faculty, Larache, Morocco.

²National School of Commerce
and Management of Tangier,
Morocco.

Keywords:

- (1) Varying price
- (2) Aggregation of variables
- (3) Fishery model
- (4) Stability

Abstract

We present a dynamical model of fishery describing the time evolution of the fish stock, the fishing effort with a variable price, the market price is fixed by the gap between the supply and the demand. The three-dimensional model considers a nonlinear harvesting function. Assuming two-time scales, we use “aggregation of variables methods” in order to derive a reduced model governing fish density and fishing effort at a slow time scale. This reduced model is analyzed.

The possible effects of the creation of marine protected areas (MPAs), sites where fishing is prohibited, on the fish stock and fishery are evaluated. We show that MPAs can have a positive effect on the restoration of depleted fish stocks by destabilizing the “over-exploitation” equilibrium and keeping only one positive equilibrium which will be globally asymptotically stable.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Auger, P., Mchich, R., Raissi, N., Kooi B., 2010. Effects of market price on the dynamics of a spatial fishery model: Over-exploited fishery/traditional fishery. *Ecological Complexity* 7: 13/20.
- [2] Auger P.M, Bravo de la Parra R, Poggiale J.C, Sanchez E. and Nguyen H.T., 2008. Aggrégation of variables and applications to population dynamics. In: P. Magal.
- [3] Clark, C.W., 1990. *Mathematical Bioeconomics: The Optimal Management of Renewable Resources*, 2nd ed. Wiley, New York.
- [4] Ly, S., Balde, M., Mansal, F., Nguyen-Huu, T., and Auger, P. A Model of a Multi-Site Fishery with Variable Price: from Over-Exploitation to Sustainable Fisheries. *Math.Model. Nat. Phenom.* 8, 130-142 catch. *Acta biotheoretica*, 62(3):371384, 2014.
- [5] Mchich, R., Auger, P., EL abdlouai, A. ,(2005) Méthode d’agrégation des variables appliquée à la dynamique des population.
- [6] Mchich, R., Auger, P., Brochier, T. ,Brehmer, (2016). Interactions Between the Cross-Shore Structure of Small Pelagic Fish Population ,Offshore Industrial Fisheries and Near Shore Artisanal Fisheries : A Mathematical Approach.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Agent-Based Simulation of a Multi-Strain SEIR Epidemic Model.

Communication Info

Authors:

Mohammed BENMIR¹
Zineb TABBAKH¹
Rajae ABOULAICH¹
Jaafar EL KARKRI¹

¹ Laboratory LERMA,
Mohammadia School of
Engineering, Mohammed V
University in Rabat, Avenue
Ibn Sina B.P 765, Agdal
Rabat 10090, Morocco

Keywords:

- (1) Multi-strain SEIR epidemic model
- (2) Compartmental models
- (3) Basic reproduction number
- (4) Agent-based simulation

Abstract

This work introduces a novel SEIR epidemiological model that simultaneously considers two strains. The model is presented by a system of nonlinear ordinary differential equations describing the interactions between the compartments and helps to understand the spread of both strains. We establish the basic reproduction number expression. In this work, we implement an agent-based model in NetLogo to simulate different scenarios, depending on the basic reproduction number R_0 . The results provide a deeper understanding of the spread of both strains infectious diseases in a population and help to inform decision-making about disease control and prevention measures.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

Acknowledgment

This work is supported by the CNRST and Mohammed V University in Rabat, project: Mathematical modeling and artificial intelligence for the analysis of the evolution of the Coronavirus pandemic in Morocco.

References

- [1] Arino, J., Brauer, F., van den Driessche, P., Watmough, J., & Wu, J. (2006). Simple models for containment of a pandemic. *Journal of the Royal Society Interface*, 3(8), 453-457.
- [2] Arino, J., & Portet, S. (2020). A simple model for COVID-19. *Infectious Disease Modelling*, 5, 309-315.
- [3] Brauer, F. 2008. Compartmental models in epidemiology. *Mathematical epidemiology Mathematical epidemiology* (pp. 19-79). Springer. https://doi.org/10.1007/978-3-540-78911-6_2
- [4] Chabbar, S., Benmir, M., Karkri, J. E., Bensaid, K., Aboulaich, R., & Nejari, C. (2021). Modeling and simulation of the evolution of the corona virus pandemic in a context of migration. *Journal of Theoretical and Applied Information Technology*, 4363-4374.
- [5] Wilensky, U., & Rand, W. (2015). *An introduction to agent-based modeling: modeling natural, social, and engineered complex systems with NetLogo*. Mit Press.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Modeling the CTLs immune response in HBV DNA-containing capsids infection with logistics growth

Communication Info

Authors:

Mariem ELKAF¹
Adil Meskaf²
Karem ALLALI¹

¹Laboratory of Mathematics and Applications, Faculty of Sciences and Techniques Mohammedia, University Hassan-II Casablanca, PO Box 146, Mohammedia, Morocco
²Department of SEG, Faculty of Economic and Social Legal Sciences, University Chouaib Doukkali, EL Jadida, Morocco.

Keywords:

- (1) HBV infection,
- (2) DNA-containing capsids,
- (3) CTL immune response,
- (4) logistic growth, stability,
- (5) numerical solution.

Abstract

To know more about the infection of hepatitis B virus (HBV), in this paper, we present the interactions between HBV with DNA-containing capsids and Cytotoxic T-Lymphocyte (CTL) immune response. We formulate the growth of the healthy and infected hepatocyte cells with logistics functions, then we analyse the positivity, boundedness and we discuss the local stability of the equilibria. In addition to these results, the numerical simulations are performed to compromise our theoretical findings.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Meskaf, Adil, Elkaf Mariem, et Allali, Karam. Viral infection dynamics of HBV DNA-containing capsids with logistics growth and saturated rate. *Commun. Math. Biol. Neurosci.*, 2023, vol. 2023.
- [2] Hussam Alrabaiah, Mati Ur Rahman, Ibrahim Mahariq, Samia Bushnaq, and Muhammad Arfan. Fractional order analysis of hbv and hcv co-infection under abc derivative. *Fractals*, 30(01):2240036, 2022.
- [3] Jaouad Danane, Karam Allali, and Zakia Hammouch. Mathematical analysis of a fractional differential model of hbv infection with antibody immune response. *Chaos, Solitons & Fractals*, 136:109787, 2020.
- [4] Miaolei Li and Jian Zu. The review of differential equation models of hbv infection dynamics. *Journal of virological methods*, 266:103–113, 2019.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Dynamics of HBV Infection with DNA-Containing Capsids, Logistics Growth, Saturated Rate and Therapy

Communication Info

Authors:

Hamza AIT TAMERZ¹

Karam ALLALI²

Adil MESKAF¹

¹LITE, Faculty of Sciences El
Jadida, Chouaib Doukkali
University, El Jadida, Morocco

²LMCSA, FSTM, Hassan II
University of Casablanca,
Casablanca, Morocco

Keywords:

- (1) HBV Infection
- (2) DNA-containing capsids
- (3) Logistics growth
- (4) Optimal control
- (5) Numerical simulation

Abstract

In this paper, we propose a new mathematical model to better understand the mechanisms and dynamics of hepatitis B virus (HBV) with capsids logistics growth functions and saturated rate. we also discuss a therapy option available for treating HBV infection by specifying α denotes the efficiency of PEG IFN drugs. We initiate the work with the description and the well-posedness of the formulation. Next, we give the conditions that insure the existence of the disease-free equilibrium and the endemic equilibrium. Then, we show the local stability of the endemic and disease-free equilibria. Finally, by numerical simulation, we verify numerically the theoretical founding.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Meriem Elkaf, Meskaf Adil and Karam Allali, Mathematical Modeling of HBV Infection with DNA-Containing Capsids and Therapy, *Nonlinear Dynamics and Complexity*, DOI: 10.1007/978-3-031-06632-0_20, 2022
- [2] Ullah S, Khan MA, Gómez-Aguilar JF. Mathematical formulation of hepatitis B virus with optimal control analysis. *Optim Control Appl Meth.* 2019
- [3] Jaouad Danane, Adil Meskaf and Karam Allali, Optimal Control of a Delayed Hepatitis B Viral Infection Model with HBV DNA-containing capsids and CTL immune response, *Optimal Control Applications and Methods*, <https://doi.org/10.1002/oca.2407>, 2018; 1-11.
- [4] Meskaf Adil, Karam Allali and Youssef Tabit, Optimal Control of a Delayed Hepatitis B Viral Infection Model with Cytotoxic T-lymphocyte and Antibody and Responses, *International Journal of Dynamics and Control*, 5(3):893902, 2017 Springer,

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Modélisation bioéconomique d'un système complexe de ressources communes renouvelables : Application au cas des pêcheries du Maroc

Communication Info

Authors :

Youssef Eddagchoue
Imane Agmour
Youssef EL foutayni

Abstract

Dans le cadre de la modélisation bioéconomique [1] nous travaillons sur des modèles mathématiques qui décrivent l'évolution des espèces marines en prenant en compte les déférences interactions biologiques [2] et les influences extérieures pour les étudier, afin de trouver la meilleure façon de les exploiter sur les côtés biologiques et économiques.

Dans ce cadre nous avons choisi un modèle proie-prédateur [3] de dimension trois avec la présence de l'effet du phénomène anti-prédateur [4.5] dans la nature, et comment affect la dynamique du système.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] C. W. Clark, Bioeconomic modelling and fisheries management, John Wiley and Sons, New York, NY, USA, 1985.
- [2] J.L.Bronstein, Game structures in mulualisms :what can the evidence tell us about the kinds of models we need ?Advances in the stady of behavior,n34 ,2004 ,p 59-104 .
- [3] Y. F. Lv, R. Yuan, Y. Z. Pei, A prey-predator model with harvesting for fishery resource with reserve area, Appl. Math. Model., 37 (2013), 3048–3062. <https://doi.org/10.1016/j>
- [4] Z. Hoover, M. Ferrari, D. P. Chivers, The effects of sub-lethal salinity concentrations on the anti-predator responses of fathead minnows, Chemosphere, 90 (2013), 1047–1052. <https://doi.org/10.1016/j.chemosphere.2012.08.051>
- [5] Y. Choh, M. Ignacio, M. W. Sabelis, A. Janssen, Predator-prey role reversals, juvenile experience and adult antipredator behaviour, Sci. Rep., 2 (2012), 728. <https://doi.org/10.1038/srep00728>

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Study of Hopf bifurcation of delayed tritrophic system

Communication Info

Authors:

M. HAFDANE¹
I. AGMOUR¹
Y. EL FOUTAYENI^{2,3}

¹ LAMS, Hassan II

University of
Casablanca,
Casablanca, Morocco

² Cadi Ayyad University,
Morocco

³ Unit for Mathematical
and Computer
Modeling of Complex
Systems, IRD, France

Keywords:

- (1) Stability analysis
- (2) Hopf bifurcation
- (3) Discrete delay

Abstract

In this paper, we have a discrete delayed dynamic system of three marine species: prey, predator, and superpredator. In addition to the effect of prey toxicity, we consider the negative fishing effect of these species. The study of this model consists of the search for equilibria with eigenvalue analysis, the existence of Hopf bifurcations at interior equilibria, and the determination of direction and stability analysis of Hopf bifurcation using the theory of normal form and center manifold. Some examples are given with numerical simulations to illustrate the results in different cases of delay.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Bentounsi M, Agmour I, Achtaich N, El Foutayeni Y (2018) The Hopf bifurcation and stability of delayed predator-prey system Springer. [https:// DOI 10.1007/s40314-018-0658-7](https://doi.org/10.1007/s40314-018-0658-7).
- [2] Akkocaoglu H, Merdan H, Çelik C (2013) Hopf bifurcation analysis of a general non-linear differential equation with delay. *J Comput Appl Math* 237:565–575.
- [3] Hassard BD, Kazarinoff ND, Wan YH (1981) Theory and applications of hopf bifurcation. Cambridge University Press, Cambridge.
- [4] El Foutayeni Y, Khaladi M (2016) Equilibrium Points and Their Stability Properties of a Multiple Delays Model. *Differ Equa Dyn Syst Springer*. <https://doi.org/10.1007/s12591-016-0321-y>.
- [5] Ruan S, Wei J (2001) On the zeros of a third degree exponential polynomial with applications to a delayed model for the control of testosterone secretion. *IMA J Math Appl Med Biol* 18(18):41–52

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Vaccination against infectious diseases in the Moroccan education system

Communication Info

Authors:

Nabila BEQQALI^{1,2}

Khalid HATTAF^{1,2}

Naceur ACHTAICH¹

¹LAMS, Hassan II University of Casablanca, Casablanca, Morocco

² Equipe de Recherche en Modélisation et Enseignement des Mathématiques (ERMEM), Centre Régional des Métiers de l'Education et de la Formation (CRMEF), Casablanca Morocco

Keywords:

(1) Vaccination

(2) Moroccan education system

(3) Infectious diseases

(4) Mathematical modeling

(5) Mathematics education

Abstract

The aim of this work is to study the role of vaccination against infectious diseases via a mathematical model. The proposed model introduces the basic concepts and notions of mathematical modeling concerning such infectious diseases in high school mathematics education.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

[1] Royaume du Maroc, Orientations pédagogiques et curricula pour l'enseignement des mathématiques dans le cycle secondaire qualifiant, Ministère de l'Education nationale, de l'Enseignement supérieur et de la recherche scientifique 2007.

[2] Royaume du Maroc, Curriculum de l'enseignement primaire, Ministère de l'éducation nationale, de l'enseignement supérieur et de la recherche scientifique, 2021. Available online: <https://men-gov.ma/wpcontent/uploads/2021/07/Curriculum-Primaire-2021-Final-28-juillet-mengov.ma.pdf>.

[3] Kingdom of Morocco, programs and directions for life and earth sciences in the middle school, 2009.

[4] Kingdom of Morocco, programs and directions for life and earth sciences in the high school, 2007.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



A nonlinear epidemic model for COVID-19 with Hattaf fractional operator and fixed point

Communication Info

Authors:

Hamza EL MAMOUNI¹
Khalid HATTAF^{1,2}
Noura YOUSFI¹

¹LAMS, Hassan II University of Casablanca, Casablanca, Morocco

²Equipe de Recherche en Modélisation et Enseignement des Mathématiques (ERMEM), Centre Régional des Métiers de l'Education et de la Formation (CRMEF), Casablanca, Morocco

Keywords:

- (1) COVID-19
- (2) SARS-CoV-2
- (3) Fixed point theory
- (4) Hattaf-type fractional derivative
- (5) Numerical simulations.

Abstract

In this work, we propose a mathematical model for COVID-19 by taking into account the effects of memory and carrier, and also others aspects such as the nonlinearity of the incidence function, the death rate due to COVID-19 and the recovery rates of the asymptomatic and symptomatic individuals. The effect of memory is modeled by the new generalized Hattaf fractional (GHF) derivative. The existence and uniqueness of solutions are obtained by fixed point theory. Finally, numerical simulations are given to support the analytical results.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] K. Hattaf, A new generalized definition of fractional derivative with nonsingular kernel, *Computation* 8 (2020) 1-9.
- [2] K. Hattaf, On the stability and numerical scheme of fractional differential equations with application to biology, *Computation* (2022) 10-97.
- [3] A. A. Mohsen, H. F. Al-Husseiny, X. Zhou, K. Hattaf, Global stability of COVID-19 model involving the quarantine strategy and media coverage effects. *AIMS Public Health Journal* 7(3) (2020) 587-605.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Mathematical study of compartmental models on marine species

Communication Info

Authors :

Imane BOUHAYAOUI¹

Imane BERRAIE²

¹LAMS, Hassan II University of
Casablanca, Casablanca,
Morocco

Keywords:

(1) Aquatic animal

(2) pathogens

(3) Compartmental models

Abstract

Even though it is not far away, epidemiological research focuses on human and terrestrial animal systems, with a little focus on aquatic animal health. The huge interaction between humans and the aquatic environment means that the study of pathogens in aquatic animals is important to protect a valuable food source, and a reasonable number of human diseases may originate in the aquatic environment. The most used tool that provides an understanding of the underlying mechanisms that influence the spread of disease, explains epidemiological phenomena, and predicts the future course in order to control an epidemic is the mathematical models that attempts to capture the flow of aquatic individuals between the different infectious status compartments within a population which are often referred as compartmental models..

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Edmund J Peeler* and Nicholas GH Taylor, The application of epidemiology in aquaticanimal health opportunities and challenges, Peeler and Taylor Veterinary Research 2011,
- [2] Fred Brauer Carlos Castillo-Chavez, Mathematical Models in Population Biology and Epidemiology, Springer Science+Business Media, LLC 2012.
- [3] Roy M. Anderson, Robert M. May, Population biology of infectious diseases: Part I, Nature Vol. 280 2 August 1979.
- [4] Nokes D. J. and Anderson R. M, The use of mathematical models in the epidemiological study of infectious diseases and in the design of mass immunization programmes, Nature Vol. 280 2 August 1979.
- [5] Herbert W. Hethcote, Qualitative Analyses of Communicable Disease Models, Epidem. Inf. (1988), 101, 1-20 Printed in Great Britain

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Contribution à l'analyse déterministe de quelques modèles épidémiologiques : cas des plantes naturelles

Communication Info

Authors:

Siham HACHOUM¹
Imane EL BERRAI¹
Khalid ADNAOUI¹

¹LAMS, Hassan II University of
Casablanca, Casablanca,
Morocco

Keywords:

- (1) L'épidémiologie végétale
- (2) Modèle à compartiments
- (3) Contrôle Optimale

Abstract

L'épidémiologie végétale (les maladies épidémiques des plantes) [1] est une discipline de la pathologie végétale qui étudie le développement des populations d'agents pathogènes au sein de populations des plantes. Comme les maladies humaines et animales, les maladies des plantes sont provoquées par des bactéries, des virus et des champignons.

Actuellement, les maladies épidémiques des plantes sont les principales menaces à la production agricole, car elles provoquent 14,1 % des pertes de récoltes mondiales [2]. Ce qui implique plusieurs problèmes dans d'autres secteurs (ex. santé, environnement, social). En raison de ces problèmes, nous travaillons sur une étude dynamique des modèles épidémiologiques à compartiments [3], qui pourraient permettre de représenter de façon qualitative l'évolution de l'épidémie végétale, et nous cherchons à élaborer une stratégie logique et optimale pour réduire l'impact négatif de cette épidémie via la théorie du contrôle optimale [4].

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Frantz Rapilly, Épidémiologie en pathologie végétale : mycoses aériennes, 1991.
- [2] L. M. Contreras-Medina 1,2 , I. Torres-Pacheco, Mathematical modeling tendencies in plant pathology, México, 2009.
- [3] A. Huppert, G. Katriel, Mathematical modelling and prediction in infectious disease epidemiology. Clin Microbiol Infect 19(11) :999-1005. <https://doi.org/10.1111/1469-0691.12308>
- [4] E. Trélat, Contrôle optimal : théorie & applications. Vuibert Paris, 2005.
- [5] Cooke B.M, Gareth Jones, D. & Kaye B, The epidemiology of plant, Second Edition. Springer, 2006.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE

March 24-26, 2023 | Casablanca, Morocco



Impact of Pollution on Sardine, Sardinella, and Mackerel Fishery: A Bioeconomic Approach

Communication Info

Authors:

Fatimaezzahra Ben DAHOU¹

Nossaiba BABA¹

Youssef EL FOUTAYENI^{1,2}

Naceur ACHTAICH¹

¹LAMS, Hassan II University of
Casablanca, Casablanca,
Morocco

²UMMISCO, IRD, France

Keywords:

(1) Prey-predator model

(2) Pollution rate

(3) stability analysis

Abstract

This paper studies a bioeconomic model of three species of small pelagic marine species in Moroccan coastal areas: Sardine, Sardinella and shark. The model combines competition and predation. Two areas are proposed, one is polluted and the other is not. The model combines a biological part describing the evolution of the biomass of stocks subjected to fishing mortality and an economic part explaining the mortality rate. We study the existence and stability of equilibrium states through eigenvalue analysis and the Routh-Hirwitz criterion, then introduce economic approaches to determine the effort needed to maximize the fishermen's income. Numerical simulations are performed. The objective of this paper is to study the impact of pollution on the existence, evolution of biomass and predation, fishing effort, catches, and profits.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Halpern, B., Frazier, M., Potapenko, J. et al. Spatial and temporal changes in cumulative human impacts on the world's ocean. *Nat Commun* 6, 7615 (2015). <https://doi.org/10.1038/ncomms8615>
- [2] Ben Rhila S., Agmour, I., Rachik, M., Achtaich, N., El foutayeni, Y. Optimal control of a phytoplankton-zooplankton spatiotemporal discrete bioeconomic model. *Research Communication*. Volume 2021, Communication ID 91.
- [3] Baba, N., Agmour, I., Achtaich, N., El foutayeni, Y. The stock assessment of *Aristeus Antennatus* between a protected fishing area and a free access area. *International Journal of Computational Biology and Drug Design*. Vol. 14, No. 6
- [4] Baba, N., Agmour, I., El Foutayeni, Y. et al. The Tide Effects on Bioeconomic Model of *Sardina pilchardus*, *Engraulis encrasicolus* and *Xiphias gladius* in Atlantic Moroccan Zone. *Earth Syst Environ* 6, 295–305 (2022). <https://doi.org/10.1007/s41748-021-00227-4>
- [5] H. El Bouanani, Y. El Foutayeni, and M. Khaladi, "A new method for solving non-linear complementarity problems," *International Journal of Nonlinear Science*, vol. 19, pp. 81–90, 2015.
- [6] Y. El Foutayeni, H. El Bouanani, and M. Khaladi, "An (m+1)-step iterative method of convergence order (m+2) for linear complementarity problems," *Journal of Applied Mathematics and Computing*, vol. 54, no. 1-2, pp. 229–242, 2017.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Optimal control problem for a class of bilinear systems with an unbounded control operator

Communication Info

Authors:

Soufiane YAHYAOUÏ¹

Mohamed OUZAHRA²

*1M2PA Team, University of Sidi
Mohamed Ben Abdellah
Morocco*

*2 M2PA Team, University of Sidi
Mohamed Ben Abdellah
Morocco*

Keywords:

- (1) Bilinear systems
- (2) Quadratic cost
- (3) Optimal control,
- (4) Feedback stabilization

Abstract

In this paper, we will investigate the optimal control problem for unbounded bilinear systems, with control operators in $L(V,H)$.

The case of bounded bilinear systems has been investigated in several works (see [4,5]). The same problem has been studied in some particular situations of unbounded control operators in [1,2,3]. We will first study the case of finite time-horizon with unconstrained or constrained endpoint. This result is further applied to build the optimal control for infinite time horizon.

Finally, we solve the bilinear optimal control for the transport equation. Then we consider the fractional diffusion equation, for which we prove the strong stabilization by an optimal time-varying feedback control.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] T. Breiten, K. Kunisch & L. Pfeiffer. (2018). Infinite-horizon bilinear optimal control problems: Sensitivity analysis and polynomial feedback laws. *SIAM Journal on Control and Optimization*, 56(5), 3184-3214.
- [2] M. S. Aronna, & F. Troltzsch (2021). First and second-order optimality conditions for the control of Fokker-Planck equations. *ESAIM: Control, Optimization, and Calculus of Variations*, 27-15.
- [3] A. Addou and A. Benbrik (2002). Existence and uniqueness of optimal control for a distributed parameter bilinear system, 141--152.
- [4] S. Yahyaoui and M. Ouzahra. (2021). Quadratic optimal control and feedback stabilization of bilinear systems. *Optimal Control Applications and Methods*.
- [5] Zerrik, E. H., and Boukhari, N. E. (2019). Regional optimal control for a class of semilinear systems with distributed controls. *International Journal of Control*, 92(4), 896-907.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Study of the local and global stability of an epidemiological model SEIR

Communication Info

Authors:

Farid MORTAJI¹
Hassan LAARABI¹
Mostafa RACHIK¹
Youssef EL FOUTAYENI¹
Abdelhadi ABTA²

¹LAMS, Hassan II University of
Casablanca, Casablanca,
Morocco

²Cadi Ayyad University, Safi,
Morocco

Keywords:

- (1) Lyapunov function
- (2) Equilibrium points

Abstract

In the literature, Lyapunov's method has been successfully used to prove the global stability of equilibrium points. The method consists in finding a Lyapunov function, positive definite such that its derivative along the trajectories is negative definite [1]. In this presentation, we will apply the Lyapunov's method to prove the asymptotic global stability of equilibrium points.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Capasso, V. and Serio, G. A generalization of the Kermack–Mckendrick deterministic epidemic model, *Math.Biosci.* 42 41–61, 1978.
- [2] Cooke, K. Stability analysis for a vector disease model, *Rocky Mountain Journal of Mathematics* 9 31–42, 1979.
- [3] Kermack, W. O. and McKendrick, A. G. A contribution to the mathematical theory of epidemics, *Proc. Royal Soc. London A*, 115 700–721, 1927.
- [4] Wu, J. *Theory and Applications of Partial Functional Differential Equations*, Springer : New York, NY, USA, 1996.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Optimal Control Strategy for Marriage Divorce

Communication Info

Authors:

Soukaina HILAL¹
Hassan LAARABI²
Mostafa RACHIK³

¹LAMS, Hassan II University of
Casablanca, Casablanca,
Morocco

Keywords:

- (1) Les contrôles optimaux
- (2) Simulations numériques

Abstract

Nous avons proposé un modèle mathématique de divorce considérant le divorce comme une maladie transmissible qui se transmet entre les êtres humains propagés par les femmes/hommes divorcés aux personnes mariées, pour réduire ses effets négatifs sur l'humanité et les économies mondiales.

Ceci en proposant deux stratégies de contrôle. Le principe du maximum de Pontryagin [1] est appliqué afin de caractériser les contrôles optimaux, et le système d'optimalité est résolu en utilisant une approche itérative. Enfin, des simulations numériques sont exécutées pour vérifier l'analyse théorique à l'aide de MATLAB.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Tilahun, T. Daniel Makinde, Malonza, D. (2017). Modelling and optimal control of typhoid fever disease with cost-effective strategies. Computational and mathematical methods in medicine, 2017.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



COMPENSATION PROBLEM IN LINEAR FRACTIONAL ORDER TIME-INVARIANT DISTURBED SYSTEMS

Communication Info

Authors:

Chadi AMISSI¹
El Mostafa MAGRI²
Larbi AFIFI³
Mustapha LHOUS⁴

¹ Département de mathématiques
et informatique, FSAC, Université
Hassan II,

Keywords:

- (1) Fractional linear disturbed systems,
- (2) Dynamical systems,
- (3) Disturbance.

Abstract

Perturbations can generate significant damage to the dynamic system (infections, pollution, etc.) in various domain. Disturbed systems have continued to grow in importance in recent years. Unknown disturbances are detected by observation and several works have been devoted to their detection and reconstruction from the corresponding observation. (see [2], [3]).

We study with respect to the observation, the possibility of finite time compensation of known or unknown disturbances. Under convenient hypothesis, we show how to find the optimal control ensuring the compensation of a disturbance, by bringing back the corresponding observation to the normal one. This concept is also examined as minimization problem with a decent cost function. Various situations are also examined.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] L. Afifi, M. Bahadi, A. El Jai and A. El Mizane (2007) The compensation problem in disturbed systems: Asymptotic analysis, Approximations and numerical simulations. International Journal of Pure and Applied Mathematics, 41(7).
- [2] L. Afifi, A. El Jai and E. M. Magri (2008) Compensation problem in finite dimension linear dynamical systems. International Journal of Applied Mathematical Sciences. Vol.2, N_45, pp 2219-2228.
- [3] L. Afifi, A. El Jai and M. Merry (2000) Detection and sources reconstruction in a tube. International Journal of Systems Science, Vol 31, N_2, pp 149-159.
- [4] Larbi Afifi L., Lasri K., Joundi M., Amimi N., (2018) Feedback controls for exact remediability in disturbed dynamical systems, IMA Journal of Mathematical Control and Information, Volume 35, Issue 2, 411-425, <https://doi.org/10.1093/imamci/dnw054>.
- [5] Souhail S. and Afifi L. (2020) Minimum energy compensation for discrete delayed systems with disturbances. Discrete and Continuous Dynamical Systems - S, 13 (9) : 2489-2508. doi:10.3934/dcdss.2020119

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



An observer-based control of linear systems with uncertain parameters via LMI approach

Communication Info

Authors:

Hiba Hizazi¹

Mustapha Lhous²

¹LMFA, Hassan II University of Casablanca, Casablanca, Morocco

²LMFA, Hassan II University of Casablanca, Casablanca, Morocco

Keywords:

- (1) Observer-based control
- (2) Linear Matrix Inequalities
- (3) Uncertain linear system
- (4) Lyapunov function
- (5) Stability

Abstract

It is well known that in many practical control systems, the system often presents some uncertainties and perturbations may be due to additive unknown internal or external noise, environmental influence, nonlinearities, data errors, etc.

In many real models, state feedback control might fail to guarantee the stabilizability when some of the system states are not measurable. Observer-based controllers are often used to stabilize unstable systems or to improve the system performances.

We propose to design observers for a class of uncertain linear systems by using LMI techniques. The observer design is formulated as an LMI feasible problem which easily solved by standard convex optimization algorithms. We give an example to illustrate the proposed results.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] M. Rachik, and M. Lhous, (2016). An observer-based control of linear systems with uncertain parameters. Archives of Control Sciences, 26(4).
- [2] H. KHELOUFI, A. ZEMOUCHE, F. BEDOUHENE and M. BOUTAYEB: A new observer-based stabilization method for linear systems with uncertain parameters. European Control Conf., Zurich, Switzerland, (2013), 1120-1125.
- [3] S. HUI and S.H. ZAK: Observer design for systems with unknown inputs. Int. J. of Applied Mathematics and Computer Science, 15(4), (2005), 431-446.
- [4] C. Lien, "Robust observer-based control of systems with state perturbations via LMI approach," IEEE Transactions on Automatic Control, vol. 49, no. 8, pp. 1365-1370, 2004.1120-1125.

ICRAMCS 2023

FOURTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 24-26, 2022 | Casablanca, Morocco



Prey-Predator model with the tide effect

Communication Info

Authors:

Nossaiba BABA¹
Fatimaezzahra Ben DAHOU¹
Youssef EL FOUTAYENI^{1,2}
Naceur ACHTAICH¹

¹LAMS, Hassan II University of
Casablanca, Casablanca,
Morocco

²UMMISCO, IRD, France

Keywords:

- (1) High tides
- (2) Low tides
- (3) Bioeconomic model

Abstract

In this study, the focus is on a tri-trophic ecosystem of zooplankton, sardines, and sharks in Moroccan waters. The research examines the biology of the system, analyzing the positive aspects, boundaries, equilibrium points, and conditions for local stability in the context of harvesting these species. The optimization of fishing efforts to maximize profits results in a generalized Nash equilibrium problem. The growth of zooplankton is influenced by the Allee effect and parameters, while the biomass of sardines and sharks is determined by parameters and the availability of other species for food. The analysis of the proposed system investigates the impact of the Allee effect on fishing efforts, catches, and profits by exploring the results of the mathematical analysis of the game-theoretic equilibrium of the situation where all fishermen seek to optimize their strategies based on the strategies of others.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Mounir A, Alahyane H, Chouikh NE, Hichami N, Bendami S (2022) Habitats and Characteristics of Sardina pilchardus, off the Moroccan Atlantic coast. *Ann Mar Sci* 6(1): 007-020. DOI: 10.17352/ams.000027
- [2] Guillaume Lecointre, Hervé Le Guyader, *Classification phylogénétique du vivant (tome 2)*, Belin, 2017, 831 p.
- [3] H. Badsı1, H. Oulad Ali1, M. Loudiki2, M. El Hafa1, R. Chakli1, A. Aamiri1. Ecological factors affecting the distribution of zooplankton community in the Massa Lagoon (Southern Morocco). *African Journal of Ecology and Ecosystems* ISSN: 9428-167X Vol. 5 (2), pp. 001-012, February, 2018.
- [4] Nossaiba Baba, Imane Agmour, Yousef El Foutayeni, Naceur Achtaich, "Bioeconomic-Epidemiological Model of Scomber colias Population in the Moroccan Coasts", *Journal of Applied Mathematics*, vol. 2021, Article ID 8892388, 22 pages, 2021. <https://doi.org/10.1155/2021/8892388>
- [5] Baba, N., Agmour, I., El Foutayeni, Y. et al. The Tide Effects on Bioeconomic Model of Sardina pilchardus, Engraulis encrasicolus and Xiphias gladius in Atlantic Moroccan Zone. *Earth Syst Environ* 6, 295–305 (2022). <https://doi.org/10.1007/s41748-021-00227-4>

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Sufficient and necessary conditions for exponential stabilization of distributed second order semilinear systems with time delay

Communication Info

Authors:

Ahmed DELBOUH¹
Azzeddine TSOULI¹

¹*LMAI, Hassan II University of Casablanca, ENS, Casablanca, Morocco.*

Keywords:

- (1) Second order semiinear systems
- (2) Exponential stabilization
- (3) Time delay

Abstract

The stability issue of second order systems with delay is, therefore, of theoretical and practical importance which is motivated by the fact that the modeling of many evolutionary phenomena, occurring in physics, biology or engineering sciences. The exponential stabilization of such systems without time delay has been considered in many works. In [1], Haraux has studied the exponential stability of a linear second order system with a sufficient and necessary conditions. In [2], Tebou has been extended the result given in [1] to semilinear systems. The time delay case has been studied in many works [3-5].

In this communication, we will study the problem of exponential stabilization for a class of distributed second order semilinear systems with time delay.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Haraux, A. (1989). Une remarque sur la stabilisation de certains systèmes du deuxième ordre en temps. *Portugaliae mathematica*, 46 (3), 245-258.
- [2] Tebou, L. T. (2009). Equivalence between observability and stabilization for a class of second order semilinear evolution. In *Conference publications* (Vol. 2009, p. 744).
- [3] Nicaise, S., & Pignotti, C. (2014). Stabilization of second-order evolution equations with time delay. *Mathematics of Control, Signals, and Systems*, 26 (4), 563-588.
- [4] Nicaise, S., & Pignotti, C. (2012). Asymptotic stability of second-order evolution equations with intermittent delay. *Advances in Differential Equations*, 17 (9/10), 879-902.
- [5] Ammari, K., & Nicaise, S. (2015). Stabilization of second order evolution equations with unbounded feedback with delay. In *Stabilization of elastic systems by collocated feedback* (pp. 61-71). Springer.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



On four-dimensional absolute valued algebras with left omnipresent unit

Communication Info

Authors:

Abdelhadi MOUTASSIM¹

Hakima MOUANIS²

Noureddine MOTYA²

¹CRMEF, Casablanca-Settat,
Morocco

²LSMA, Dhar El-Mahraz
University, Fez, Morocco

Keywords:

(1) Absolute valued algebra

(2) Pre-Hilbert algebra

(3) Left omnipresent unit

Abstract

A classification of all four-dimensional absolute valued algebras with left omnipresent unit is given [1], [3] and [6]. We construct, by algebraic methods all four-dimensional absolute valued algebras with left omnipresent unit [7]. These new algebras contain at least one sub-algebra of dimension two [2] and [4], note that there exists a four-dimensional absolute valued algebra with left unit containing no sub-algebra of dimension two [5].

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] A. A. Albert, Absolute valued real algebras. Ann. Math. 48 (1947), 495-501.
- [2] M. Benslimane and A. Moutassim, Some New Class of Absolute Valued Algebras with Left Unit, Advances in Applied Clifford Algebras, 21 (2011), 31-40.
- [3] M. L. El-Mallah, On finite dimensional absolute valued algebras satisfying $(x, x, x) = 0$, Arch Math. 49 (1987), 16-22.
- [4] A. Moutassim and M. Benslimane, Four dimensional absolute valued algebras containing a nonzero central idempotent or with left unit. int. J. Algebra, Vol 10, 2016, no.11, 513-524.
- [5] M.I. Ramirez, On four-dimensional absolute valued algebras. Proceedings of the International Conference on Jordan Structures (Malaga, 1997), univ. Malaga, 1999, pp. 169-173.
- [6] A. Rodriguez, One-sided division absolute-valued algebras. Publ. Math. 36 (1992), 925-954.
- [7] A. Rodriguez, Absolute valued algebras of degree two. In Nonassociative Algebra and its applications (Ed. S. Gonzalez), Kluwer Academic Publishers, Dordrecht-Boston-London (1994), 350-356.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Characterization of doubly regular tournaments by spectral slater index

Communication Info

Authors:

Sara EZZAHIR¹
Abderrahim BOUSSAIRI¹
Soufiane LAKHLIFI¹
Soukaina MAHZOUM¹

¹MFA, Hassan II University of
Casablanca, Casablanca,
Morocco

Keywords:

(1) Doubly regular
tournament
(2) Skew-spectrum
(3) slater index

Abstract

A tournament is doubly regular if there is a constant $k \geq 1$ such that each unordered pair of vertices is jointly dominated by exactly k vertices. Doubly regular tournaments exist only for orders $n \equiv 3 \pmod{4}$.

The spectral Slater index of a tournament T is the spectral distance between T and a transitive tournament.

In this talk, we characterize the class of doubly regular tournaments whose spectral Slater index reaches the bounds.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Noga Alon. Ranking tournaments. *SIAM Journal on Discrete Mathematics*, 20(1):137–142, 2006.
- [2] P Erdős and JW Moon. On sets of consistent arcs in a tournament. *Canadian Mathematical Bulletin*, 8(3):269–271, 1965.
- [3] Alan J Hoffman and Helmut W Wielandt. The variation of the spectrum of a normal matrix. In *Selected Papers Of Alan J Hoffman: With Commentary*, pages 118–120. World Scientific, 2003.
- [4] Alireza Abdollahi, Shahrooz Janbaz, and Mohammad Reza Oboudi. Distance between spectra of graphs. *Linear Algebra and its Applications*, 466:401–408, 2015.
- [5] Christos Koukouvinos and Stella Stylianou. On skew-Hadamard matrices. *Discrete Mathematics*, 308(13):2723–2731, 2008.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



On the skew-characteristic polynomial of tournaments

Communication Info

Authors:

Soukaïna MAHZOUM¹
Abderrahim BOUSSAIRI²
Sara EZZAHIR³
Soufiane LAKHLIFI⁴

¹LMFA, FSAC Hassan II
University of Casablanca,
Casablanca, Morocco

²LMFA, FSAC Hassan II
University of Casablanca,
Casablanca, Morocco

Keywords:

- (1) Tournament
- (2) Skew-adjacency matrix
- (3) Skew-characteristic polynomial
- (4) Determinant

Abstract

A tournament is a digraph in which every pair of vertices is joined by exactly one arc. Let T be a tournament with n vertices v_1, \dots, v_n . The skew-adjacency matrix of T is the $n \times n$ zero-diagonal matrix $S = [s_{ij}]$, such that $s_{ij}=1$ if v_i dominates v_j and $s_{ij} = -1$ if v_j dominates v_i . It is well-known that the determinant of S is zero or a square of an odd integer. The skew-characteristic polynomial of T is the skew-characteristic polynomial of its skew-adjacency matrix. In this talk we characterize the class of tournaments T such that every principal submatrix of their skew-adjacency matrices has determinant at most 9 and we introduce the skew-characteristic polynomial of tournaments in this class.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] BABAI, László et CAMERON, Peter J. Automorphisms and Enumeration of Switching Classes of Tournaments. The electronic journal of combinatorics, 2000, vol. 7, no 1, p. R38.
- [2] CAMERON, Peter J. Orbits of permutation groups on unordered sets. Journal of the London Mathematical Society, 1978, vol. 2, no 3, p. 410-414.
- [3] DENG, Bo, LI, Xueliang, SHADER, Bryan, et al. On the maximum skew spectral radius and minimum skew energy of tournaments. Linear and Multilinear Algebra, 2018, vol. 66, no 7, p. 1434-1441.
- [4] MCCARTHY, Clifford A. et BENJAMIN, Arthur T. Determinants of the tournaments. Mathematics Magazine, 1996, vol. 69, no 2, p. 133-135
- [5] MOORHOUSE, G. Eric. Two-graphs and skew two-graphs infinite geometries. Linear Algebra and its Applications, 1995, vol. 226, p. 529-551.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Study of the spectral monomorphy of l_2 -structures

Communication Info

Authors:

Imane SOUKTANI^{2,3}
Abderrahim BOUSSAIRI²
Mohamed ZOUAGUI³

¹LMFA, Hassan II University of
Casablanca, Casablanca,
Morocco

²LMFA, Hassan II University of
Casablanca, Casablanca,
Morocco

³LMFP, International
University of Casablanca,
Casablanca, Morocco

Keywords:

- (1) spectral monomorphy
- (2) graphs
- (3) tournaments

Abstract

Let g be a complex l_2 -structure on a nonempty set V , that is a map from $E_2(V) := \{(x, y) : x \neq y \in V\}$ to the complex field \mathbb{C} . With respect to an ordering v_1, v_2, \dots, v_n of V , the adjacency matrix of g is the $n \times n$ zero diagonal complex matrix $M = [m_{ij}]$ in which $m_{ij} = g(v_i, v_j)$ if $i \neq j$. The characteristic polynomial of g is defined as the characteristic polynomial of its adjacency matrix. We say that g is k -spectrally monomorphic if all its substructures with k vertices have the same characteristic polynomial. In this work, we characterize the class of k -spectrally monomorphic Hermitian matrices of order n , the class of k -spectrally monomorphic tournaments. We also give some results about k -seidel-spectrally monomorphic graphs.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] A. Boussaïri, I. Souktani, I. Talbaoui, M. Zouagui, k -spectrally monomorphic tournaments. *Discrete Mathematics*. 2022 May 1 ; 345(5) :112804.
- [2] K.B. Reid, E. Brown, Doubly regular tournaments are equivalent to skew Hadamard matrices, *J. Combin. Theory Ser. A* 12 (1972)332–338
- [3] Reid Kb, Brown E. Doubly regular tournaments are equivalent to skew Hadamard matrices, *Journal of Combinatorial Theory, Series A*, 12(3):332-338, 1972.
- [4] k. Attas, A. Boussairi, and I. Souktani. Characterization of k -spectrally monomorphic Hermitian matrices, 2019.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Jordan ideals of prime near-rings with algebraic identities

Communication Info

Authors:

Abdelkarim BOUA¹

¹LSI, Sidi Mohamed Ben
Abdellah University of FEZ,
Morocco

Keywords:

- (1) Prime near-rings
- (2) Jordan ideals
- (3) Generalized derivations

Abstract

In this paper, we study 3-prime near rings with left multipliers satisfying certain differential identities on Jordan ideals, and we provide examples to show that the assumed restrictions cannot be relaxed.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] M. Ashraf and A. Shakir, On (σ, τ) -derivations of prime near-rings-II, Sarajevo J. Math., 4 (16) (2008), 23-30.
 - [2] M. Ashraf and S. Ali, On left multipliers and commutativity of prime rings. Demonstratio Math., 2008, *XLI* (4), 763-771.
 - [3] H. E. Bell and G. Mason, On derivations in near-rings, North-Holand Mathematics Studies, 137 (1987), 31-35.
 - [4] H. E. Bell, On Derivations in Near-Rings II. Kluwer Academic Publishers, North-Holand, (1997).
-

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



On the affine k-symplectic manifolds

Communication Info

Authors:

El mokhtar FANICH
Said ESSABAB

LAMS, Hassan II University of
Casablanca, Casablanca,
Morocco

Keywords:

- (1) Affine manifolds
- (2) k-symplectic structures

Abstract

We know that the complete, compact, locally affine manifolds of dimension n are the quotients \mathbb{R}^n/Γ , where Γ is a subgroup of the affine group $A(n)$ of \mathbb{R}^n , acting freely and properly discontinuously on \mathbb{R}^n and $\Gamma = \pi_1(M)$.

The affine manifolds have been studied by several authors. See, for example, L. Auslander, D. Fried, W. Goldman, P. Benzecri, Y. Carrière, T. Sari, etc, while our purpose is to study the affine manifolds equipped with an additional structure, which is the k-symplectic structure.

These manifolds are the quotients $\mathbb{R}^{n(k+1)}/\Gamma$ of $\mathbb{R}^{n(k+1)}$ by a subgroup Γ of the affine group $A(n(k+1))$ of $\mathbb{R}^{n(k+1)}$ acting freely and properly discontinuously on $\mathbb{R}^{n(k+1)}$ and leaving invariant the k-symplectic structure.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Auslander, L. The structure of complete locally affine manifolds. *Topology* **1964**, 3, 131–139.
- [2] Wolf, J.A. *Spaces of Constant Curvature*; Mc Graw-Hill: New York, NY, USA, 1967.
- [3] Awane, A.; Goze, M. *Pfaffian Systems. k-Symplectic Systems*; Kluwer Academic Press: Drive Norwell, MA, USA, 2000.
- [4] Fanich El, Essabab S., An Infinite Family of Compact, Complete, and Locally Affine k-Symplectic Manifolds of Dimension Three. *Symmetry* Vol. 13, Iss 11. 2159. (2021)

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Surfaces de translation générées par des indicatrices sphériques de courbes régulières d'un espace euclidien à trois dimensions

Communication Info

Authors:

Salma KHAN¹
Malika IZID²
Soukaina OURAB³
Amina OUAZZANI CHAHDI⁴

¹ LAMS, Faculté des Sciences
Ben M'Sick, Casablanca, Maroc,
² LAMS, Faculté des Sciences
Ben M'Sick, Casablanca, Maroc,
³ LAMS, Faculté des Sciences
Ben M'Sick, Casablanca, Maroc,
⁴ LAMS, Faculté des Sciences
Ben M'Sick, Casablanca, Maroc.

Keywords:

- (1) Surface de translation
- (2) Indicatrices sphériques
- (3) Courbure gaussienne
- (4) Courbure moyenne
- (5) Surface minimale
- (6) Surface développable
- (7) Repère de Frenet

Abstract

En géométrie différentielle, une surface de translation est une surface qu'on obtient en translatant une courbe $\alpha = \alpha(u)$ le long d'une autre courbe $\beta = \beta(v)$. Les surfaces de translation peuvent être paramétrées localement par

$$\varphi(u, v) = \alpha(u) + \beta(v),$$

où $\alpha : IC \mathbb{R} \rightarrow E^3$ et $\beta : JC \mathbb{R} \rightarrow E^3$, avec E^3 un espace euclidien à 3 dimensions.

Pour $\psi = \psi(s)$ une représentation naturelle d'une courbe de E^3 , on note par $C_0(s) = \psi(s)$, $C_1 = \psi'(s)$ et plus généralement $C_k(s) = \frac{C_{k-1}(s)}{\|C_{k-1}(s)\|}$ dite k-indicatrices sphériques de la courbe $\psi = \psi(s)$.

Dans ce travail, nous nous intéressons aux surfaces de translation générées par les k-indicatrices sphériques de deux courbes régulières α et β de E^3 , notées $C_{k\alpha}(u)$ et $C_{k\beta}(v)$ munies de leurs repères de Serret-Frenet respectifs $(C_{k+1\alpha}, C_{k+2\alpha}, w_{k+2\alpha})$ et $(C_{k+1\beta}, C_{k+2\beta}, w_{k+2\beta})$. En calculant la courbure de Gauss et la courbure moyenne de ces surfaces, on détermine une condition nécessaire et suffisante pour que ces dernières soient développables (resp. minimales) et on étudie le cas particulier où les courbes α et β sont planes, respectivement des hélices (k-1)-obliques.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Neriman Acar, Ferdag Kahraman Aksoyak, " Some characterizations of translation surfaces generated by spherical indicatrices of space curves ", Palestine Journal of Mathematics. Vol. 11(1) (2022), 456-468.
- [2] P. DO-CARMO (1976), Differential Geometry of Curves and Surfaces; IMPA, 511.
- [3] T. Ali Ahmad, H. S. Abdel Aziz and H. Sorour Adel, On curvatures and points of the translation surfaces in Euclidean 3-space, J. Egyptian Math. Soc., 23, 167-172, (2015).
- [4] L. Verstraelen, J. Walrave, S. Yaprak, The minimal translation surfaces in Euclidean space, Soochow J. Math. 20 (1) (1994) 77-82.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Goodness-of-fit in cox model with correlated covariates

Communication Info

Authors:

Lahcen LAILI¹
Mohamed Ali HAFDI²

¹LIMI, Ibn Zohr University of
Agadir, Morocco
²High school of technology
Laayoune, Ibn Zohr University
of Agadir, Morocco

Keywords:

- (1) Goodness of fit
- (2) Cox model
- (3) Proportionality hypothesis

Abstract

The Cox model, introduced in 1972 by Cox [1], is the best known model by its numerous applications in survival analysis. It assumes that the effect of each covariate on the probability of survival is proportional. The test of such an assumption has been the subject of a large number of research works, see for example: Kraus [2] Kvaløy and Neef [3]. These two works have shown that the proposed tests misjudge the proportionality of a proportional covariate if it is correlated with a non-proportional one. This is mainly due to their formulation which assumes that all other covariates not concerned by the test are proportional, which is not always the case. In 2008 KRAUS [4] reformulated his test [2] by adding artificial time covariates to all the covariates and not only to the one concerned by the test. In all the cases of simulations considered in KRAUS [4] the sample size was large ($n=200$) and the given results are powerful. In this communication we will remake these simulations for even smaller sizes (e.g. $n=50, 100$) to review the performance of the test for these cases, so as to apply this idea (of KRAUS [4]) on other alternatives.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Cox, D. R. (1972). Regression models and life tables. *J. R. Statist. Soc., B*, 34:187–220.
- [2] Kraus, D. (2006). Data-driven smooth tests of the proportional hazards assumption. *Lifetime Data Anal*, 13:1–16.
- [3] Kvaløy, J. T. and Neef, L. R. (2004). Tests for the proportional intensity assumption based on the score process. *Lifetime Data Analysis*, 10:139–157.
- [4] Kraus, D. (2008). Identifying Nonproportional Covariates in the Cox Model, *Communications in Statistics - Theory and Methods*, 37:4, 617-625

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



On probability of constructing certain finite groups

Communication Info

Authors:

Khalid Alajmi¹
Mashhour Bani- Ata²
Department of Mathematics
PAAET-Kuwait

Keywords:

- (1) Probability number
- (2) Expected number
- (3) nilpotent groups

Abstract

Let G be a finite group. Let $\alpha(G)$ denote the expected number of elements of G which have to be drawn random with replacement from G before a set of generators is found. Define $P(G)$ to be the probability that elements drawn at random with replacement from G generate G . For the above two definitions see[1]. In this talk we compute $\alpha(G)$ and $P(G)$ for certain p -groups, elementary abelian groups and nilpotent groups of nilpotency class 2. For more information about probabilistic group theory one may refer to [2,3,4,5].

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] V. Acciario, the probability of generating some common families of finite groups. *Utilitas Mathematica*, vol.49 (1996), 243 – 253.
- [2] K. Jaber, F.O. Wagner, Largeness and equational probability in groups, *Annales Mathematiques Blaise Pascal*, Clermont - Ferrand, In press, hal-02271406v2 (2020)
- [3] John D. Dixon, The probability of generating the symmetric group, *Math. Z.* 110(1969),199 – 205.
- [4] R.M. Guralnick and J.S. Wilson, The probability of generating a finite soluble group, *Proc. London Math. Soc.* (3) 81 (2000), 405-427.
- [5] . J.D. Dixon. L. Pyber, A. Seress, and A. Shalev. Residual properties of free groups and probabilistic methods, submitted for publication.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Biodiversity dynamics in fluctuating landscapes

Communication Info

Authors:

Carlos J. MELIAN¹
Alejandro ROZENFELD²
Gian Marco PALAMARA¹
Charles N. de SANTANA³
Jan KLECKA⁴
Rodrigo RIERA⁵
Victor M. EGUILUZ⁶

¹ETH-Domain and University of Bern,
Switzerland

²University of the Center of Buenos Aires,
Argentina

³Charles N. de Santana, Programa de
Graduação em Ciências da Terra e do Ambiente,
Universidade Estadual de Feira de Santana,
Bahia, Brasil.

⁴Jan Klecka, Institute of Entomology, Biology
Centre of the Czech Academy of Sciences,
Ceske Budvejovice, Czech Republic

⁵Departamento de Ecología, Facultad de
Ciencias, Universidad Católica de la Santísima
Concepcion, Casilla 297, Concepcion, Chile

⁶Instituto de Física Interdisciplinar y Sistemas
Complejos IFISC (CSIC-UIB), E07122 Palma de
Mallorca, Spain.

Keywords:

- (1) Neutral theory
- (2) Mathematical modeling
- (3) Biodiversity theory

Abstract

Experimental, theoretical, and empirical studies have shown that biodiversity can increase in both high and low connected landscapes [1,2,3]. Yet, we lack predictions related to biodiversity dynamics with fluctuations in landscape connectivity [4]. In this talk, we introduce a framework to study the relationship between fluctuations in landscape connectivity and biodiversity dynamics [5]. Our results suggest that fluctuations in connectivity increase the total number of species coexisting in dynamic landscapes, when compared with static landscapes.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

1. Damschen, E. I. Brudvig, L. A. Burt, M. A. Fletcher, R. J. and Haddad, M. Levey, D. J. Orrock, J. L. Resasco, J. and Tewksbury, J. (2019). Ongoing accumulation of plant diversity through habitat connectivity in an 18-year experiment. *Science*, 365:1478–1480.
2. Gilarranz, L. J. Rayfield, B. Liñan-Cembrano, G. Bascompte, J. and Gonzalez, A. (2017). Effects of network modularity on the spread of perturbation impact in experimental metapopulations. *Science*, 357:199–201.
3. Shtilerman, E. and Lewi, S. (2015). The effects of connectivity on metapopulation persistence: Network symmetry and degree correlations. *Proceedings of the Royal Society B: Biological Sciences*, 282:1806.
4. Leibold, M. A. and Chase, J. M. (2018). *Metacommunity Ecology*. Princeton. University Press, Princeton, USA
5. Rozenfeld, R. Palamara, G. M. de Santana, C. Klecka, J. Riera, R. Eguiluz, V. M. and Melian, C. J. (2023). Biodiversity dynamics in landscapes with fluctuating connectivity. *Ecography* (2nd revision after favorable reviews).

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



A Mathematical Model of Ideas Transmission

Communication Info

Authors:

Anwar El FADIL EL IDRISI¹
Abdelhak YAACOUBI²

¹MAEGE, Hassan II University of
Casablanca-AIN SEBAA,
Casablanca, Morocco

²MAEGE, Hassan II University of
Casablanca-AIN SEBAA,
Casablanca, Morocco

Keywords:

Human Behavior-transmission-
epidemiological-
sociopsychological-stability

Abstract

As a consequence of the advent of new communication channels, social networks increasingly host public dialogues. These public spaces of Commerce are profoundly established in our culture, but they also serve as sensitive sensors of human behavior and collective emotions. The transmission of ideas is quite rapid. It may be used for both good and evil and poses one of society's gravest threats, since it can disrupt financial, political, and economic markets. Multiple mathematical models, based on epidemiological models, have been constructed in an effort to comprehend this complex transmission process that is primarily impacted by sociopsychological elements. In this study, we provide a novel paradigm for the transmission of ideas that accounts for a variety of conceivable changes in the categories of social network members. With this new model, we describe admissible equilibrium states, the fundamental conditions for their stability, and the stability parameters for the model.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- Séverine Bernard, T. C. (2018,). Stability analysis of a new e-rumor model. Lecture notes in economics and mathematical systems, Control systems and mathematical methods in economics,, 687, pp.377-390.
- GOFFMAN, W. N. (1964). Generalization of Epidemic Theory: An Application to the Transmission of Ideas. Nature, 225--228.
- Misra, A. (2012). A simple mathematical model for the spread of two political parties. Nonlinear Analysis: Modelling and Control, 343--354.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Estimation of Nonlinear Panel-Data Models: A Comparative Study

Communication Info

Authors:

Aziz LMAKRI¹
Abdelhadi AKHARIF²

¹ENSAM, Hassan II University,
Casablanca, Morocco

²FST, Abdelmalek Essâadi
University, Tanger, Morocco

Keywords:

- (1) Adaptive estimate
- (2) Bilinear models
- (3) Panel regression models
- (4) Weighted least squares
- (5) Ordinary least squares

Abstract

Many estimation methods have been proposed for the parameters of the regression models with serially correlated error. In this work, we propose a comparative study by Monte-Carlo simulation between *adaptive*, *ordinary* and *weighted least squares* estimators for the coefficients of multivariate panel regression models when the errors are bilinear serially correlated. As a consequence of the uniform local asymptotic normality property, we obtain adaptive estimates of the parameters. In addition, we show that the adaptive estimates are more efficient than the weighted and ordinary least squares estimates.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] M.R. Abonazel, Different estimators for stochastic parameter panel data models with serially correlated errors, *J. Stat. Appl. Probab*, 7 (2018) 423-434.
- [2] J. Allal and S. El Melhaoui, Tests de rangs adaptatifs pour les modèles de régression linéaire avec erreurs ARMA, *Ann. Math. du Québec*, 30 (2006) 29-54.
- [3] Z. C. Elmezouar, A. M. Kadi and M. M. Gabr, Linear regression with bilinear time series errors, *Panam. Math. J.* 22 (2012) 1-13.
- [4] C. W. J. Granger and A. P. Andersen, *An Introduction to Bilinear Time Series Models*, Vandenhoeck and Ruprecht, Getttingen, 1978.
- [5] A. Lmakri, A. Akharif and A. Mellouk, Optimal detection of bilinear dependence in short panels of regression data, *Rev. Colomb. Estad.*, 43 (2020) 143-171.
- [6] L. Le Cam and G. L. Yang, *Asymptotics in Statistics*, Springer, US, 1990.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Asymptotics of the cross-variation of Young integrals with respect to general self-similar Gaussian process

Communication Info

Authors:

Soufiane MOUSSATEN¹
Soukaina DOUISSI²
Khalifa ES-SEBAIY^{3,4}

¹LMFA, Hassan II University of Casablanca, Casablanca, Morocco

²LIBMA, Cadi Ayad University, Marrakech, Morocco

³Kuwait University, Kuwait.

Keywords:

- (1) Self-similar Gaussian process
- (2) Young integral
- (3) Breuer-Major theorem

Abstract

We show in this presentation that the limit in law of the cross-variation of processes having the form of Young integral with respect to a general self-similar centered Gaussian process which does not necessarily have stationary increments of order Beta in $[1,2,3,4]$ is normal according to the values of Beta. Our results obtained in this work can be seen as a generalization of the work of Nourdin and Zintout [1], when one replaces the two dimensional fractional Brownian motion $(B(1);B(2))$ having identical Hurst parameter H by any Beta-self-similar Gaussian processes $(G(1);G(2))$. We apply our results to two self-similar Gaussian processes: the subfractional Brownian motion and the bifractional Brownian motion.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] I. Nourdin, R. Zintout, Cross-Variation of Young integral with respect to long-memory fractional Brownian motions. *Probab Math Stat-Pol*, 2016, 36: 35-46.
- [2] D. Harnett, D. Nualart, Central limit theorem for functionals of a generalized self-similar Gaussian process. *Stochastic Process Appl*, 2018, 128(2): 404-425.
- [3] J. M. Corcuera, D. Nualart, M. Podolskij, Asymptotics of weighted random sums. *Commun Appl Ind Math*, 2014, 6(1).
- [4] D. Nualart, G. Peccati, Central limit theorems for sequences of multiple stochastic integrals. *Annals of Probability*, 2005, 33(1): 177-193.
- [5] G. Peccati, C. A. Tudor, Gaussian limits for vector-valued multiple stochastic integrals. *Seminaire de Probabilites*, 2005, XXXVIII: 247-262.
- [6] I. Nourdin, Selected aspects of fractional Brownian motion. Milan: Bocconi & Springer Series, 2012.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



A Low-Cost Estimation Method for Conditional Probabilities in Resource-Constrained Environments

Communication Info

Authors:

Ali LABRIJI¹

Abdelkrim BENNAR¹

Mostafa RACHIK¹

¹LAMS, Hassan II University of
Casablanca, Casablanca,
Morocco

Keywords:

- (1) Conditional probability
- (2) Stochastic approximation
- (3) Conditional expectation

Abstract

The use of conditional probabilities is popular in various fields such as medicine, finance, and image processing due to large datasets. However, large datasets also require significant computational capacity and prolonged compilation time. We propose a low-cost estimation method based on stochastic approximation (first proposed in Robbins Monro [6] and developed by Professor Bennar [3]) as an alternative to traditional methods outlined in [5] and developed in [4, 1, 2]. This method reduces the computational burden and compilation time while still estimating conditional probabilities. We provide theoretical foundation and evidence of its effectiveness through mathematical analysis and simulations on real-life data of diabetic patients (demonstrating the ability to predict diabetes probability).

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Robbins, H., & Monro, S. (1951). A stochastic approximation method. *The annals of mathematical statistics*, 400-407.
- [2] Bennar, A., Bouamaine, A., & Namir, A. (2008). Almost sure Convergence and in quadratic mean of the gradient stochastic process for the sequential estimation of a conditional expectation. *Applied Mathematical Sciences*, 2(8), 387-395.
- [3] Nelder, J. A., & Wedderburn, R. W. (1972). Generalized linear models. *Journal of the Royal Statistical Society: Series A (General)*, 135(3), 370-384.
- [4] McCullagh, P., & Nelder, J. A. (1983). *Generalized linear models*, 37.
- [5] Agresti, A. (1990). *Categorical Data Analysis*.
- [6] Antoniadis, A., Berruyer, J., & Carmona, R. (1992). *Régression non linéaire et applications*. *Economica*.



switching diffusion epidemic model with varying population size

Communication Info

Authors:

Abdeladim Nait Brahim¹
Adel SETTATI¹

¹The University of Abdelmalek
Essaâdi, Department of
Mathematics, Faculty of
Sciences and techniques B.P.
416, Tangier, Morocco

Keywords:

- (1) stochastic epidemic model
- (2) extinction
- (3) stochastic persistence
- (4) stationary distribution

Abstract

The purpose of this work is to investigate the asymptotic properties of a stochastic version of the classical SIS epidemic model with standard incidence and varying population size. The stochastic model studied here includes white vector noise and telegraph noise modeled by Markovian switching. We established conditions for extinction both in probability one and in p th moment. We also established the persistence of disease under different conditions on the intensities of noises and the parameters of the model. Furthermore, we showed the existence of a stationary distribution and derive expressions for its mean and variance. The presented results are demonstrated by numerical simulations.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] World Health Organization, (2008). The global burden of disease: 2004 update. www.who.inthehealthinfo/global_burden_disease/GBD_report_2004update_full.pdf.
- [2] V.Capasso, Mathematical structures of epidemic systems, Corrected 2nd printing, Springer, Heidelberg, 1882008.
- [3] J. Zhou, H.W. Hethcote, Population size dependent incidence in models for diseases without immunity, J. Math. Biol. 32 (1994) 809-834.
- [4] E. Beretta, Y. Takeuchi, 1995. Global stability of a SIR epidemic model with time delay. J. Math. Biol., 33,250-260.
- [5] A. Gray, D. Greenhalgh, X. Mao., J. Pan, The SIS epidemic model with Markovian switching, J. Math. Anal. Appl. 394 (2012) 496-516.
- [6] N. Dalal, D.Greenhalgh, X. Mao, A stochastic model of AIDS and condom use, J. Math. Anal. Appl. (2007) 325, 36-53.
- [7] A. Lahrouz, L. Omari, D. Kiouach, A. Belmaati, Complete global stability for an SIRS epidemic model with generalized non-linear incidence and vaccination, Appl. Math. Comput. 218 (2012) 6519-6525.
- [8] R. M. Anderson, R .M. May, The population dynamics of microparasites and their invertebrate hosts. Trans. R. Philos. Soc. B, 291 (1981), 451-524.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Numerical Analysis of Finite Difference Method for Fokker-Planck equation driven by symmetric Lévy motion

Communication Info

Authors:

Abdelali CHAIB^{1,2}
Mohamed BEN SAID²
Amal BERGAM¹

¹SMAD, Polydisciplinary
Faculty of Larache, Abdelmalek
Essaadi University, Larache,
Morocco

²MMA, Polydisciplinary Faculty
of Larache, Abdelmalek Essaadi
University, Larache, Morocco

Keywords:

- (1) Fokker-Planck equation
- (2) α -stable Lévy motions
- (3) Fractional Laplacian operator
- (4) Finite difference method

Abstract

The Fokker-Planck equations are used to analyze the time progression of the probability density of solution paths for stochastic dynamical systems [1]. When the noise is non-Gaussian, such as α -stable Lévy motions, the Fokker-Planck equation takes an additional Fractional Laplacian term $(-\Delta)^{\alpha/2}$ [1-5]. In this work, we present a finite difference scheme to approximate the solution of the Fokker-Planck equation driven by symmetric Lévy motion. The stability, and convergence of the method are discussed. Our numerical method is validated by comparison with exact solutions for special cases.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Jinqiao Duan. An introduction to stochastic dynamics. T. 51. Cambridge University Press, 2015.
- [2] Ting Gao, Jinqiao Duan et Xiaofan Li. "Fokker-Planck equations for stochastic dynamical systems with symmetric Lévy motions". In : Applied Mathematics and Computation 278 (2016), p. 1-20.
- [3] Li Lin et al. "Dynamical behavior of a nonlocal Fokker-Planck equation for a stochastic system with tempered stable noise". In : Chaos : An Interdisciplinary Journal of Nonlinear Science 31.5 (2021), p. 051105.
- [4] Yanjie Zhang et al. "Numerical analysis and applications of Fokker-Planck equations for stochastic dynamical systems with multiplicative α -stable noises". In : Applied Mathematical Modelling 87 (2020), p. 711-730.
- [5] Xiao Wang et al. "Fokker-Planck equation driven by asymmetric Lévy motion". In : Advances in Computational Mathematics 45.2 (2019), p. 787-811.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Asymptotic analysis for a feedforward network of critical multiclass processor sharing queues

Communication Info

Authors:

Amal EZZIDANI¹
Abdelghani BEN TAHAR¹

¹IR2M, Hassan I University of
Settat, Settat, Morocco

Keywords:

- (1) Feedforward network
- (2) Invariant state
- (3) Fluid model asymptotic

Abstract

Building on our prior work [5] in which, we considered a feedforward network of multiclass processor sharing queues and proved existence and uniqueness of critical fluid solution. This paper contains an asymptotic analysis of the critical fluid model for the feedforward network of multiclass processor sharing queues. Specifically, we define the notion of invariant state of a fluid model solution, and prove a result that characterizes invariant state.

We show the convergence of fluid model solution to the set of invariant states. Finally, we illustrate the different results through numerical examples.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] J.M. Harrison, R.J. Williams, Brownian models of Feedforward queueing networks, Quasireversibility and product form solutions, *Ann. Appl. Prob.*, 2, 263-293 (1992).
- [2] A.L. Puha, R.J. Williams, Invariant states and rates of convergence for the fluid limit of a heavily loaded processor sharing queue, *Queueing Systems Theory Appl.*, Vol.14 (2004) 517-554.
- [3] A. Ben Tahar, A. Jean-Marie, The fluid limit of the multiclass processor sharing queue, *Queueing Systems Theory Appl.*, 71(4) (2012) 347-404.
- [4] A.J. Mulvany, A.L. Puha, R.J. Williams, Asymptotic behavior of a critical fluid model for a multiclass processor sharing queue via relative entropy, *Queueing Systems Theory Appl.*, 93 (2019) 351-397.
- [5] A. Ezzidani, A. Ben Tahar, M. Ghazali, M. Hanini, The fluid limit of critical feedforward network of multiclass processor sharing queues, preprint



Threshold Behavior in a Stochastic SIS Epidemic Model with saturation incidence and logistic growth

Communication Info

Authors:

Soulaimane AZNAGUE¹
Aadil LAHROUZ¹
Adel SETTATI¹

¹The University of Abdelmalek
Essaâdi, Department of
Mathematics, Faculty of
Sciences and techniques B.P.
416, Tangier, Morocco

Keywords:

- (1) Stochastic SIS model
- (2) Logistic growth
- (3) Extinction
- (4) Stationary distribution

Abstract

In this communication, we present a SIS epidemic system with logistic growth and saturated incidence rate for susceptibles. We study the long time behavior of the stochastic system. We classify the extinction and ergodicity by introducing a real-valued threshold λ . Then, we show that if $\lambda < 0$, the disease goes to extinction and if $\lambda > 0$, the system model has a unique positive stationary distribution. We also present several numerical simulations to support and complement our analytical findings.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] N.T. Dieu, D.H. Nguyen, N.H. Du, and G. Yin, Classification of asymptotic behavior in a stochastic SIR model, SIAM J. Appl. Dyn. Syst., 15 (2016), pp. 1062–1084.
- [2] Gray A., Greenhalgh D., Hu L., Mao X., Pan J. A stochastic differential equation SIS epidemic model. SIAM J. Appl. Math. 2011;71:876–902.
- [3] D.H. Nguyen, G. Yin, C. Zhu, Long-term analysis of a stochastic SIRS model with general incidence rates, SIAM J. Appl. Math. 80 (2020) 814–838.
- [4] N.Dinh Phu , D.O'Regan , T.D.Tuong, Longtime characterization for the general stochastic epidemic SIS model under regime-switching, Nonlinear Analysis: Hybrid Systems 38, November 2020, 100951.
- [5] X.Zhang ,Q.Yang, Threshold behavior in a stochastic SVIR model with general incidence rates, Applied Mathematics Letters 121, November 2021, 107403.
- [6] Liu, J., Chen, L. & Wei, F. The persistence and extinction of a stochastic SIS epidemic model with Logistic growth. Adv Differ Equ 2018, 68 (2018).Sci., 4 (2010) 3289-3306.
- [7] Li, S., & Guo, S. (2021). Permanence and extinction of a stochastic SIS epidemic model with three independent Brownian motions. Discrete & Continuous Dynamical Systems-B, 26(5), 2693.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Integral bases of some families of quartic number fields

Communication Info

Authors:

Mouhcine TALJAOUÏ¹
Mostapha BOUHAMZA²

1.Laboratory of Fundamental
Mathematic and Applications,
FSAC, Hassan2 University, BP
5366 Casablanca 20100, Morocco

2.Laboratory of Fundamental
Mathematic and Applications,
FSAC, Hassan2 University, BP
5366 Casablanca 20100, Morocco

Keywords:

(1) Integral Basis;
(2) Quartic Number Fields

Abstract

Many authors have proposed Integral Basis of Biquadratic Number Fields [4], in 1984 Funakura [1] was interested in Quartic Number Fields.

D. Marcus [2] in his book 1977, using the Dirichlet theorem [3] proposed a theoretical method for Integral Basis of Number Field of degree n.

In this paper using another method, we will show the integral Basis of Quartic Number $K = \mathbb{Q}\sqrt[4]{4p}$. where p is any prime number.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] T. Funakura : On integral bases of pure quartic fields, Mathematical Journal of Okayama University. Volume 26. Issue 1 (1984).
- [2] D.A.Marcus : Number Fields \ Springer-Verlag, (1977).
- [3] P.Samuel : Théorie algébrique des nombres. Hermann, (1967)..
- [4] K.S.Williams : Integer of biquadratic Fields, Canad. Math. Bull.13 N 4, 519-526 (1970)

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



A combined Ant Colony Optimization with Levy flight mechanism for the Probabilistic Traveling Salesman Problem with deadlines

Communication Info

Authors:

Fadoua EL ASRI¹
Chakir TAJANI¹
Hanane FAKHOURI¹

¹ Department of Mathematics,
Polydisciplinary Faculty of
Larache, Abdelmalek Essaadi
University, Morocco

Keywords:

- (1) Probabilistic traveling salesman problem with deadlines
- (2) Levy flight
- (3) Ant colony optimization

Abstract

The Probabilistic Traveling Salesman Problem with deadlines (PTSPD) is an extension of the well-known probabilistic traveling salesman problem (PTSP) where, in addition to random customer availability, customers must also be visited before a known deadline. The goal is to find an optimal tour of minimal expected length that visits a random subset of customers in the same order as they appear in the tour. This problem is #P-hard [1]. The Levy flight is a widely used method for solving combinatorial optimization problems; based on the Levy distribution and helps to balance the search space and speed for global optimization [2]. In this communication, an improved ant colony algorithm with Levy flight is proposed [3]. As a result, some ants will take long jumps according to the Levy distribution, to escape from local optima situations. Our computational results on the probabilistic traveling salesman problem with deadlines show that the proposed Levy ACO algorithm obtains better results than the traditional ACO algorithm.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] D. Weyland, On the computational complexity of the probabilistic traveling salesman problem with deadlines. *Theoretical Computer Science*, 540 (2014) 156-168.
- [2] M. Jamil, Z. H.J. Zepernick, Lévy flights and global optimization, *Swarm intelligence and bio-inspired computation*. Elsevier, (2013) 49-72.
- [3] Y. Liu, C. Buyang, A novel ant colony optimization algorithm with Levy flight, *Ieee Access*, 8 (2020) 67205-67213

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Wasserstein Bounds in the Clt of Estimators of The Drift Parameter for Ornstein-Uhlenbeck Processes Observed at High Frequency

Communication Info

Authors:

MISHARI AL-FORAIH¹

Kuwait University

Keywords:

- (1) Linear Complementarity
- (2) Mathematical programming
- (3) Interior-point method

Abstract

This paper deals with the rate of convergence for the central limit theorem of estimators of the drift coefficient, denoted θ , for a Ornstein-Uhlenbeck process $X := \{X_t, t \geq 0\}$ observed at high frequency. We provide an Approximate minimum contrast and an approximate maximum likelihood estimators of θ

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Biermé, H., Bonami, A., Nourdin, I., Peccati, G. (2012). Optimal Berry-Esseen rates on the Wiener space: the barrier of third and fourth cumulants. *ALEA* 9, no. 2, 473-500. 2.
- [2] Bishwal, J.P., (2006). Rates of weak convergence of approximate minimum contrast estimators for the discretely observed Ornstein-Uhlenbeck process. *Statistics & probability letters*, 76(13), pp.1397-1409. 3.
- [3] Bishwal, J.P.N., Bose, A., (2001). Rates of convergence of approximate maximum likelihood estimators in the Ornstein-Uhlenbeck process. *Comput. Math. Appl.* 42 (1-2), 23-38. 4.
- [4] Cheridito, P., Kawaguchi, H., Maejima, M. (2003). Fractional Ornstein-Uhlenbeck processes, *Elect*

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



THE ONE-DIMENSIONAL PARTIAL DIFFERENTIAL EQUATION OF BLACK SCHOLES

Communication Info

Authors:

Youness SAOUDI¹
Hajar SABIKI²
Mehdi Moulay FALLOUL³
Hanaa HACHIMI⁴

^{1,2,4}LGS, Sultan Moulay Slimane
University of Beni Mellal,
Morocco

³LEG, Sultan Moulay Slimane
University of Beni Mellal,
Morocco

Corresponding Author :
saoudiyouness@gmail.com

Keywords:

- (1) PDE
- (2) Black- Scholes
- (3) Call Option
- (4) Put Option
- (3) MASI Index

Abstract

The purpose of this paper is the application of the one-dimensional partial differential Black Scholes equation on the MASI Index to mitigate market risk during 03 months including the COVID 19 crisis. This study would be extremely beneficial in judging equity investments in the context of the Moroccan equity market during Stress scenarios, as well as the test of effectiveness of the Black-Scholes equation in minimizing risk.

The partial differential Black scholes equation is written as follows:

$$\frac{\partial \varphi(t, x)}{\partial t} + \frac{1}{2} \sigma^2 x^2 \frac{\partial^2 \varphi(t, x)}{\partial x^2} + r \cdot x \frac{\partial \varphi(t, x)}{\partial x} = r \cdot \varphi(t, x)$$

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1]. F. Black and M. Scholes, The Pricing of Options and Corporate Liabilities, Journal of Political Economy 81 (3), 637-654 (1973).
- [2]. P. Wilmott, Paul Wilmott Introduces Quantitative Finance, 2nd ed. (John Wiley & Sons, Ltd, 2007), pp. 81-125.
- [3]. D. Teneng, Limitations of the Black-Scholes Model, International Research Journal of Finance and Economics 68, 100-102 (2011).
- [4]. G. S. Thanekar and Z. S. Shaikh, 2021 "Hedging The Portfolio Using Options Strategies," 2021 7th International Conference on Advanced Computing and Communication Systems (ICACCS), 2021, pp. 586-591, doi: 10.1109/ICACCS51430.2021.9441986.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Residual power series method for the approximate solutions of the space-time fractional Black-Scholes equation

Communication Info

Authors:

Hicham OUHRAICHO¹

Khalid HILAL¹

Abdelmajid El HAJJAJI¹

**Laboratory LMACS, FST
of Beni-Mellal,**

Sultan Moulay Slimane
University, Morocco.

Keywords:

Black-Scholes option pricing
equation

Residual power series
Fractional derivative

Abstract

The task of present research is to apply an enhanced version of residual power series method (RPSM) for the approximate solutions of the space-time fractional Black-Scholes equation. The approximate solutions using the RPSM were compared to the exact solutions and to the approximate solutions using other methods using numerical examples.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Black F, Scholes M (1973) The pricing of options and corporate liabilities. J Polit Econ 81:354–637
- [2] Abu Arqub O (2013) Series solution of fuzzy differential equations under strongly generalized differentiability. J Adv Res Appl Math 5:31–52
- [3] M. A. Bayrak ,A. Demir ,E. Ozbilge. An Improved Version of Residual Power Series Method for Space-Time Fractional Problems. Hindawi. Advances in Mathematical Physics. Volume 2022, (2022)
- [4] M. A. Bayrak ,A. Demir. A new approach for space-time fractional partial differential equations by residual power series method. Applied Mathematics and Computation 336 (2018) 215–230

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



CoVaR modeling to measure the impact of climate risk on financial stability

Communication Info

Authors:

Bazzi Mehdi¹
Himri Hicham²
El Alaoui Abdelkader³

¹Engineering Sciences
Laboratory, National School of
Applied Sciences, Ibn Tofail
University, Kenitra, Morocco

²University Hassan II, Faculty
of Juridical, Economic and
Social Sciences, Casablanca,
Morocco

³Rabat Business School,
Université Internationale de
Rabat, Morocco

Keywords:

(1) Climate risk
(2) Financial Stability
(3) conditional Value at Risk
(CoVaR)

Abstract

In recent years, we have been witnessing how climate risk can spread rapidly in the financial system and threaten financial stability. Therefore, the focus of this study has been on the development of climate risk indicators that can be used by financial institutions and regulators as monitoring tool.

CoVaR is a systemic risk measure Implemented here for this purpose. It Represents conditional value at risk and will help us measure the contribution of a Variable Climate to other financial indexes or specific economic Sectors. The conclusion is that CoVaR can, along with other systemic risk indicators, help better quantify the chains of transmission and Understand the Risks That threaten the stability of the Moroccan financial system.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] T. Adrian and MK Brunnermeier "CoVaR," Federal Reserve Bank of New York Staff Reports, no. 348, September 2008; revised September 2011.
- [2] R. Koenker, Quantile Regression (Econometric Society Monographs), Cambridge University Press, 2005.
- [3] Dilhani Marasinghe, Quantile Regression For Climate Data, 2014
- [4] Glenn Hoggarth, steffen Sorensen Stress tests of UK banks using a VaR approach, working paper no. 282 2005
- [5] Diana hancockand wayne passmore, Finantial stability and the capital adequacy of broad US Banking Organizations: a VAR Approach
- [6] Diana hancockand wayne passmore, Finantial stability and the capital adequacy of broad US Banking Organizations: a VAR Approach
- [7] Mathias Letmark, Robustness of conditional value at risk for measuring Market Risk, June 2016

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE

March 16-17-18, 2023 | Casablanca, Morocco



Analyse via une modélisation économétrique à vocation prévisionnelle de l'impact de la pandémie covid-19 sur les transferts des MRE.

Communication Info

Auteurs :

Samir FARHI
Hicham EL BOUANANI

*LMAEG, Hassan II University of
Casablanca, Casablanca,
Morocco*

Mots-clés :

- (1) Modèle prévisionnel
- (2) Propriétés cycliques
- (3) Transferts de fonds
- (4) Covid19
- (5) MRE
- (6) Enquête HCP

Résumé

Il est indéniable que la crise de la Covid-19 a été un choc inédit pour le monde entier, elle a prouvé sans aucun doute que ses répercussions étaient plus graves que toute autre crise que le monde a connue au cours du siècle dernier. Pour faire face à la pandémie, le Maroc a pris des mesures sans précédent, telles que la fermeture des frontières et le confinement.

Etant donné le contexte exceptionnel de la pandémie et les mesures restrictives rigoureuses prises par l'Etat, les envois de fonds effectués par les Marocains résidant à l'étranger (MRE) ont fait preuve d'une remarquable résilience durant cette période et se sont révélés être un outil économique performant et solide.

L'objet de cette communication est de faire un état des lieux en se basant sur les données d'une étude réalisée par le HCP, ensuite d'étudier les propriétés cycliques des transferts de fonds vers le Maroc. Et expliquer cette résistance des envois de fonds malgré le contexte de crise liée à la Covid-19. Par la suite, on analysera l'impact éventuel de la crise sanitaire sur les transferts à l'aide d'une modélisation économétrique à vocation prévisionnelle appliquée à des données allant de 2004 à 2019.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- BOURBONNAIS, R. (2015), *Économétrie*, 9e éd. Dunod.
- CHAABITA, R. (2016), ouvrage « Le Maroc et la Migration Internationale : Approches, politiques et enjeux » éditions Universitaires Européennes, 15 Novembre 2016. ISBN 978-3-8416-1887-0
- CHAABITA, A. (2019), « Transferts de fonds et développement socio-économique au Maroc : une analyse empirique », in *Revue Africaine des Migration Internationales*, Vol n° 2, N°2, ISSN: 2509-176X
- COIFFARD, M. "Les déterminants et impacts macroéconomiques des transferts de fonds des migrants : une analyse du cas des pays fortement dépendants". Université de Grenoble, 2011. tel-00784378
- HCP : Premiers résultats de l'Enquête du Haut-commissariat au Plan sur la Migration Internationale au cours de 2018-2019
- MAKHLOUF, F. 2014. "Propriétés cycliques des transferts de fonds des migrants marocains," Working Papers 2013-2014_9, CATT - UPPA - Université de Pau et des Pays de l'Adour, revised Feb 2014.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Impact of Morocco's Participation in Global Value Chains on Growth, Productivity, and Employment Application of the Autoregressive Lagged Approach (ARDL)

Communication Info

Authors:

FARAH BENOMAR¹
Hicham EL BOUANANI¹
ABDELAAZIZ EZZIANI¹

¹LMAEG, Hassan II University of
Casablanca, Casablanca,
Morocco

Keywords:

- (1) GVC
- (2) Growth
- (3) Productivity
- (4) Employment
- (5) ARDL

Abstract

One of the trends observed in recent decades is the rise of global value chains (GVCs). Integration into a GVC means that a country becomes part of an international production network in which intermediate goods are sourced from different locations and assembled in a third country (1). GVCs offer developing countries the opportunity to participate in the global economy (2), and are an important driver of growth and productivity and promote job creation (3). To examine whether participation in GVCs has beneficial macroeconomic effects and could represent a development strategy for Morocco, we will test econometrically the relationship between GVC participation, productivity, employment, and economic growth. For this purpose, we will exploit data from the World Bank, OECD, and WTO databases covering the period from 1991 to 2021 and, through the autoregressive lag model (ARDL), we will analyze the results obtained.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References:

1. *L'intégration du Maroc et l'Afrique du Sud dans les Chaines de valeur mondiale: Cas du secteur automobile.* **BENOMAR, Farah, EL Bouanani, Hicham et Ezziani, Abdelaaziz.** 2, 28 Mai 2022, Revue Internationale du Chercheur, Vol. 3, pp. 434-457.
2. **Baldwin, Richard.** *Trade and Industrialisation after Globalisation's 2nd Unbundling: How Building and Joining a Supply Chain Are Different and Why It Matters.* s.l. : National Bureau of economic research, 2011.
3. **OCDE.** *Economies interconnectées; Comment tirer parti des chaines de valeur mondiales.* 2014.
4. *La participation aux Chaines de valeur mondiale et la mise à niveau économique : Revue de littérature et élaboration de modèle conceptuel.* **BENOMAR, Farah, EL Bouanani, Hicham et Ezziani, Abdelaaziz.**(preprint)

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Dynamics of IS-LM model with general investment and fiscal policy delays

Communication Info

Authors:

Maha ELKARMOUCHI¹
Sara LASFAR¹
Khalid HATTAF^{1,2}
Noura YOUSFI¹

¹LAMS, Hassan II University of
Casablanca, Casablanca,
Morocco

²ERMEM, Centre Régional des
Métiers de l'Éducation et de la
Formation (CRMEF), 20340
Derb Ghalef, Casablanca,
Morocco

Keywords:

- (1) IS-LM model
- (2) Fiscal policy delays
- (3) Asymptotic stability
- (4) Hopf bifurcation

Abstract

In this work, we develop an IS-LM model with general investment and fiscal policy delays. The well-posedness of the model is proved through existence and uniqueness of solution. Furthermore, we study the existence of economic equilibrium. Finally, we establish the stability analysis and Hopf bifurcation.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] K. Hattaf, D. Riad, N. Yousfi, A generalized business cycle model with delays in gross product and capital stock, *Chaos, Solitons and fractals* 98 (2017), 31-37.
- [2] D. Riad, K. Hattaf, N. Yousfi, Dynamics of a delayed business cycle model with general investment function, *Chaos, Solitons and fractals* 85 (2016), 110-119.
- [3] D. Riad, K. Hattaf, N. Yousfi, Mathematical analysis of a delayed IS-LM model with general investment function, *The Journal of Analysis* 27 (4) (2019), 1047-1064.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Utility Functions for Predator-Prey Game: A Possible Connection between the *Esox Lucius-Gobio Gobio* Model and the Utility Functions

Communication Info

Authors:

Asmaa IDMBAREK¹
Fatima MAYA²
Noussaiba BABA¹
Youssef EL FOUTAYENI¹

¹LAMS, Hassan II University of Casablanca, Casablanca, Morocco

²University of Bremen, Faculty 3 - Mathematics and Computer Science, Germany

Keywords:

- (1) Prey-predator interaction
- (2) Utility function
- (3) Nash Equilibrium

Abstract

A generalization of the utility functions for the prey-predator interaction is defined, such functions depends on various parameters that suitably describe animal instincts, considering both physical and environmental conditions. Both running or being quiet have been considered as possible strategies for each animal. Our study showed that the most important cooperative strategies—both animals running or staying quiet- be considered as Nash equilibrium solutions to suitably define the game. Lastly, we proposed a mathematical model to describe the interacting behavior of predator and prey and we discuss the possible connection between the *Esox Lucius-Gobio Gobio* model and the utility functions.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Sainmont, J. Thygesen, U.H. Visser, Diel vertical migration arising in a habitat selection game, *Theoretical Ecology* 6(2): 241-251, 2013.
- [2] W. A. Mitchell, Multi-behavioral strategies in a predator-prey game: an evolutionary algorithm analysis, *Oikos* 118: 1073-1083, 2009.
- [3] A. Idmbarek, Y. Achik, H. Nafia, I. Agmour, Y. El Foutayeni, Interrelationships between Prey and Predators and How Predators Choose Their Prey to Maximize Their Utility Functions, *Journal of Applied Mathematics*, Volume 2021, Article ID 6619500.
- [4] J. I. Hammond, B. Luttbeg and A. Sih, Predator and prey space use: Dragonflies and tadpoles in an interactive game, *the Ecological Society of America*, 88(6), 2007, pp. 1525–1535.
- [5] R. Leonard, Von Neumann, Morgenstern, and the Creation of Game Theory, New York: Cambridge University Press, 2010.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



The use of American options to help oil producers during the spread of covid-19 pandemic

Communication Info

Authors:

Hajar Nafia¹
Yamna Achik¹
Asmaa Idmbarek¹
Youssef El Foutayeni¹
Naceur Achtaich¹

¹LAMS, Hassan II University of
Casablanca, Casablanca,
Morocco

Keywords:

- (1) Linear Complementarity
- (2) Heston Model
- (3) American option

Abstract

An option is a contract that gives the right to buy or sell an underlying asset at a given price and during a given period. American option can be exercised at any time until it expires. Most of the options traded in the world fall into this category. In this work, by using the Heston model we will show the usefulness of the American put options for helping the oil producing companies to overcome the crisis caused by the covid-19 pandemic. The Heston model is a model with a stochastic volatility; this volatility evolves according to the price of exercise and the maturity of the option. We reformulated this model as a linear complementarity problem that has a unique solution.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] F. Black, M. Scholes, The Pricing of Options and Corporate Liabilities, The Journal of Political Economy, Vol. 81, No 3, 637-654 (1973).
- [2] P. Ruckdeschel, T. Sayer, A. Szimayer, Pricing American options in the Heston model: a close look on incorporating correlation, Berichte des Fraunhofer ITWM, Nr. 204 (2011).
- [3] S. Heston, A Closed-Form Solution for Options with Stochastic Volatility with Applications to Bond and Currency Options, The Review of Financial Studies, Vol. 6, 327-343 (1993).
- [4] J.B. Wiggins, Option Values under Stochastic Volatilities, Journal of Financial Economics, Vol. 19, 351-372 (1987).
- [5] Y. Achik, A. Idmbarek, H. Nafia, I. Agmour, Y. El foutayeni, A fast algorithm for solving the Linear Complementarity Problem in a finite number of steps, Abstarct and Applied Analysis, Vol. 2020.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Numerical methods for solving BSDEs using Neural Networks: Application to the American options

Communication Info

Authors:

Takidine AHANDOUR¹

²
^{3,4}

¹LAMAI, FSTG, Cadi Ayad
University, Marrakech,
Morocco

²
³
⁴

Keywords:

- (1) Partial differential equation
- (2) Neural networks
- (3) BSDE
- (4) Stochastic process
- (5) American options

Abstract

Neural networks are increasingly used to adapt numerical solution methods for differential stochastic calculus. In this presentation, we will first introduce different types of Backward Stochastic Differential Equations (BSDEs). After a brief description of the classical methods used for the solution of BSDEs, we will go on with the uses of neural networks in this domain, inspired by proven methods related to Partial Differential Equations (PDEs). Then, we will review some algorithms used for this purpose. Finally, we will conclude our study with examples from the world of finance, dealing with the valuation of American options and using methods for solving BSDEs by means of neural networks. An extensive bibliography will summarize the state of the art.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Delong, Łukasz. Backward Stochastic Differential Equations with Jumps and Their Actuarial and Financial Applications: BSDEs with Jumps. EAA Series. London New York: Springer, 2013.
- [2] Dixon, Matthew F., Igor Halperin, et Paul Bilokon. Machine Learning in Finance: From Theory to Practice. Cham, Switzerland: Springer, 2020.
- [3] Du, K.-L., Ke-Lin Du, et M. N. S. Swamy. Neural Networks and Statistical Learning. London: Springer, 2014.
- [4] El Karoui, Nicole & Hamadene, Said & Matoussi, Anis. (2008). BSDEs and applications.
- [5] Hilpisch, Yves. Derivatives Analytics with Python: Data Analytics, Models, Simulation, Calibration and Hedging. Wiley Finance Series. Chichester: Wiley, 2015.
- [6] Menshawy, Ahmed. Deep Learning by Example: A Hands-on Guide to Implementing Advanced Machine Learning Algorithms and Neural Networks, 2018.
- [7] Pascucci, Andrea. PDE and Martingale Methods in Option Pricing. Bocconi & Springer Series 2. Milan New York: Springer, 2011.
- [8] Sakarkar, Gopal, Gaurav Patil, et Prateek Dutta. Machine learning algorithms using Python programming. Internet of things and machine learning. New York: Nova Science Publishers, 2021.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



ARFIMA models applied to the financial market during the covid 19 crisis

Communication Info

Authors:

Maria ACIM¹
Mehdi ZAHID¹

¹LAMAI, CADI AYYAD
University, FSTG Marrakech,
Morocco.

Keywords:

- (1) ARFIMA Models
- (2) Financial Market
- (3) Covid 19

Abstract

In this work, we investigate the impact of COVID-19 on the Malaysian bonds. The goal of this part is to analyze the characteristics of long memory for our series during the COVID-19 period, as well as the impact of the crisis on long memory for the analyzed series at each age level. We were based on government indexes with several maturities over the period from 2018 to 2022. We have confirmed that long and medium maturity bonds had a long memory during the studied period, and that short maturity bonds have a short memory during this period and we compared those results with ones obtained before in our published article on ARFIMA Model.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] A. Lahiani, O. Scaillet, Testing for threshold effect in ARFIMA models: Application to US unemployment rate data, International Journal of Fore-casting, 2009.
- [2] Yanlin Shi, Kin-Yip Ho, Long memory and regime switching: A simulation study on the Markov Regime-Switching ARFIMA model, Journal of BankingFinance 2015.
- [3] Krzysztof Burnecki Grzegorz Sikora, Identification and validation of stable ARFIMA processes with application to UMTS data, Chaos, Solitons Frac-tals, 2017.
- [4] Salim Lahmiri, Stelios Bekiros, The effect of COVID-19 on long memory in returns and volatility of cryptocurrency and stock markets, Chaos, Solitons Fractals, 2021.
- [5] I. N. Lobato and N. E. Savin (1998): Real and Spurious Long-Memory Properties of Stock-Market Data, Journal of Business Economic Statistics, 16, 261-268.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Pricing of futures Bitcoin price under a fractional volatility

Communication Info

Authors:

Houssam BOUGHABI¹
Yassine EL QALLI²

¹National Institute of Statistics
and Applied Economics, Rabat,
Morocco

²National Institute of Statistics
and Applied Economics, Rabat,
Morocco

Keywords:

- (1) Heston-Nandi
- (2) Fractional Volatility
- (3) Bitcoin
- (4) Options
- (5) Futures

Abstract

Through this article, we have proposed a model that incorporates the long memory character of volatility using figarch models, by redefining volatility as the fractionally differenced log-variance in deviation. From the long run level we obtain variance as a function of the lagged variances and risk premiums, we then go for pricing futures using the last equation to have a formula that defines futures as a function of the variance at the coming instant and the spot on the same date: this shows how futures are calibrated to the market as a function of spot and volatility. Options afterward are priced under a risk neutral measure, by redefining a new measure we calculate the late expectation using the characteristic function of the spot. Our model is applied to bitcoin data when we use market values toward a calibration of our model especially for Futures. Our model is original in the sense we have proposed a new insight frame, we have gathered Nandi and FIGARCH models to say that volatility has a long memory and so far, can price derivatives under the same results.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] M. Alfeus, L.Overbeck and E.Schlögl. Regime switching rough Heston model. Journal of Futures Markets (2019) 39 (5) 538-55.
- [2] D.Ardia, K.Bluteau and M.Rüede. Regime changes in Bitcoin GARCH volatility dynamics. Finance Research Letters (2019) 29 266-71.
- [3] E.Bouri, L.Gil-Alana, R.Gupta and D. Roubaud. Modelling long memory volatility in the Bitcoin market: Evidence of persistence and structural breaks. International Journal of Finance & Economics (2019) 24 412-26.
- [4] B.J.Christensen and J.Zhu. Long memory in stock market volatility and the volatility-in-mean effect the FIGARCH-M model. Journal of Empirical Finance (2010) 17 460-470.
- [5] P.Katsiampa. Volatility estimation for Bitcoin: A comparison of GARCH models. Economics Letters (2017) 158: 3-6.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Optimizing Hospital Emergency Processes

Communication Info

Authors:

Selma CHADLI¹
Firdaous ZAIR²
Abdelhak YACOUBI¹

¹MEAGE, Hassan II University
of Casablanca, Casablanca,
Morocco

²Mundiapolis University,
Casablanca, Morocco

Keywords:

- (1) Comparative Study
- (2) Hospital emergency processes
- (3) Efficiency
- (4) Methodology
- (5) Optimization

Abstract

This paper proposes a comparative study of hospital emergency processes in France, Canada, Spain, and Morocco, with the aim of identifying and addressing the critical points, or bottlenecks, in emergency services. The study is significant because it addresses a pressing need for improving the efficiency and effectiveness of hospital emergency processes [1] [2]. The methodology involves a theoretical examination of existing emergency processes in the studied countries, as well as an exploratory study of emergency services in Morocco through inventory analysis, interviews with specialists, and visits to emergency services. The study aims to establish a comprehensive model that detects, designs, and improves the process flow in emergency services and enhances the responsiveness of hospital services[3]. The findings of this research have the potential to inform and guide the optimization of hospital emergency processes, contributing to better patient outcomes and a more efficient healthcare system.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] A. Brizio et J. Bouchez, « Du plan blanc au dispositif hospitalier de gestion de crise : une proposition d'évolution conceptuelle et opérationnelle », *Ann. Fr. Médecine Urgence*, vol. 7, n° 4, p. 258-267, juill. 2017, doi: 10.1007/s13341-017-0765-x.
- [2] R. Mohammed, B. Maroua, et B. Chaimaa, « L'impact du COVID-19 sur la chaîne logistique hospitalière au Maroc, Quel effet a eu cette crise sanitaire sur les échanges internationaux ? », *Tech. Sci.*, n° 1, 2020.
- [3] M. A. H. Alouane, M. F. Chu, et Z. Jemai, « Vers une approche intégrée pour la planification tactique et opérationnelle d'un service d'urgence hospitalier ».

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Conceptual modelling framework for B2C e-supply chain diagnostic: An application to a logistic service provider

Communication Info

Authors:

Firdaous ZAIR¹
Imane ZERGOUT¹

¹Mundiapolis University of
Casablanca, Casablanca,
Morocco

Keywords:

- (1) B2C e-supply chain
- (2) E-fulfilment system programming
- (3) Process improvement,
- (4) Conceptual methodology
- (5) Performance analysis

Abstract

The proposed methodology in this paper presents a valuable contribution to the field of B2C e-commerce supply chain management. The conceptual framework presents a new approach to improving the design and performance of B2C e-fulfilment systems through rigorous and accurate analysis. The methodology is developed to address three critical aspects of e-commerce B2C supply chain management: (1) the identification of B2C scenarios, inputs, outputs, and flows; (2) the exploration and analysis of constraints, bottlenecks, and dysfunctions of e-supply chain processes; and (3) the generation of significant improvements. The methodology is tested and applied to an e-logistic service provider, demonstrating its efficacy and potential impact on the field. The proposed framework highlights the importance of an integrated and systematic approach to addressing e-commerce B2C supply chain management challenges [1-4] and represents a crucial step towards improving the overall efficiency and effectiveness of the industry.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Puche, Julio, Borja Ponte, José Costas, Raúl Pino, et David de la Fuente. 2016. « Systemic approach to supply chain management through the viable system model and the theory of constraints ». *Production Planning & Control* 27 (5): 421-30. <https://doi.org/10.1080/09537287.2015.1132349>.
- [2] Nguyen, Dung H., Sander de Leeuw, et Wout E.H. Dullaert. 2018. « Consumer Behaviour and Order Fulfilment in Online Retailing: A Systematic Review: Order Fulfilment in Online Retailing ». *International Journal of Management Reviews* 20 (2): 255-76. <https://doi.org/10.1111/ijmr.12129>.
- [3] Montreuil, Benoit. 2016. « Omnichannel Business--to--Consumer Logistics and Supply Chains: Towards Hyperconnected Networks and Facilities ».
- [4] Moons, Stef, Katrien Ramaekers, An Caris, et Yasemin Arda. 2017. « Integration of Order Picking and Vehicle Routing in a B2C E-Commerce Context ». *Flexible Services and Manufacturing Journal*, mars. <https://doi.org/10.1007/s10696-017-9287-5>.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



A note on L-Dunford-Pettis sets in a topological dual Banach space

Communication Info

Authors:

Abderrahman Retbi¹
Bouazza El Wahbi²

¹LIMATI, Sultan Moulay

Slimane University of Beni
Mellal, Beni Mellal, Morocco

²LAGA, Ibn Tofail university of
Kenitra, Kenitra, Morocco

Keywords:

- (1) Banach lattice
- (2) L-Dunford-Pettis set
- (3) Dunford-Pettis completely continuous operator

Abstract

We introduce and study the concept of L-Dunford-Pettis sets and L- Dunford-Pettis property in Banach spaces. Next, we give a characterization of L- Dunford-Pettis property with respect to some well-known geometric properties of Banach spaces. Finally, some complementability of operators on Banach spaces with the L-Dunford-Pettis property are also investigated.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] C. D. Aliprantis and O. Burkinshaw, Positive operators, Springer, Dordrecht, 2006.
- [2] M. Bahreini Esfahani, Complemented subspaces of bounded linear operators, Ph.D. thesis, University of North Texas, 2003.
- [3] P. Cembranos, $C(K;E)$ contains a complemented copy of c_0 , Proc. Amer. Math. Soc., 91 (1984), no. 4, 556-558.
- [4] G. Emmanuele, Banach spaces in which Dunford-Pettis sets are relatively compact, Arch.Math., 58 (1992), no. 5, 477-485.
- [5] I. Ghenciu and P. Lewis, The Dunford-Pettis property, the Gelfand-Phillips property, and L-sets, Colloq. Math., 106 (2006), no. 2, 311-324. [7] N. J. Kalton, Spaces of compact operators, Math. Ann., 208 (1974), 267-278.
- [6] P. Meyer-Nieberg, Banach lattices, Universitext, Springer-Verlag, Berlin, 1991.
- [7] C. P. Niculescu, Weak compactness in Banach lattices, J. Operator Theory., 6 (1981), no. 2, 217-231.
- [8] A. Retbi, B. El Wahbi, L-Dunford-Pettis property in Banach spaces, Methods Func. Anal. Topol. 22 (2016), 387-392.
- [9] A. Retbi, A note on L-Dunford-Pettis sets in a topological dual Banach space, Czechoslovak Mathematical Journal. Vol. 70 (2020), No. 4, pp. 1047-1057.
- [10] Y. Wen and J. Chen, Characterizations of Banach spaces with relatively compact Dunford-Pettis sets, Adv. in Math., (China) 45 (2016), no. 1, 122-132.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



The Nehari Manifold for a $p(m)$ -Kirchhoff problem with logarithmic nonlinearity on Riemannian manifolds

Communication Info

Authors:

Hind Bouaam¹
Chakir Allalou¹
Said Melliani¹

¹ *Laboratory LMACS, FST of Beni-Mellal, Sultan Moulay Slimane University, Morocco.*

Keywords:

- (1) Riemannian manifolds
- (2) logarithmic nonlinearity
- (3) Nehari manifold

Abstract

The goal of this paper is to investigate the existence and multiplicity of nontrivial weak solutions for a $p(m)$ -Kirchhoff problem with logarithmic nonlinearity on Riemannian manifolds. The proof of our main result uses the Nehari manifold approach.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] T. Aubin, *Nonlinear Analysis on Manifolds. Monge-Ampere Equations*, Grundlehren der mathematischen Wissenschaften, 252. Springer-Verlag, New York, 1982.
- [2] Y. Fu and L. Guo, Variable Exponent Spaces of Differential Forms on Riemannian Manifold, *Journal of Function Spaces and Applications*, Article ID 575819(2012).
- [3] L. Guo, The Dirichlet problems for nonlinear elliptic equations with variable exponents on Riemannian manifolds, *J. Appl. Anal. Comput.*, 5 (2015), 562-569.
- [4] M. Gaczkowski, P. Górkka. Sobolev spaces with variable exponents on Riemannian manifolds, *Nonlinear Analysis: Theory, Methods & Applications*. 92 (2013), 47-59.
- [5] M. Gaczkowski, P. Górkka, and D. J. Pon, Sobolev spaces with variable exponents on complete manifolds, *J. Funct. Anal.*, 270 (2016), 1379-1415.
- [6] E. Hebey, *Nonlinear analysis on manifolds: Sobolev spaces and inequalities: Sobolev spaces and inequalities*. Am. Math. Soc. 5, 25 (2000).

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Fourier transform for integrable Boehmians on locally compact abelian groups

Communication Info

Authors:

Abdelmajid Khadari¹
Radouan Daher¹

¹FSAC, Hassan II University of
Casablanca, Casablanca,
Morocco

Keywords:

- (1) Locally compact groups
- (2) Harmonic analysis
- (3) Integrable Boehmians

Abstract

Harmonic analysis on locally compact groups is a generalization of the classical Fourier analysis on the real line, in such setting we can define the Fourier transform such that the characters plays the role of the exponential function in the classical case, in this present talk we generalize the Fourier transform from the space of locally compact abelian groups to the space of integrable Boehmians on a locally compact groups, which is in turn a generalization of the generalized functions (the space of distributions), Boehmians was first introduced by Mikusinski, J. [1], as a generalization of distributions, the space of Boehmians contains all regular operators, all distributions and some objects which are neither operators nor distributions, many researchers have worked on different kind of integral transforms to generalize it to the space of integrable Boehmians see: J. Burzyk, D. Nemzer, P. Mikusinski [2, 3].

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Mikusinski, J. "Quotients de suites et leurs applications dans l'analyse fonctionnelle." CR Acad. Sci. Paris 293 (1981): 463-464.
- [2] Mikusinski, Piotr. "Fourier transform for integrable Boehmians." The Rocky Mountain Journal of Mathematics (1987): 577-582.
- [3] Nemzer, Dennis. "The Laplace transform on a class of Boehmians." Bulletin of the Australian Mathematical Society 46.2 (1992): 347-352.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Multiply recurrent operators in linear dynamics

Communication Info

Authors:

Fatima-Ezzahra SADEK¹
Mohamed AMOUCH¹

¹LMFA, Chouaib doukkali
University of El Jadida, El
Jadida, Morocco.

Keywords:

- (1) Linear dynamics
- (2) Recurrence
- (3) pseudo-shift operators

Abstract

In this work, we introduce and we study the notion of multiply recurrent vector for an operator acting on a Fréchet space. We give a characterization of topologically multiply recurrent operator by means of the set of multiply recurrent vectors.

As an application, we characterize the multiple recurrence of pseudo-shift operators acting on F -sequence space, which is indexed by an arbitrary countable infinite set, in terms of the weights, the OP-basis and the shift mapping. Furthermore, we prove that the recurrence and the hypercyclicity of pseudo-shift operators are equivalents.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] F. Bayart, É. Matheron, Dynamics of Linear Operators. Cambridge University Press, Cambridge 2009.
- [2] R. Cardeccia, S. Muro, Multiple recurrence and hypercyclicity, arXiv. (2104) 15033, 2021.
- [3] G. Costakis, A. Manoussos, I. Parissis, Recurrent linear operators, Complex Anal. Oper. Theory 8 (2014) 1601–1643.
- [4] G. Costakis, I. Parissis, Szemerédi's theorem, frequent hypercyclicity and multiple recurrence, Math. Scand. 110 (2012) 251–272.
- [5] K.-G. Grosse-Erdmann, A. Peris Manguillot, Linear Chaos, Springer, New York 2011.
- [6] H.N. Salas, Hypercyclic weighted shifts, Trans. Am. Math. Soc., 347 (1995) 993–1004.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Equilibrium Problems: Existence Results without Ekeland's Variational Principle

Communication Info

Authors:

Issam DALI¹

Mohamed Bilal MOUSTAID²

^{1,2}University of Chouaib

Doukkali, Faculty of Sciences,
El Jadida, Morocco

Keywords:

(1) Equilibrium problems

(2) Ekeland's variational
principle

Abstract

In the present work, we provide existence results without scalar and vectorial form of Ekeland's variational principle [1,2] for both scalar and vector equilibrium problems (for the definition of such type of problems and applications, we refer the reader for instance to [3,4]). These results are stated in the setting of Hausdorff topological spaces not necessarily first countable and in the absence of convexity and lower semi-continuity assumptions. As an application, we establish an existence result for countable systems of equilibrium problems.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

[1] M. Bianchi, G. Kassay, R. Pini, Existence of equilibria via Ekeland's principle, J Math Anal Appl. 2005, 305(2):502–512.

[2] Q.H. Ansari, Vectorial form of Ekeland-type variational principle with applications to vector equilibrium problems and fixed point theory, J Math Anal Appl. 2007, 334(1):561–575.

[3] Q.H. Ansari, E. Kobis, J.C. Yao, Vector Variational Inequalities and Vector Optimization, Springer, 2018.

[4] Q.H. Ansari, Metric Spaces: Including Fixed Point Theory and Set-valued Maps, Alpha Science International, 2010.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Continues dual operator frame in Hilbert A-module

Communication Info

Authors:

M'hamed GHIATI¹
Moamed ROSSAFI²

¹Laboratory of Analysis,
Geometry and Applications
(LAGA). Department of
Mathematics, Faculty of
Sciences, Ibn Tofail University,
B.P. 133, Kenitra, Morocco.

²LaSMA, Department of
Mathematics, Faculty of
Sciences Dhar El Mahraz,
University Sidi Mohamed Ben
Abdellah,
Fez, Morocco

Keywords:

- (1) Frame
- (2) Controlled frame
- (3) A-module

Abstract

Recently, the discipline of mathematics so called frame theory has had a grand revolution and it's becoming the most important in many applications. The This talk is devoted to studying the controlled frames in Hilbert A-modules, some useful results are presented. Also, the concept of controlled dual frames is given. Finally, we discuss the stability problem for controlled frames in Hilbert A-modules.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] R.J. Duffin, A.C. Schaeffer, A class of nonharmonic Fourier series, Trans. Am. Math. Soc. 72 (1952) 341–366.
- [2] R. Echarchaoui, M. Ghiati, M. Mouniane, M. Rossafi, Some Properties of Controlled K-g-Frames in Hilbert C*-Modules, Int. J. Anal. Appl. 20 (2022) 14.
- [3] M. Ghiati, S. Kabbaj, H. Labrigui, A. Touri, M. Rossafi, *-K-g-frames and their duals for Hilbert A-modules, J. Math. Comput. Sci. (2022).
- [4] H. Labrigui, A. Touri, M. Rossafi, S. Kabbaj, Controlled Frame for Operator in Hilbert c *-Modules, Int. J. Math. Math. Sci. 2022 (2022).
- [5] M. Rossafi, S. Kabbaj, *-K-g-frames in Hilbert A-modules, J. Linear Topol. Algebr. 7 (2018) 63–71.
- [6] M. Rossafi, F.-D. Nhari, C. Park, S. Kabbaj, Continuous g-Frames with C*-Valued Bounds and Their Properties, Complex Anal. Oper. Theory. 16 (2022).

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Continuous *g -frames in Hilbert C^* -modules

Communication Info

Authors:

Fakhr-dine Nhari¹

Mohamed Rossafi²

¹LAGA, University Ibn Tofail,
Kenitra,
Morocco

²LaSMA, University Sidi
Mohamed Ben Abdellah,
Fez,
Morocco

Keywords:

(1) continuous frames

(2) continuous *g -frames

(3) Hilbert C^* -modules

Abstract

In this talk, we devoted to the concept called continuous *g -frame in Hilbert C^* -modules, we introduce this concept and we establish some results. Moreover we investigate the operator dual of them we also discuss the stability problem.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

[1] Ali, S. T., Antoine, J. P., Gazeau: Continuous frames in Hilbert spaces. *Ann. Phys.*222, 1-37(1993).

[2] Alijani, A. Generalized frames C^* -valued bounds and their operator duals. *Filomat* 29(7),1469-1479(2015).

[3] Alijani, A., Dehghan, M: * -frames in Hilbert C^* -modules, *Politrn. Univ. Bucharest sci. Bull. Ser A Appl Math. Phys* 73(4),89-106(2011).

[4] M, Rossafi. F, Nhari. C, Park. S, Kappaj: continuous g -frames with C^* -valued bounds and their properties. *Complex Analysis and Operator Theory*(2022).

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Une classe des opérateurs de Toeplitz

Communication Info

Authors:

Adel Babbah¹
Mohamed Zohry²

¹Faculte polydisciplinaire de
Larache.

²Faculte des sciences de
Tetouan

Keywords:

(1) Toeplitz operator.
(2) Spectral theorem.
(3) Complex symmetric
operator.

Abstract

Dans l'espace de Hardy les opérateurs les plus étudiés sont les opérateurs dite de Toeplitz. Les plus simples parmi eux sont les opérateurs de décalage à gauche et à droite (Forward-Backward shifts). En général les Opérateurs de Toeplitz sont ceux dont leurs matrices dans une base hilbertienne standard de H_2 remplit par des diagonales constantes.

On discutera quelques résultats intéressants concernant le spectre et autre aspects de ces opérateurs.

En étudiant les opérateurs de Toeplitz dans H_2 , comme projection des opérateurs de multiplication (définie dans $L_2(T)$), les travaux de [1] une piste référence pour les propriétés théoriques des opérateurs Toeplitz, noté T_ϕ en relation les propriétés théoriques des fonctions, dite symbole, ϕ ; d'autre part la théorie spectrale pour ces opérateurs est largement détaillée par les travaux de [2]. D'autre côté les opérateurs de conjugaison et ces propriétés a permis des résultats remarquables concernant les propriétés théoriques et spectrale de la classe opérateurs Toeplitz symétriquement complexe.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] A. Brown, P. B. Halmos, Algebraic Properties of Toeplitz operators.
- [2]. Banach Algebra Techniques in Operator Theory, Ronald G. Douglas.
- [3] P. Aiena, Some Remarks on the Spectral Properties of Toeplitz Operators. Mediterranean Journal of Mathematics · December 2019
- [4] R. Lia, Y. Yangb, Y. Lub, A class of complex symmetric Toeplitz operators on Hardy and Bergman spaces, J. Math. Anal. Appl. 489 (2020) 124173.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Fixed points for weakly contractive mappings in rectangular b-metric spaces

Communication Info

Authors:

Mohamed Rossafi¹
Abdelkarim Kari²

¹*LaSMA, University Sidi
Mohamed Ben Abdellah,
Fez,
Morocco*

²*LAMS, Hassan II University,
Casablanca,
Morocco*

Keywords:

- (1) Fixed point
- (2) weakly contractive mapping
- (3) rectangular b-metric space

Abstract

In this talk, inspired by the concept of generalized weakly contractive mappings in metric spaces, we introduce the concept of generalized weakly contractive mappings in rectangular b-metric spaces to study the existence of fixed points for the mappings in these spaces.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] **M. Rossafi**, A. Kari, Fixed points for weakly contractive mappings in rectangular b-metric spaces, *Int. J. Nonlinear Anal. Appl.* In Press, 1–21. <http://dx.doi.org/10.22075/ijnaa.2022.27260.3542>.
- [2] A. Kari, **M. Rossafi**, E. Marhrani, M. Aamri, Fixed-point theorem for nonlinear F-contraction via w-distance, *Adv. Math. Phys.* 2020 (2020), Article ID 6617517.
- [3] A. Kari, **M. Rossafi**, E. Marhrani, M. Aamri, New fixed-point theorems for θ - φ -contraction on complete rectangular b-metric spaces, *Abstr. Appl. Anal.* 2020 (2020), Article ID 8833214.
- [4] A. Kari, **M. Rossafi**, E. Marhrani, M. Aamri, θ - φ -Contraction on (α, η) -complete rectangular b-metric spaces, *Int. J. Math. Math. Sci.* 2020 (2020), Article ID 5689458.
- [5] **M. Rossafi**, A. Kari, C. Park, J. R. Lee, New fixed-point theorems for θ - φ -contraction on b-metric spaces. *J. Math. Comput. Sci.* (2023); 29(1):12-27

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



On the Periodic Solutions for a class of Partial Differential Equation with infinite Delay

Communication Info

Authors:

Abdelhai El Azzouzi¹
Mohammed Kriche¹

¹LSI, Sidi Mohamed Ben
Abdellah University, Fes,
Morocco

Keywords:

- (1) Semigroup,
- (2) Hille-Yosida condition
- (3) integral solutions
- (4) semi-Fredholm operators
- (5) Poincaré map
- (6) periodic solution
- (7) Simulation

Abstract

Through this work we investigate the periodicity of solutions for a class of partial differential equations with infinite delay of the form $w(t) = Lw(t) + D(wt) + H(t)$. We suppose that the operator $(L, D(L))$ is generally nondensely defined operator and verifies the Hille-Yosida condition. Using the theory of perturbation of semi-Fredholm operators, we propose, when the phase space is a fading memory space, some sufficient conditions on the linear operators L and D to guarantee the periodicity of solutions of this class of partial differential equations from bounded ones on the positive real half-line. In addition, we consider the case where the operator L is a sum of two operators, the first one verifies the Hille-Yosida condition and the second one is a bounded linear operator. In this case, we give in the both situations of fading and uniform fading memory space, more sufficient conditions to derive periodic solutions from bounded ones. All this, without considering neither the compactness nor the exponential stability of the semigroup generated by the part of L on the closure of its domain. At the end, an application with numerical simulations, is given to confirm the applicability of the obtained theoretical results.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] R. Benkhalti, H. Bouzahir, K. Ezzinbi, Existence of a periodic solution for some partial functional differential equations with infinite delay, *J. Math. Anal. Appl.* 256, (2001), 257–280.
- [2] R. Benkhalti, K. Ezzinbi, Periodic solutions for some partial functional differential equations. *Appl. Math. Stoch. Anal.* 1, (2004), 9–18.
- [3] S. N. Chow and J. K. Hale, Strongly limit-compact maps, *Funkcial. Ekvac.* 17, (1974), 31-38.
- [4] N. Dunford and J. T. Schwartz, *Linear operators, Part I*, Wiley-Interscience, NewYork, (1987).
- [5] A. Elazzouzi, K. Ezzinbi, Ultimate boundedness and periodicity for some partial functional differential equations with infinite delay *J. Math. Anal. Appl.* 329, (2007), 498-514.
- [6] A. Elazzouzi, K. Ezzinbi, and M. Kriche, Periodic solution for some class of linear partial differential equation with infinite delay using semi-Fredholm perturbations, *Nonauton. Dyn. Syst.*, 9, (2022), 116-144.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Some generalizations of Darbo's fixed point under weak topology features with application to a functional integral equation

Communication Info

Authors:

Abdelmjid KHCHINE
Mohamed KHAZOU

*LMSC, Cadi Ayyad University
of Marrakech, Marrakech,
Morocco*

Abde

Keywords:

- (1) Fixed point theorem
- (2) Weak topology
- (3) Hammerstein integral equations
- (4) Measure of weak noncompactness.

Abstract

In this presentation, we provide some generalizations of Darbo's fixed point theorem for classes of contraction mappings in Banach spaces. The main assumptions of our results are formulated in terms of weak topology and an axiomatic definition of the measure of weak noncompactness. These results generalize and extend several well-known comparable results in the literature. The presented theoretical results are used to study the existence of solutions for a system of Hammerstein integral equations.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] D. O'Regan, Fixed point theory for weakly sequentially continuous mappings, *Math. Comput. Modelling*, Vol. 27, No. 5, (1998), 1-14.
- [2] A. Aghajani, R. Allahyari, M. Mursaleen, A generalization of Darbo's theorem with application to the solvability of systems of integral equations, *J. Comput. Appl. Math.*, 260(2014), 68-77.
- [3] M. Khazou and A. Khchine, Some generalizations of Darbo's fixed point under weak topology features with application to a functional integral equation, *soumis*.
- [4] H. İşik, S. Banaei, F. Golkarmanesh, V. Parvaneh, C. Park, M. Khorshidi. On new extensions of Darbo's fixed point theorem with applications, *Symmetry (Basel)*, 12(3), 2020.
- [5] J. Garcia-Falset, Existence of fixed points and measure of weak noncompactness, *Nonlinear Anal.*, 71 (2009), 2625-2633.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Best Proximity Point of Generalized $(F-\tau)$ - Proximal Non-Self Contractions in Generalized

Communication Info

Authors:

Adil BAIZ¹

Jamal MOULINE¹

¹LAMS, Hassan II University,
Casablanca,
Morocco

Keywords:

- (1) Fixed point
- (2) fixed point, generalized metric space,
- (3) contraction mapping

Abstract

La théorie du point fixe est l'un des outils les plus importants des mathématiques modernes. Elle occupe une place importante dans l'analyse non linéaire et dans de nombreuses disciplines mathématiques. Elle permet d'établir des théorèmes d'existence et d'unicité de solutions pour plusieurs problèmes non linéaires. En particulier, lorsqu'il s'agit de la résolution des équations fonctionnelles (équations différentielle équations matricielles, etc). On peut distinguer trois grandes approches en théorie du point fixe : l'approche métrique, l'approche topologique et l'approche discrète.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] A.Kari, H.Hammad, **A.Baiz, J.Mouline**, Best Proximity Point of Generalized $(F-\tau)$ -Proximal Non-Self Contractions in Generalized Metric Spaces; pap:853-861; (2022).
- [2] A. Kari, M. Rossafi, E. Marhrani, M. Aamri, New fixed-point theorems for $\theta-\varphi$ -contraction on complete rectangular b-metric spaces, Abstr. Appl. Anal. 2020 (2020), Article ID 8833214.
- [3] R.Zuhra, M.Noorani, F.Shaddad, Contraction mapping principle in partially ordered quasi metric space concerning to w-distances: Journal of Nonlinear Sciences and applications; pp:699-712; (2017):.
- [4]M. Rossafi, A. Kari, C. Park, J. R. Lee, New fixed-point theorems for $\theta-\varphi$ -contraction on b-metric spaces. J Math Comput SCI-JM. (2023); 29(1):12-27

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



A general fixed point theorem in random normed spaces and its applications

Communication Info

Authors:

Chaimaa BENZAROUALA¹
Janusz BRZDEK²
Lahbib OUBBI³

¹Laboratory LMSA, Team
GrAAF, Faculty of Sciences,
Rabat, Morocco.

²AGH University of Science and
Technology, Krakow, Poland

³Laboratory LMSA, team
GrAAF, Mohammed V-
University, Ecole Normale
Supérieure Takaddoum, Rabat,
Morocco

Keywords:

- (1) Fixed point
- (2) Function space
- (3) Random normed space
- (4) Ulam stability

Abstract

We prove a general fixed point theorem in the space of functions taking values in a random normed space (RN-space) and show several of its consequences. In fact, one of these consequences will be seen as the random normed space version of the fixed point theorem due to Brzdęk, Chudziak and Páles [2], other consequence will be an analogue of the classical Banach contraction principle in random normed spaces (somewhat generalized). Next, we present some applications of this general fixed point theorem in proving the Ulam stability of various functional equations in random normed spaces. This talk is based on the article [1].

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] C. Benzarouala, J. Brzdęk, L. Oubbi, A fixed point theorem and Ulam stability of a general linear functional equation in random normed spaces. *J. Fixed Point Theory Appl.* 25, 33 (2023). <https://doi.org/10.1007/s11784-022-01034-8>.
- [2] J. Brzdęk, J. Chudziak, Z. Páles, A fixed point approach to stability of functional equations. *Nonlinear Anal. Theory Methods Appl.* 74, 6728-6732 (2011).
- [3] Y. J. Cho, T. M. Rassias, R. Saadati, *Stability of Functional Equations in Random Normed Spaces*. Springer Optimization and Its Applications, vol. 86. Springer, Berlin (2013).
- [4] K. Menger, Statistical metrics. *Proc. Natl. Acad. Sci. USA* 28, 535-537 (1942).
- [5] A. N. Šerstnev, Random normed spaces: problems of completeness. *Kazan Gos. Univ. Učhen Zap.* 122, 3-20 (1962).
- [6] S. M. Ulam: *Problems in modern mathematics*. Chapter VI, Science Editions, Wiley, New York, 1940.



Classification of hyperspectral images with a convolutional neural network for land cover mapping

Communication Info

Authors:

Assia Nouna¹
Boujamaa Achchab¹
Mohamed Mansouri¹
Soumaya Nouna¹

¹Hassan First University
of Settat, ENSA Berrechid,
Laboratory LAMSAD,
Morocco.

Keywords:

(1) Deep Learning
(2) hyperspectral images
(3) Convolutional neural
network (CNN)

Abstract

Classifying hyperspectral images (HSI) is a crucial task with various applications in remote sensing. Recently, several approaches have been suggested, with CNN-based algorithms demonstrating superior performance [1]. However, these algorithms require significant computational resources and storage capacity. In this article, we utilize convolutional neural networks (CNNs)[2] for the classification of hyper-spectral images [3] using the spectral domain. Specifically, we have proposed a new CNN architecture to improve image classification. The proposed method has been shown through experimentation on various hyperspectral image data sets to outperform traditional methods, such as k-nearest neighbors (KNN) [4] and Support Vector Machines (SVMs) [5], as well as other methods based on deep learning, in terms of classification accuracy.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Li, Shutao, et al. "Deep learning for hyperspectral image classification: An overview." IEEE Transactions on Geoscience and Remote Sensing 57.9 (2019): 6690-6709.
- [2] Albawi, Saad, Tareq Abed Mohammed, and Saad Al-Zawi. "Understanding of a convolutional neural network." 2017 international conference on engineering and technology (ICET). Ieee, 2017.
- [3] Lv, Wenjing, and Xiaofei Wang. "Overview of hyperspectral image classification." Journal of Sensors 2020 (2020).
- [4] Huang, Kunshan, et al. "Spectral-spatial hyperspectral image classification based on KNN." Sensing and Imaging 17.1 (2016): 1-13..
- [5] Guo, Baofeng, et al. "Customizing kernel functions for SVM-based hyperspectral image classification." IEEE Transactions on Image Processing 17.4 (2008): 622-629.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



A Modular solution to bring transparency to the food supply chain by using public blockchain combined with IoT and machine learning

Communication Info

Authors:

Kamal ADDOU¹
Mohammed. Y. EL GHOUMARI ¹
Soufiane ARDCHIR¹
Mohammed AZZOUBAZI ¹

¹LTIM, Hassan II University of
Casablanca, Casablanca,
Morocco

Keywords:

- (1) Blockchain
- (2) IoT
- (3) Machine learning
- (4) Food supply chain
- (5) Transparency
- (6) Traceability

Abstract

The food supply chain is a complex network of multiple players interchanging three main components [2], Food, money and information, to track the movement of these three components [1], a new modular solution has been established. The solution enables to provide real-time data acquisition, monitoring, and storing on a tamper-proof public blockchain the main food supply chain movement, using smart contracts that are deployed on the Ethereum blockchain to allow every participant to transact securely with other FSC players [5], IoT networks are implemented in different workplaces to gather multiple data about food status without human involvement to ensure transparency and data integrity[4], machine learning models are established to ensure the correctness of the collected data and help drive decision making

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1]Kerschke-Risch, Pamela - The horse meat scandal: The unknown victims of economically motivated crime VL5
- [2] Pandey, Vivekanand and Pant, Millie and Snasel, Vaclav Blockchain technology in food supply chains: Review and bibliometric analysis
- [3]Valeri Natanelov , Shoufeng Cao , Marcus Foth , Uwe Dulleck Blockchain smart contracts for supply chain finance: Mapping the innovation potential in Australia-China beef supply chains.
- [4] Mustapha Hrouga , Abdelkader Sbihi , Marc Chavallard The potentials of combining Blockchain technology and Internet of Things for digital reverse supply chain: A case study
- [5] Francisco-Javier, Ferrández-Pastor, Jerónimo Mora-Pascual, Daniel Díaz-Lajara Agricultural traceability model based on IoT and Blockchain: Application in industrial hemp production

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Text Classification using Machine Learning in a Big Data environment, controlled with Fuzzy Logic

Communication Info

Authors:

CHAFI Soumia¹

KABIL Mustapha²

KAMOISS Abdessamad³

¹FSTM, Hassan II

University Mohammedia,
Morocco

²FSTM, Hassan II University
Mohammedia, Morocco

³FSTM, Hassan II University
Mohammedia, Morocco

Keywords:

(1) Apache Spark

(2) Classification de texte

(3) NLP

(4) Machine learning

(5) Fuzzy logic

Abstract

Today, we are witnessing an unprecedented digital revolution, characterized by an increase in the quantity of textual data produced and exchanged. For this reason, text processing and text classification became an important task in the field of natural language processing.

Several techniques have come together to improve the quality of this processing, such as machine learning, NLP, distributed Big Data systems, fuzzy logic....

In this work we propose an automatic system for classification of the text extracted from CVs in the context of e-recruitment using the classifier of the KNN machine learning algorithm, this system will be deployed in a distributed environment based on Apache Spark and Hadoop Distributed File System (HDFS), and controlled by a fuzzy logic system, in order to optimize the time and quality of the processing carried out, in order to perform automatic candidate profiling.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] F. Masulli and S. Rovetta, The Challenges of Big Data and the contribution of fuzzy logic, Springer Nature Switzerland AG 2019. https://doi.org/10.1007/978-3-030-12544-8_25
- [2] J.-Yi Jiang, R.-Jia Liou, and S.-Jue Lee, A Fuzzy Self-Constructing Feature Clustering Algorithm for Text Classification, IEEE TRANSACTIONS ON KNOWLEDGE AND DATA ENGINEERING, VOL. 23, NO. 3, MARCH 2011
- [3] K. George, Sidiropoulos, N. Diamianos, D. Kyriakos, Apostolidis et G. A. Papakostas, Classification de texte à l'aide de mesures d'ensembles flous intuitionnistes - Un Étude d'évaluation, informations MDPI, May 2022, doi.org/10.3390/info13050235
- [4] H. Liu, P. Burnap, W. Alorainy and L. M. Williams, A Fuzzy Approach to Text Classification with Two Stage Training for Ambiguous Instances
- [5] A. Alsirhani, S. Sampalli and P. Bodorik, DDoS Detection System: Using a Set of Classification Algorithms Controlled by Fuzzy Logic System in Apache Spark, IEEE TRANSACTIONS ON NETWORK AND SERVICE MANAGEMENT, 2019, DOI 10.1109/TNSM.2019.2929425
- [6] Sourav, M., Pranay, L., & Tanuja, S. Resume Parsing And Processing Using Hadoop. International Engineering Research Journal (IERJ), Volume 2 Issue 7 Page 2391-2393, 2017 ISSN 2395-1621.
- [7] Papiya, D., Manjusha, P., & Siddharth, S. R. (2018). A CV Parser Model using Entity Extraction Process and Big Data Tools. International Journal of Information Technology and Computer Science 10(9):21-31.
- [8] Pradeep, K. R., Sarabjeet, S. C., & Rocky, B. (2020). A Machine Learning approach for automation of Resume Recommendation system. Procedia Computer Science 167 (2020) 2318-2327.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Parameters estimation and simulation of a two-group epidemiological model using physics-informed neural networks (PINNs)

Communication Info

Authors:

K. IDHAMMOU OUYOUSSEF¹
M. BENMIR¹
R. ABOULAICH¹
L. MATAR TINE²
J. EL KARKRI¹

¹ Department of Modeling and Computer Science, LERMA Laboratory, Mohammed V University in Rabat, Morocco.

² Université Lyon 1 (UCBL), UMR5208 Institut Camille Jordan.

Keywords:

- (1) Neural network
- (2) physics-informed neural networks (PINNs)
- (3) Covid-19 modeling
- (4) Two group epidemic model

Abstract

The course of an epidemic can often be successfully described mathematically using compartmental models. These models are generally governed by systems of ordinary, partial, and delay differential equations. In the present paper, and after estimating epidemiological parameters values from real data using physics-informed neural networks (PINNs). We study, simulate, and analyze the asymptotic behavior of the two-group epidemiological model governed by a system of ordinary differential equations. To estimate parameters, such as the transmission rate, the compound loss function is minimized by respecting both the neural network's inherent parameters and the unknown parameters. The method will be tested on real Covid-19 case data. We compare the performances of different Physics-informed neural networks architectures and discuss the obtained results in the conclusion section.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] V. Grimm, A. Henlein, A. Klawonn, M. Lanser and J. Webe, Estimating the time-dependent contact rate of SIR and SEIR models in mathematical epidemiology using physics-informed neural networks, 2022.
- [2] M. Raissi, P. Perdikaris and G.E. Karniadakis, Physics-Informed Neural Networks: A Deep Learning Framework for Solving Forward and Inverse Problems Involving Nonlinear Partial Differential Equations
- [3] Sebastian Anița, Malay Banerjee, Samiran Ghosh, Vitaly Volpert, Vaccination in a two-group epidemic model, Applied Mathematics Letters, ELSEVIER, 2021
- [4] Raissi, Maziar and Perdikaris, Paris and Karniadakis, George E, A Novel Physics Informed Deep Learning Method for Simulation-Based Modelling, AIAA Scitech, 2021.
- [5] Yadav, Neha and Yadav, Anupam and Kumar, Manoj and others, An introduction to neural network methods for differential equations, Springer, edition, 2015.
- [6] Mohamed Anass El Yamani, Jaafar El Karkrit, Saiida Lazaar, and Rajae Aboulaich, A two-group epidemiological model: stability analysis and numerical simulation using neural networks, (2022), pp,1-16.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Application of Machine Learning to Sentiment Analysis

Communication Info

Authors:

Oumaima BELLAR¹
Amine BAINA²
Mostafa BELLAFKIH³

¹RAISS Team, STRS Lab,
National Institute of Posts and
Telecommunications INPT
Rabat, Morocco

²RAISS Team, STRS Lab,
National Institute of Posts and
Telecommunications INPT
Rabat, Morocco

³RAISS Team, STRS Lab,
National Institute of Posts and
Telecommunications INPT
Rabat, Morocco

Keywords:

- (1) Sentiment Analysis
- (2) Natural Language Processing (NLP)
- (3) Machine Learning

Abstract

Sentiment analysis is part of text mining, this analytical technique consists of extracting the meaning of numerous textual sources, such as survey responses, online reviews or comments on social networks [2]. Sentiment analysis can be performed using a lexical approach, a machine learning-based approach or a hybrid approach [1]. The lexicon-based approach faces a drawback that the strength of the sentiment classification depends on the size of the lexicon (dictionary) [1]. As the size of the lexicon increases, this approach becomes more erroneous and time-consuming [3]. This document explains the different steps to perform sentiment analysis on data using Machine Learning algorithms [5]. A Machine Learning Classifier requires a labeled dataset that is divided into which is divided into training set and test set [4]. So, the next step is to perform pre-processing of the data using NLP based techniques, followed by a feature extraction method followed by a feature extraction method to extract relevant features [5].

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Munir Ahmad, Shabib Aftab, Syed Shah Muhammad, Sarfraz Ahmad, Machine Learning Techniques for Sentiment Analysis: A Review, International Journal of Multi- Sciences and Engineering, 2017.
- [2] Suchita V Wawre, Sachin N Deshmukh, Sentiment Classification using Machine Learning Techniques, International Journal of Science and Research (IJSR), 2016.
- [3] Ali Hasan, Sana Moin, Ahmad Karim, Shahaboddin Shamsirband, Machine Learning-Based Sentiment Analysis for Twitter Account, MDPI, 2018.
- [4] Walaa Medhat, Ahmed Hassan, Hoda Korashy, Sentiment analysis algorithms and applications: A Survey, Ain Shams Engineering Journal, 2014.
- [5] Anuja P.Jain, Asst. Prof Padma Dandannavar, Application of Machine Learning Techniques to Sentiment Analysis, 2nd International Conference on Applied and Theoretical Computing and Communication Technology (iCATccT), 2016.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



The most important scientific learning skill justified by artificial intelligence

Communication Info

Authors:

Okacha DIYER^{1,2}
Naceur ACHTAICH²
Khalid NAJIB³

¹Training Center for Education
Inspectors, Rabat, Morocco

²LAMS, Hassan II University of
Casablanca, Casablanca,
Morocco

³Superior National School of
Mines

Keywords:

- (1) Scientific skills assessment
- (2) Artificial intelligence
- (3) Decision tree
- (4) Innovative learning

Abstract

The objective of developing scientific skills is to make learners acquire attitudes of reflection and behavior in the face of the different scientific pedagogical and didactic situations. Several researchers have focused on the importance of these enriched scientific skills, namely C₁: Appropriate, C₂: Analyze and reason, C₃: Achieve, C₄: Validate and C₅: Communicate, see [1-4]. The work presented in [5] assumed that all these skills have the same impact on the overall acquisition of science subjects. In our work, we were interested in extending the work [5], using artificial intelligence based on the decision tree by implementing a program in Python. This research aims to detect the most predominant scientific competence for the scientific subjects acquisition and which leads to the birth of ideas. Therefore, the teacher should give more importance to improving this skill.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] S. Ceylan, S. A. Zeynep and A. K. Seyit, STEM Skills in the 21st Century Education. Research Highlights in STEM Education, ISRES Publishing, (2018) 81-101
- [2] S. Harshvardhan, Skill Based Education System in Meeting Employer's Needs. Ind. J. App. Res. 4, 12, (2014).
- [3] B. O. Ogunlade, L. K. Bello, Pre-Service Teachers' Perceived Relevance of Educational Technology Course, Digital Performance: Teacher Perceived of Educational Technology, Int. J. Tech. En. Stud. Supp. Ser, (2019) 41-54.
- [4] O. Diyer, N. Achtaich and K. Najib, An Intelligent Strategy for Developing Scientific Learning Skills, Advances in Science, Technology & Innovation, (Eds): Emerging Trends in ICT for Sustainable Development. 978-3-030-53439-4, 496016-1-En, (2021) 29-36
- [5] O. Diyer, N. Achtaich and K. Najib, Assessment of Scientific Learning Skills Based on Artificial Intelligence, 2022 2nd Inter. Conf. on Innov. Res. in Appl. Sc., Eng. and Tech. (IRASET), (2022) 1-5.



Toward an efficient emotion recognition from facial expressions using ML

Communication Info

Authors:

Hmad ZENNOU¹
Mohamed OUHDA²
Mohamed BASLAM³

¹ IPDSL, Sultan Moulay Slimane University, Beni Mellal, Morocco

² IPDSL, Sultan Moulay Slimane University, Beni Mellal, Morocco

³ IPDSL, Sultan Moulay Slimane University, Beni Mellal, Morocco

Keywords:

- (1) facial expressions
- (2) emotions recognition
- (3) deep learning
- (4) LSTM

Abstract

This paper studies the use of machine learning algorithms to recognize emotions in image sequences of facial expressions. It compares state-of-the-art algorithms for handling spatiotemporal data and proposes a new architecture called Spatio-Temporal Convolutional Features with nested LSTMs. This architecture uses 3D CNN to extract spatiotemporal features from image sequences and combines the dynamics of facial expressions using nested LSTMs (Temp-LSTM and Conv-LSTM). The proposed architecture was designed to learn multi-level appearance features and temporal dynamics of facial expressions in a unified way. The method was tested on two benchmark databases and demonstrated improved performance compared to the current state-of-the-art algorithms. Experiments were conducted on two benchmark databases, Oulu-CASIA, and, SASE-FE and the results showed that the proposed method achieved better performance than the expanded versions of CNN, 3D CNN, and Recurrent methods.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] M. G. Calvo and D. Lundqvist. Facial expressions of emotion (KDEF): Identification under different display-duration conditions. Behavior Research Methods, 2008.
- [2] T. Hassner, S. Harel, E. Paz, and R. Enbar. Effective Face Frontalization in Unconstrained Images.
- [3] D. Tran, L. Bourdev, R. Fergus, L. Torresani, and M. Paluri. Learning spatiotemporal features with 3D convolutional networks. In Proceedings of the IEEE International Conference on Computer Vision, 2015.
- [4] Y. Jia, E. Shelhamer, J. Donahue, S. Karayev, J. Long, R. Girshick, S. Guadarrama, and T. Darrell. Caffe: Convolutional Architecture for Fast Feature Embedding.
- [5] N. Neverova, C. Wolf, G. Taylor, and F. Nebout. ModDrop: Adaptive multi-modal gesture recognition. IEEE Transactions on Pattern Analysis and Machine Intelligence, 2016.



A Hybrid Approach for Supplier Selection and Performance Evaluation

Communication Info

Authors:

Marouane EL ABBASSI ¹
Karim RHOFIR ²
MASSOUR EL AOUD Mohamed ³

^{1 2 3}LaSTI Laboratory, National
School of Applied Sciences
Sultan Moulay Slimane University
Khouribga,
Morocco.

Keywords:

- (1) Supplier evaluation
- (2) FAHP
- (3) Multi-criteria decision-making.
- (4) TOPSIS

Abstract

This paper proposes a new two-step method for supplier selection and performance evaluation. At the first stage, the FAHP (Fuzzy Analytical Hierarchy Process) is used for qualitative performance evaluation to find standard weights for criteria, and then suppliers are ranked using the TOPSIS method at the second step. This approach considers both qualitative and quantitative variables in evaluating supplier performance, which is a multi-criteria decision problem involving various factors such as price, quality, delivery, and service. The new method aims to improve the quality of supplier selection and evaluation, and is supported by previous studies and research in the field, as evidenced by references [1-6]. The literature review covers various MCDM/MADM methods, sustainable energy management, decision making techniques, green supplier selection, and supplier evaluation in fuzzy environments.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Edmundas Kazimieras Zavadskas, Zenonas Turskis, Simona Kildienė, "State of art surveys of overviews on MCDM/MADM methods", Technological and Economic Development of Economy, Volume 20, 2014 - Issue 1, 2022
- [2] Elanur Adar, Buket Karatop, Mahir Ince, Mehmet Sinan Bilgili, "Comparison of methods for sustainable energy management with sewage sludge in Turkey based on SWOT-FAHP analysis", Volume 62, September 2016, Pages 429-440
- [3] A. M. All and J. Terms, "to Make a Decision : The Analytic," vol. 24, no. 6, pp. 19-43, 2014.
- [4] Mobasshira Zaman, "Supplier Selection Using AHP-VIKOR and AHP-TOPSIS Method: a Case Study for Bangladeshi Jute Mill of Khulna, The International Journal of Industrial Engineering: Theory, Applications and Practice 7(01):1-11, Region" January 2020, DOI:10.14445/23499362/IJIE-V7I1P101
- [5] Abbas Mardani, Edmundas Kazimieras Zavadskas, Kannan Govindan, Aslan Amat Senin, Ahmad Jusoh, VIKOR Technique, "A Systematic Review of the State of the Art Literature on Methodologies and Applications", Sustainability 2016, 8, 37; doi:10.3390/su8010037, 4 January 2016

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Towards an approach to the development and democratization of MOOCs via artificial intelligence in higher education in Morocco.

Communication Info

Authors:

Ismail NANOUI¹
Bouchaib RIYAMI²
Mohamed AZOUAZZI¹
EL Houssine LABRIJI¹

¹LTIM, Ben M'sik Faculty of
Science, Hassan II University of
Casablanca, Casablanca,
Morocco

²Institut supérieur de Génie
Appliqué, Hassan II University
of Casablanca, Casablanca,
Morocco

Keywords:

- (1) IA
- (2) MOOC
- (3) Learner Modeling
- (4) Evaluation
- (5) Higher Education

Abstract

In the last few years, millions of learners have been able to follow thousands of courses in the form of high quality MOOCs. However, this thirst and need for lifelong learning generates an immense amount of data and information, which, if exploited, could allow for a better exploitation and production of new MOOCs that are even more adapted and efficient. We could thus hope to democratize learning through MOOCs and reach populations that do not have access to higher education. Nevertheless, the demand would exceed the supply. Today, Artificial Intelligence (AI) is the solution to properly exploit this "Big Data" and meet this increased demand. The question is then: "How can AI and its tools contribute to a better understanding of the MOOC ecosystem and how can they help improve it? Our contribution is to model the learner in order to improve learning through automatic assessment via AI tools.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] I. Nanou, H. Akhasbi, B. Riyami, & E. H. Labriji.. Virtualization of Data to Improve Pedagogical Approaches the Case of Higher Education in Morocco in the Face of the COVID-19 Pandemic. In CSEDU (2) (pp. 606-613) (2022).
- [2] M. Romero, L. Heiser, A. Lepage. Enjeux de la formation à l'IA. Enjeux éducatifs à l'ère de l'intelligence artificielle, Association Institut Européen IA; Maison de l'Intelligence Artificielle, Sophia Antipolis, France (2022).
- [3] Galindo, Luis, R. Canopé, and A. Lepage. IA et éducation. (2021).
- [4] S. Lalmuanawma, J. Hussain, et L. Chhakchuak. Applications of machine learning and artificial intelligence for Covid-19 (SARS-CoV-2) pandemic: A review. Chaos, Solitons & Fractals, 2020, vol. 139, p. 110059.
- [5] V. Nourani, Ö. Kisi, & M. Komasi. Two hybrid artificial intelligence approaches for modeling rainfall-runoff process. Journal of Hydrology, (2011), 402(1-2), 41-59.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Artificial Intelligence tool for Third molar angulation measurements, to predict extraction difficulty.

Communication Info

Authors:

Zakariae SAIDI¹
Sofia DOUDA¹

¹, University Hassan I, Faculty of Science and Technology of Settat Morocco

Keywords:

- (1) Third molar
- (2) Convolutional neural network
- (3) Dental panoramic images
- (4) Segmentation
- (5) Principal component analysis

Abstract

The goal of this work is to create a fully automated tool that uses artificial intelligence to determine the orientation of mandibular third molar teeth from dental panoramic images [1], and then predict the extraction difficulty. The Dataset used in this study, contains 543 panoramic images, grouped into 8 categories [2]. The molar segmentation maps were jointly predicted by a fully convolutional neural network with a framework for real-time instance segmentation [3]. The orientation of molars was then predicted using segmentation results and Principal component analysis [4]. Network angle measurements classify molars into three class horizontal, vertical, and inclined [5]. This tool provides dental specialists with a new way to make informed decisions. In conclusion we developed the first fully automated system based on machine learning and computer vision capable of detecting, segmenting and calculating the angulation of mandibular third molar, from 2D panoramic images, destined to dental specialist to help them in decision making.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Vranckx M, Van Gerven A, Willems H, Vandemeulebroucke A, Ferreira Leite A, Politis C, Jacobs R. Artificial Intelligence (AI)-Driven Molar Angulation Measurements to Predict Third Molar Eruption on Panoramic Radiographs. *Int J Environ Res Public Health*. 2020 May 25
- [2] B. Silva, L. Pinheiro, L. Oliveira, and M. Pithon, "A study on tooth segmentation and numbering using end-to-end deep neural networks," in *Conference on Graphics, Patterns and Images*. IEEE, 2020.
- [3] Daniel Bolya and Chong Zhou and Fanyi Xiao and Yong Jae Lee. YOLACT++: Better Real-time Instance Segmentation. *IEEE*, 2020.
- [4] M. Mudrová, A. Procházka, PRINCIPAL COMPONENT ANALYSI IN IMAGE PROCESSING. *Developers Corner*, 2021.
- [5] Juodzbalys G, Daugela P. Mandibular third molar impaction: review of literature and a proposal of a classification. *J Oral Maxillofac Res*. 2013 Jul.



Numerical modeling of the seakeeping of floating structures

Communication Info

Authors:

Sara CHAGDALI¹
Hassan BEL ARABI¹
Mustapha RACHIK¹

¹ LAMS, Hassan II University of Casablanca, Morocco.

Keywords:

- (1) Numerical modeling
- (2) Seakeeping
- (3) Hydrodynamics
- (4) Fluid/structure interaction

Abstract

The seakeeping refers to the determination of the movements of a floating structure subjected to an incident wave [1]. In general, it consists of studying the coupling between hydrodynamic stresses and movements of the structure [2, 3]. This, by using the continuity at the fluid/structure interface to solve simultaneously the hydrodynamic and the mechanical problems.

In order to evaluate the dynamic response of the floating structure and the induced forces, consideration is given to reflection, refraction and diffraction [6-9]. The theoretical and numerical aspects are presented in this communication. The numerical computational method used is based on the integral boundary equations [4,5].

The results obtained by the numerical method implemented are compared to a hydrodynamic calculation note from the literature.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] J. Bougis, Tenue à la mer des structures, Cours Institut des sciences de l'ingénieur de Toulon et du var, Université de Toulon et du Var, 2015.
- [2] Hydrodynamique marine et navale, thèse de doctorat, Université de Casablanca, 2006.
- [3] B. Molin, Tenue du navire en mer ouverte, Septièmes journées scientifiques et techniques CETMEF, 2008.
- [4] P. K. Banerjee. The Boundary Element Methods in Engineering. McGraw-Hill College, 1994.
- [5] A. Babarit, BEM Solver Nemoh, Ecole Centrale de Nantes, CNRS, 2016.
- [6] Xiaofei Cheng, Chang Liu, Qilong Zhang, Ming He, and Xifeng Gao, Numerical Study on the Hydrodynamic Characteristics of a Double-Row Floating Breakwater Composed of a Pontoon and an Airbag J. Mar. Sci. Eng. 2021. <https://doi.org/10.3390/jmse9090983>.
- [7] J. Dai, C.M. Wang, T. Utsunomiya, W. Duan, Review of recent research and developments on floating breakwaters. Ocean Eng, 2018.
- [8] E. Delavari, E., Gharabaghi, A.R.M., Simulating regular wave effects on a pile-moored floating breakwater using a modified WCSPH method. J. Waterw. Port Coast. Ocean Eng. 2017.
- [9] H. Zhang, B. Zhou, C. Vogel, R. Willden, J. Zang, L. Zhang, Hydrodynamic performance of a floating breakwater as an oscillating-buoy type wave energy converter. Applied Energy, Volume 257, 2020

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



E-government Interoperability and Data Standardization

Communication Info

Authors:

Naziha LAAZ¹

Hanane BENADDI²

¹ASYR RT, LAGES Laboratory,
Department of Mathematics,
Computer Science and Geomatics
Hassania School of Public Works
EHTP Casablanca, Morocco

²Partial Differential Equations,
Spectral Algebra and Geometry
Laboratory, Department of
Information Modelling and
Communication Systems
University Ibn Tofail, Kenitra,
Morocco

Keywords:

(1) Data standardization

(2) Semantic interoperability

(3) Technical interoperability

Abstract

Despite the relevance of data standardization, there is a little application of such standardization in governments [1]. E-government interoperability involves sharing public data across different ministries and governmental entities in several layers [2]. Data standardization and E-government interoperability are critical for smarter public e-services delivery.

In this paper, we focus on two levels of government interoperability, semantic and technical. Semantic interoperability refers to the ability to access and interpret data by different entities [3]. Technical interoperability deals with the interconnectivity of information technologies and communication infrastructures [4]. Combining the two aspects helps ensuring data standardization, streamlining public e-services processes and improving their maturity level.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

[1] M. Gal et D. L. Rubinfeld, « Data Standardization », *SSRN Journal*, 2018.

[2] H. Benaddi, N. Laaz, A. Bouhlal, et E. El Kettani, « Data storage architecture for e-government interoperability: Morocco case », *IJEECS*, vol. 29, n° 3, p. 1678, mars 2023.

[3] S. D. Nagowah, H. Ben Sta, et B. A. Gobin-Rahimbux, « An Overview of Semantic Interoperability Ontologies and Frameworks for IoT », in *2018 Sixth International Conference on Enterprise Systems (ES)*, Limassol, oct. 2018, p. 82-89.

[4] D. Er Riyanto, P. Wisnu Wirawan, et K. Kurniawan, « E-Government Interoperability: Architecture Model for Public Information Services of Sub-District Governments », *MATEC Web Conf.*, vol. 218, p. 03008, 2018.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Use of genetic algorithms in convolutional neural networks to brain tumor image

Communication Info

Authors:

Sofia EL AMOURY¹
Abdelillah DAFRANE¹
Noussaima EL KHATTABI²
Youssef FAKHRI³

¹ENIC, Hassan I University,
Settat, Morocco

²LCS, University Mohammed V,
Rabat, Morocco

³RI, Ibn Tofail University,
Kenitra, Morocco

Keywords:

- (1) CNN
- (2) Classification
- (3) Genetic algorithm
- (4) Image cerebral
- (5) Brain tumor detection

Abstract

In this work, we classified brain images by convolutional neural networks (CNN) [1-4] to detect brain tumors. A certain number of hyper-parameters (the number of filters per layer, the size of the filters, the activation function, etc.) must be set to execute a CNN. In order to bypass the trial and error method of determining the values of these hyper-parameters, we used genetic algorithms (GA) [5]. The GA was adapted in order to generate the optimal values of the hyper-parameters thus allowing to obtain a better precision of the CNN model.

The tests were carried out on a dataset comprising 7063 brain images divided into four classes. The GA allowed us to obtain an accuracy of more than 98% with only a small number of generations and a small population size.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] M. Aamir, Z. Rahman, Z. A. Dayo, W. A. Abro, M. I. Uddin, I. Khan, A. S. Imran, Z. Ali, M. Ishfaq, Y. Guan, Z. Hu, A deep learning approach for brain tumor classification using MRI images, *Computers and Electrical Engineering*, 101 (2022) 108105.
- [2] M. Nazir, S. Shakil, K. Khurshid, Role of deep learning in brain tumor detection and classification, (2015 to 2020): A review, *Computerized Medical Imaging and Graphics*, 91 (2021) 101940.
- [3] A. Çinar, M. Yildirim, Detection of tumors on brain MRI images using the hybrid convolutional neural network architecture, *Medical Hypotheses*, 139 (2020) 109684.
- [4] J. Bernal, K. Kushibar, D. S. Asfaw, S. Valverde, A. Oliver, R. Martí, X. Llado, Deep convolutional neural networks for brain image analysis on magnetic resonance imaging, *Artificial Intelligence in Medicine*, 95 (2019) 64-81.
- [5] D. E. Goldberg, *Genetic algorithms in search, optimization, and machine learning*. Addison-Wesley, Boston, 1989.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Analytical model for task offloading in a fog computing system with vacation interruption, breakdown and repair process

Communication Info

Authors:

Hibat Eallah Mohtadi¹
Mohamed Hanini¹
Abdelkrim Haqiq¹

¹Hassan First University of
Settat, Faculty of Sciences and
Techniques, Computer,
Networks, Mobility and
Modeling laboratory: IR2M,
26000 - Settat, Morocco

Keywords:

- (1) Fog computing
- (2) queuing theory
- (3) performance modelling
- (4) QoS
- (5) Vacation
- (6) Breakdowns

Abstract

Fog computing was developed to expand cloud computing's computation, storage, and networking capabilities to the network's edge, therefore reducing latency and improving the quality of service [1]. In fact, it produces a little cloud at the network's edge by utilizing a huge number of community and geo-distributed network equipment called as Fog Nodes (FN), such as routers, switches, and access points [2]. Fog computing raises concerns about offloading tasks for remote processing, such as the loss of a node in a computer network, whether due to unforeseeable causes such as system failure, breakdowns, or scheduled outages such as vacations taken by the fog node[3]. These concerns can result in reduced computer network performance in a fog environment or loss of redundancy [4]. This work provides an analytical model based on queuing theory for investigating the quality of service in a fog computing network where the fog nodes could break down or go on vacation [5].

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Kumari, N., Yadav, A., Jana, P.K.: Task offloading in fog computing: A survey of algorithms and optimization techniques. *Computer Networks* 214, 109137 (2022)
- [2] Xie, J., Jia, Y., Chen, Z., Nan, Z., Liang, L.: Efficient task completion for parallel offloading in vehicular fog computing. *China Communications* 16(11), 42–55 (2019)
- [3] Wu, Q., Ge, H., Liu, H., Fan, Q., Li, Z., Wang, Z.: A task offloading scheme in vehicular fog and cloud computing system. *IEEE Access* 8, 1173–1184 (2019)
- [4] Hamdi, A.M.A., Hussain, F.K., Hussain, O.K.: Task offloading in vehicular fog computing: State-of-the-art and open issues. *Future Generation Computer Systems* (2022)
- [5] Vemireddy, S., Rout, R.R.: Fuzzy reinforcement learning for energy efficient task offloading in vehicular fog computing. *Computer Networks* 199, 108463 (2021)

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Smart Farming Connectivity: A Comparative Study of IoT Networking Solutions

Communication Info

Authors:

Mohamed DOUBIZ¹
Mouad BANANE¹
Abdelali ZAKRANI²
Allae ERRAISSI³

¹ LAICSE, ENSAM, Hassan II University,
Casablanca, Morocco

² dept of Industrial Engineering
ENSAM, Hassan II University
Casablanca, Morocco

³ Chouaib Doukkali University,
Polydisciplinary Faculty of Sidi
Bennour, El Jadida, Morocco

Keywords:

- (1) Internet of Things
- (2) connectivity protocol
- (3) smart farms

Abstract

Increasing global food demand requires an improvement in the efficiency and productivity of food production [1]. The Internet of Things (IoT) can help to achieve this goal by allowing smart farms to collect and analyze real-time data on weather and growth conditions through IoT connectivity [2]. This connectivity, based on specialized communication protocols and using various data transmission technologies such as Wi-Fi, Bluetooth, Zigbee, Z-Wave, and 4G LTE [3], allows objects to connect to the Internet and share data with each other without human intervention [4]. However, there are many different IoT connectivity protocols available on the market, each with its own advantages and disadvantages to consider [5]. In this article, we will compare the different IoT connectivity technologies for smart farms based on their range, data transmission speed, cost, power consumption, and security. Ultimately, our goal is to provide farmers with the tools they need to make an informed decision about the best IoT connectivity protocol for their smart farm

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] 'L'avenir de l'alimentation et de l'agriculture - Parcours alternatifs d'ici à 2050 | Etudes prospectives mondiales | Organisation des Nations Unies pour l'alimentation et l'agriculture'. Accessed: Sep. 30, 2022. [Online]. Available: <https://www.fao.org/global-perspectives-studies/resources/detail/fr/c/1169748/>
- [2] C. Yoon, M. Huh, S.-G. Kang, J. Park, and C. Lee, 'Implement smart farm with IoT technology', in 2018 20th International Conference on Advanced Communication Technology (ICACT), Feb. 2018, pp. 749-752. doi: 10.23919/ICACT.2018.8323908.
- [3] R. K. Kodali, S. Yerroju, and S. Sahu, 'Smart farm monitoring using LoRa enabled IoT', in 2018 second international conference on green computing and internet of things (ICGCIoT), 2018, pp. 391-394.
- [4] P. K. Dutta and S. Mitra, 'Application of agricultural drones and IoT to understand food supply chain during post COVID-19', *Agric. Inform. Autom. Using IoT Mach. Learn.*, pp. 67-87, 2021.
- [5] W. Xu, Z. Zhang, H. Wang, Y. Yi, and Y. Zhang, 'Optimization of monitoring network system for Eco safety on Internet of Things platform and environmental food supply chain', *Comput. Commun.*, vol. 151, pp. 320-330, Feb. 2020, doi: 10.1016/j.comcom.2019.12.033.



Trajectory Planning Applied to the Palmer Harvesting System

Communication Info

Authors:

Lhoussaine AIT BEN MOUH
Mohamed BASLAM
Mohamed OUHDA

³LTIAD, Moulay Slimane
University, Beni Mellal,
Morocco

Keywords:

- (1) Trajectory Planning
- (2) Mobile Robot
- (3) Path Planning
- (4) Unmanned Aerial Vehicle
- (5) Heuristic
- (6) Artificial Intelligence
- (7) Harvesting System
- (8) Autonomous Vehicle

Abstract

This work is a part of trajectory planning [1] applied to the Palmer Harvesting System. It is so important to study path and trajectory planning methods before trying to implement any consistent harvesting system, as they are considered the input for the robot manipulator. Large search work is done in the path and trajectory planning for mobile robots [2], and many methods are studied to achieve the best results in terms of cost mobility, energy consumption, and gain optimization. This work studies some path-planning methods [3] and tries to figure out their capabilities and possible limits. It is also possible to categorize it using mathematical-based methods, heuristics, or artificial intelligence approaches [4]. The effectiveness of the approach can be measured by its ability to deal with a complex environment with minimum computing capacity and obstacle avoidance, which can be static or dynamic according to the application domain. A new approach to this NP(nondeterministic polynomial) problem is needed, especially in an uncertain environment where security is a must. Since a wide range of application domains, like mobile robots, unmanned aerial vehicles [5], autonomous cars, and manufacturing robots, require high efficiency and a real-time path planner to achieve the task in the best manner, Through this overview, we try to give a clear classification and figure out the limitations of different approaches after implementation using testing data and the Python programming language.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] M. Asim, W. K. Mashwani, H. Shah, and S. B. Belhaouari, "An evolutionary trajectory planning algorithm for multi-UAV-assisted MEC system," *Soft Comput.*, vol. 26, no. 16, pp. 7479–7492, 2022.
- [2] L. Antonyshyn, J. Silveira, S. Givigi, and J. Marshall, "Multiple Mobile Robot Task and Motion Planning: A Survey," *ACM Comput. Surv. CSUR*, 2022.
- [3] M. R. Jones, S. Djahel, and K. Welsh, "Path-planning for unmanned aerial vehicles with environment complexity considerations: A survey," *ACM Comput. Surv.*, 2022.
- [4] V. N. Sichkar, "Reinforcement learning algorithms in global path planning for mobile robot," presented at the 2019 International Conference on Industrial Engineering, Applications and Manufacturing (ICIEAM), 2019, pp. 1–5.
- [5] J. Yuan *et al.*, "Global Optimization of UAV Area Coverage Path Planning Based on Good Point Set and Genetic Algorithm," *Aerospace*, vol. 9, no. 2, p. 86, 2022.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Traffic congestion multilevel classification using deep learning

Communication Info

Authors:

Ayoub ESSWIDI¹
Soufiane ARDCHIR²
Abderrahmane DAIF¹
Mohamed AZOUAZI¹

¹LTIM, Hassan II University of
Casablanca, Casablanca,
Morocco

²ENCG, Hassan II University of
Casablanca, Casablanca,
Morocco

Keywords:

- (1) Traffic congestion
- (2) Traffic jam
- (3) Deep Learning
- (4) Image classification

Abstract

Reducing traffic congestion is the main task to manage roads. Several approaches have addressed the problem based on different types of data, one of the performance types is GPS information [1][2] of drivers and pedestrians. Despite this, the last approach raises the problem of the confidentiality of individuals. Providing the status of roads for drivers could contribute to reducing traffic congestion. To this end, Deep Learning [3] based on images demonstrated its performance for such problems. In this work, an approach named TraJamNet is proposed to classify roads into five levels of congestion, it is a convolutional neural network [4] improved by parameters referring to the road points, such as time of the day, day of the week, road conditions, and so on. This approach is approved by building a model on a dataset known as UA-DETRAC [5] which contains 140k frames from different locations in Beijing and Tianjin, China. The results of the experiments proved the performance of TraJamNet, which achieved an accuracy of 0.92 and a loss of 0.18 for the test. Such a model could be improved and installed in cameras fixed on roads.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] E. D'Andrea and F. Marcelloni, "Detection of traffic congestion and incidents from GPS trace analysis," *Expert Systems with Applications*, vol. 73, pp. 43–56, May 2017, doi: 10.1016/j.eswa.2016.12.018.
- [2] Z. Wang, M. Lu, X. Yuan, J. Zhang, and H. Van De Wetering, "Visual Traffic Jam Analysis Based on Trajectory Data," *IEEE Transactions on Visualization and Computer Graphics*, vol. 19, no. 12, pp. 2159–2168, Dec. 2013, doi: 10.1109/TVCG.2013.228.
- [3] Y. LeCun, Y. Bengio, and G. Hinton, "Deep learning," *Nature*, vol. 521, no. 7553, Art. no. 7553, May 2015, doi: 10.1038/nature14539.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Data Analytics in insurance industry: challenges and opportunities

Communication Info

Authors:

Ichrak SAIF¹
Soufiane ARDCHIR²
Mohamed Yassine El
GHOUMARI³
Soumya OUNACER⁴
Mohamed AZZOUAZI⁵

^{1,4,5}LTIM, Faculty of Ben M'sik,
Hassan II University,
Casablanca, Casablanca,
Morocco

^{2,3}National School of Business
and Management, Casablanca,
Morocco

Keywords:

- (1) Data Analytics
- (2) Insurance
- (3) Big Data

Abstract

The insurance industry has undergone a significant transformation in recent years with the integration of data analytics into its processes. This paper provides an overview of the current state and application of data analytics in the insurance industry. We discuss the various types of data that insurance companies collect and analyze, including demographic data, customer behavior data, and claims data. We also explore the use of predictive modeling, machine learning, and artificial intelligence in areas such as underwriting, fraud detection, and customer segmentation. The paper also examines the challenges faced by the insurance industry in adopting data analytics and the potential benefits it brings, including improved risk assessment, better decision-making, and enhanced customer experiences. The paper concludes by presenting future trends and directions for the continued growth and development of data analytics in the insurance industry.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] R. D. Burri, R. Burri, R. R. Bojja and S. R. Buruga, "Insurance Claim Analysis using Machine Learning Algorithms", International Journal of Innovative Technology and Exploring Engineering Special Issue, vol. 8, no. 6, pp. 577-582, 2019.
- [2] N. Boodhun and M. Jayabalan, "Risk prediction in life insurance industry using supervised learning algorithms", Complex & Intelligent Systems, vol. 4, no. 2, pp. 145-154, 2018.
- [3] B. Kajwang, "Implications for big data analytics on claims fraud management in insurance sector", International Journal of Technology and Systems, vol. 7, no. 1, Jul. 2022.
- [4] K. H. Kelley, L. M. Fontanetta, M. Heintzman and N. Pereira, "Artificial intelligence: implications for social inflation and insurance", Risk Management and Insurance Review, vol. 21, no. 3, pp. 373-387, 2018.
- [5] A. Zia and P. Kalia, "Emerging technologies in insurance sector: evidence from scientific literature" in Big Data: A Game Changer for Insurance Industry, Emerald Publishing Limited, pp. 43-63, 2022.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Coupled projection methods in turbulence

Communication Info

Authors:

Aicha AIT BAKRIM¹
Khalid BENMOUSSA²
Driss YAKOUBI³
Jean DETEIX⁴

¹LABSI, University of Ibn Zohr,
Agadir, Morocco

²LABSI, University of Ibn Zohr,
Agadir, Morocco

³JLL, University of Laval,
Quebec, Canada

⁴CIMM, University of Laval,
Quebec, Canada

Keywords:

- (1) Navier-Stokes equation
- (2) VVH formulation
- (3) Finite element method

Abstract

The Navier-Stokes equation is one of the most important equations in fluid mechanics which models various flows of incompressible Newtonian fluid. It can be used in fields such as oceanography, meteorology, biology and engineering.

The problem is that this equation is non-linear, which makes it more complex and mysterious.

For this reason, scientists and engineers propose several methods to solve this equation. In this communication, we study the Navier-Stokes equation coupled with the convection-diffusion equation which models the incompressible flow of Newtonian fluids. We show that this problem can be reformulated to be equivalent to the Velocity-Vorticity-Helicity (VVH) formulation. The problem has been solved by using the finite element method based on the splitting approximation. We propose a family of schemes based on projection methods, which give the best results compared to other existing schemes in the literature [1], [2]. The results of numerical experiments obtained with FreeFem++ program prove the efficiency and accuracy of the method.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] J. Deteix, A. Jendoubi, D. Yakoubi, A coupled prediction scheme for solving the Navier-Stokes and heat equations, SIAM Journal of Numerical Analysis 52 (2014) 2415-2439
- [2] Olshanskii, Maxim A., and Leo G. Rebholz. "Velocity-vorticity-helicity formulation and a solver for the Navier-Stokes equations." Journal of Computational Physics 229.11 (2010): 4291-4303.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Fast Finite Element Solution for Nonlinear Heterogeneous Anisotropic Transient Diffusion Problems

Communication Info

Authors:

Abderrahim Bahssini¹

Nouh Izem¹

Mohammed Seaid²

M Shadi Mohamed³

¹ *Laboratory of Mathematical Engineering and computing, Faculty of Science, Ibn Zohr University Agadir, Morocco.*

² *School of Engineering and Computing Sciences, University of Durham, UK.*

³ *School of Energy, Geoscience, Infrastructure and Society, Heriot-Watt University, Edinburgh EH14 4AS, UK.*

Keywords:

- (1) Heterogeneous media
- (2) Anisotropic diffusion
- (3) Partition of unity method

Abstract

In this work, nonlinear heterogeneous anisotropic transient heat diffusion problems is studied. This problem can be simplified as where the diffusivity changes with the direction inside the medium and depends on the temperature. The numerical modeling and problem-solving are the main topics of this essay. It can be difficult to handle this problem using the conventional finite element method. To deal with this challenge, we propose an enriched finite element formulation where the basis functions are augmented with a summation of exponential functions inspired from the fundamental solution. First, the initial-value problem is integrated in time using a semi-implicit scheme and the semi-discrete problem is then integrated in space using the enriched finite elements. We demonstrate through several numerical examples that the proposed approach can solve accurately nonlinear anisotropic transient diffusion problems on coarse meshes and with much fewer degrees of freedom compared to the standard finite element method. Thus, a significant reduction in the computational requirements is achieved without compromising on the solution accuracy.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] J. Melenk and I. Babuska. The partition of unity finite element method: Basic theory and applications. *Computer Methods in Applied Mechanics and Engineering*, (1996) 139:289-314.
- [2] M.S. Mohamed, M. Seaid, J. Trevelyan, and O. Laghrouche. A partition of unity fem for time-dependent diffusion problems using multiple enrichment functions. *International Journal for Numerical Methods in Engineering*, (2013) 93:245-265.
- [3] M. Malek, N. Izem, M. Seaid, M.S. Mohamed, M. Wakrim, A partition of unity finite element method for nonlinear transient diffusion problems in heterogeneous materials, *Comp. Appl. Math.* 38 (2019) 31.
- [4] M. Malek, N. Izem, M. Seaid, M.S. Mohamed, M. Laghrouche, A partition of unity finite element method for three-dimensional transient diffusion problems with sharp gradients. *Journal of Computational Physics*, (2019) 702--717.
- [5] M. Malek, N. Izem, M. Seaid, M.S. Mohamed, m. Wakrim. Numerical solution of Rosseland model for transient thermal radiation in non-grey optically thick media using enriched basis functions. *Mathematics and Computers in Simulation*, (2021) 258-275.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Picture fuzzy multi-criteria group decision making approach for video conferencing tool selection

Communication Info

Authors:

Chayel TRIPURA¹
Sayanta CHAKRABORTY²
Baby BHATTACHARYA³

¹Department of Mathematics,
National Institute of
Technology, Agartala, India

²Department of Mathematics,
National Institute of
Technology, Agartala, India

³Department of Mathematics,
National Institute of
Technology, Agartala, India

Keywords:

- (1) MCGDM
- (2) Aggregation Operator
- (3) Score function
- (4) Picture fuzzy set
- (5) VCT

Abstract

Owing to the onset of Covid-19 outbreak, usage of video conferencing tools (VCT) has gained great interest among the community as it reduces hassle of direct interaction. The present treatise aims to introduce and integrate aggregation operator (AO) based Method based on the Removal Effects of Criteria (MEREK) and Weighted Aggregated Sum Product Assessment (WASPAS) under picture fuzzy environment (PFE). The integrated multi-criteria group decision making (MCGDM) technique has been applied to identify best Video Conferencing tool. Also, to overcome the limitations of existing score function (SF) of PF number (PFN), a novel SF has been proposed. The consistency, reliability and robustness of the proposed integrated technique have been checked through comparative analysis (CA) and sensitivity analysis (SA).

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] L.A. Zadeh, Fuzzy Set. Inf control. 8(3), 338-353 (1965).
- [2] K.T. Atanassov, Intuitionistic fuzzy sets, Fuzzy Sets and Systems, 20 (1986) 87-96.
- [3] B. C. Cuong, V. Kreinovich, Picture fuzzy sets - A new concept for computational intelligence problems. 2013 Third World Congress on Information and Communication Technologies (WICT 2013). doi:10.1109/wict.2013.7113099
- [4] S. Biswas, D. Pamucar, S. Kar, P. Chowdhury, A New Decision Support Framework with Picture Fuzzy Information: Comparison of Video Conferencing Platforms for Higher Education in India (2021).
- [5] G. Wei, 'Picture Fuzzy Hamacher Aggregation Operators and Their Application to Multiple Attribute Decision Making' (2018) 271 – 320.
- [6] P. Toan, T.T. Dang, L.T.T. Hong, Evaluating Video Conferencing Software for Remote Working Using Two-Stage Grey MCDM: A Case Study from Vietnam. Mathematics (2022)10. 946. 10.3390/math10060946.
- [7] A. Si, S. Das, S. Kar, An approach to rank picture fuzzy numbers for decision making problems. Decision Making: Applications in Management and Engineering, 2(2) (2019) 54-64.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Artificial intelligent based modeling for weld bead geometry prediction of MIG-CO2 welding process made of EN-3A Grade Mild Steel using radial basis function neural network coupled with genetic algorithm

Communication Info

Authors:

Banya Das¹
Susmita Roy¹
Biswajit Das²
Paritosh Bhattacharya¹

¹Department of Mathematics,
National Institute of
Technology, Agartala-799046,
India

²Department of Mechanical
Engineering, Tripura Institute
of Technology, Narsingarh-
799009, India

Keywords:

- (1) Artificial Neural Network
- (2) Radial Basis Function
Neural Network
- (3) Genetic Algorithm
- (4) MIG-CO2 welding
- (5) Python Programming

Abstract

This paper demonstrates the effectiveness of artificial neural networks (ANN) with Genetic Algorithm (GA) for the prediction of output welding process parameters given input welding process parameters. An attempt has been made to predict the optimal weld bead geometry such as Depth of Penetration (DP), Material Deposition Rate (MDR), and Width (WH) of the HAZ zone in MIG-CO2 welded butt joints made of EN-3A mild steel. Experiments have been carried out according to the Taguchi's L 25 experimental parameter design. Three input parameters namely Welding Current (I), Arc Voltage (V) and Welding Speed (S) are considered during the experiments. Designing of input-output modelling of this process has been demonstrated in the forward direction using a radial basis function neural network model through updating its connecting weights using Genetic Algorithm based on the data collected experimentally. A comparison study has been carried out on optimizing the neural network architecture by developing a python programming and it has been observed that the welding geometry predicted by the developed network model is better than existing regression model and back propagation neural network (BPNN) model.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Das, D., Pratihari, D. K., Roy, G. G., & Pal, A. R. (2018). Phenomenological model-based study on electron beam welding process, and input-output modeling using neural networks trained by back-propagation algorithm, genetic algorithms, particle swarm optimization algorithm and bat algorithm. *Applied Intelligence*, 48, 2698-2718.
- [2] Sathiyar, P., Panneerselvam, K., & Soundararajan, R. (2012). Optimal design for laser beam butt welding process parameter using artificial neural networks and genetic algorithm for super austenitic stainless steel. *Optics & Laser Technology*, 44(6), 1905-1914.
- [3] Ghosal, S., & Chaki, S. (2010). Estimation and optimization of depth of penetration in hybrid CO 2 LASER-MIG welding using ANN-optimization hybrid model. *The International Journal of Advanced Manufacturing Technology*, 47, 1149-1157Y. El foutayeni, M. Khaladi, A Min-Max Algorithm for Solving the Linear Complementarity Problem, *J. Math. Sci. Appl*, 1 (2013) 6-11.
- [4] Dey, V., Pratihari, D. K., & Datta, G. L. (2010). Forward and reverse modeling of electron beam welding process using radial basis function neural networks. *International Journal of Knowledge-based and Intelligent Engineering Systems*, 14(4), 201-215.
- [5] Datta, S., Deepanshu, & Pratihari, D. K. (2017). Modelling of input-output relationships of metal inert gas welding process using soft computing-based approaches. *International Journal of Computational Intelligence Studies*, 6(1), 1-28.
- [6] Lahoti, G., & Pratihari, D. K. (2017). Recurrent neural networks to model input-output relationships of metal inert gas (MIG) welding process. *International Journal of Data Analysis Techniques and Strategies*, 9(3), 248-282.Y. El foutayeni, M. Khaladi, A New Interior Point Method for Linear Complementarity Problem, *Appl. Math. Sci.*, 4 (2010) 3289-3306.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Joining iso-structured models with commutative orthogonal block structure

Communication Info

Authors:

Carla SANTOS^{1,5}

Cristina DIAS^{2,5}

Célia NUNES³

João Tiago MEXIA^{4,5}

¹*Polytechnic Institute of Beja, Beja, Portugal*

²*Polytechnic Institute of Portalegre, Portalegre, Portugal*

³*Department of Mathematics and Center of Mathematics and Applications, University of Beira Interior, Covilhã, Portugal*

⁴*Department of Mathematics – NOVA SST, Lisbon, Portugal*

⁵*Center for Mathematics and Applications (NOVAMath) NOVA SST, Lisbon, Portugal*

Keywords:

(1) Best linear unbiased estimators

(2) Jordan Algebra

(3) Mixed models

Abstract

Since models with commutative orthogonal block structure (COBS), the sub-class of linear mixed models introduced by Fonseca et al. [1], have least squares estimators giving best linear unbiased estimators for estimable vectors, as shown by Zmyślony [3], it is relevant the possibility of joint analysis of COBS obtained independently, since, according to Santos et al. [2], the operation of model joining with COBS results in a COBS. Using an approach based on the algebraic structure of the models, we consider the model joining operation with iso-structured COBS, that is, with COBS generating the same commutative Jordan algebra of symmetric matrices. We obtain uniformly best linear unbiased estimators for estimable functions of the joined COBS and estimate the variance components, showing that the estimators for the joint model may be obtained from those for the individual models.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

[1] M. Fonseca, J. T. Mexia, R. Zmyślony, Inference in normal models with commutative orthogonal block structure, *Acta et Commentationes Universitatis Tartuensis de Mathematica*, 12 (2008) 3–16.

[2] C. Santos, C. Nunes, C. Dias, J. T. Mexia, Joining models with commutative orthogonal block structure, *Linear Algebra and its Applications*, 517 (2017) 235 – 245.

[3] R. Zmyślony, A characterization of best linear unbiased estimators in the general linear model, *Lecture Notes in Statistics*, 2 (1978) 365–373.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Numerical study of shape optimization for flows governed by the Stokes equations

Communication Info

Authors:

Azeddine SADIK
Abdelkrim CHAKIB
Ibrahim KHALIL
Hamid OUAISSA

Applied Mathematics Team
(AMT), Faculty of Sciences and
Techniques, Sultan Moulay
Slimane University, Beni Mellal,
Morocco.

Keywords:

- (1) Stokes equation
- (2) Shape optimization
- (3) Shape derivative
- (4) Minkowski

Abstract

In this work, we carry out a numerical study of a shape optimization problem governed by Stokes system. More precisely, we propose an effective numerical approach based on the shape derivative formula with respect to convex domains using Minkowski deformation [1]. Then, we present some numerical tests including comparison results showing that the proposed algorithm is more efficient, in term of the accuracy of the solution and central processing unit (CPU) time execution, than the one involving the classical shape derivative formula massively used in literature.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Boulkhemair and Chakib in J Convex Anal 21(1) :67–87, 2014

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Pythagorean Fuzzy Artinian and Noetherian Rings

Communication Info

Authors:

Meryem FAKHRAOUI¹
Idris BAKHADACH¹
Said MELLIANI¹

¹LMACS, Sultan Moulay
Slimane University of Beni
Mellal, Beni Mellal, Morocco

Keywords:

- (1) Artinian rings
- (2) Noetherian rings
- (3) Pythagorean fuzzy set theory

Abstract

A Pythagorean fuzzy set is a very efficient and powerful tool for handling uncertainty and vagueness.

In this paper we study rings with ascending (descending) chain conditions on their Pythagorean fuzzy substructures and various results are established. Also we prove some characterizations of rings with chain conditions in terms of Pythagorean fuzzy quotient rings and Pythagorean fuzzy ideals.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] R.R.Yager, Pythagorean fuzzy subsets, in Proc. Joint IFSA World Conger. NAFIPS Annu. Meeting(IFSA/NAFIPS),Jun.2013,pp.57-61,doi:10.1109/IFSA-NAFIPS.2013.6608375.
- [2] S.Bhunia and G.Ghorai, A new approach to fuzzy group theory using (α,β) -pythagorean fuzzy sets, Songklanakarin J.Sci.Technol, vol. 43,no.1,pp.295-306,2021.
- [3] D.Ezhilmaran and N.Palaniappan, Characterizations of Intuitionistic Fuzzy Artinian and Noetherian Γ -Near-Rings , International Mathematical Forum, vol. 6, 2011,no.68,3387,3395.
- [4] R. Rasuli , Artinian and Noetherian Fuzzy Rings, Int. J. Open Problems Compt. Math, vol. 12, March 2019, 1998-6262.
- [5] D. S. Malik, Fuzzy Ideals of Artinian rings, Fuzzy sets and Systems, 37(1990), 111-115.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



A Caputo–Fabrizio fractional differential

Communication Info

Authors:

Lekbir MONSIF¹
Jalila EL GHORDAF²
Mohammed OUKASSOU³

¹FST, SULTAN MOULAY
SLIMANE University of Beni
Mellal, Morocco

²FST, SULTAN MOULAY
SLIMANE University of Beni
Mellal, Morocco

³FST, SULTAN MOULAY
SLIMANE University of Beni
Mellal, Morocco

Keywords:

- (1) Caputo–Fabrizio fractional derivative,
- (2) Non-singularity,
- (3) iterative approach.

Abstract

Numerous fresh definitions of fractional derivatives have been put forth recently and used to create mathematical models for a wide range of real-world systems that involve memory, history, or nonlocal effects. The major goal of the current study is to construct and evaluate a Caputo-Fabrizio fractional derivative for SIR model. A fixed-point theorem and an iterative approach are used to prove the existence and singularity of the model's system of solutions. It is demonstrated that the model has an endemic and a disease-free equilibrium point. Conditions are derived for the endemic equilibrium point's existence as well as for the disease-free equilibrium point's local asymptotic stability. The findings show that as the fractional order is decreased, the disease-free equilibrium point gets more and more stable.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Mainardi, F.: Fractional calculus: some basic problems in continuum and statistical mechanics. In: Carpinteri, A., Mainardi, F. (eds.) *Fractals and Fractional Calculus in Continuum Mechanics*. Springer, Wien (1997).
- [2] Caputo, M., Fabrizio, M.: A new definition of fractional derivative without singular kernel. *Prog. Fract. Differ. Appl.* 1(2), 1–13 (2015).
- [3] Van den Driessche, P., Watmough, J.: Reproduction numbers and sub-threshold endemic equilibria for compartmental models of disease transmission. *Math. Biosci.* 180(1–2), 29–48 (2002).
- [4] Li, H., Cheng, J., Li, H.-B., Zhong, S.-M.: Stability analysis of a fractional-order linear system described by the Caputo–Fabrizio derivative. *Mathematics* 7(2), 200 (2019).
- [5] Hunter, J.K., Nachtergaele, B.: *Applied Analysis*. World Scientific, Singapore (2001).

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



The topological degree methods for COVID-19 in Morocco with a new fractional derivative

Communication Info

Authors:

Fouziya ZAMTAIN¹
M'hamed ELOMARI²
Said MELLIANI³

¹LMACS, Sultan Moulay Sliman
University of Beni Mellal, Beni
Mellal, Morocco

²LMACS, Sultan Moulay Sliman
University of Beni Mellal, Beni
Mellal, Morocco

³LMACS, Sultan Moulay Sliman
University of Beni Mellal, Beni
Mellal, Morocco

Keywords:

(1) Atangana-Baleanu
fractional derivative
(2) Chichole-Bhadane
fractional derivative
(3) Topological degree
method

Abstract

The purpose of this article is to investigate the mathematical modeling of the Moroccan coronavirus, which is introduced by Poonam Garg et al. in [2], using the new fractional derivative of S. M. Chinchole and A. P. Bhadane, which is a generalization of the Atangana-Baleanu derivative. The results are particularly focused on generalizing one parameter of the Mittag-Leffler function into two using a new derivative, namely the Chichole-Bhadane derivative..

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] A. Atangana, D. Baleanu - arXiv preprint arXiv:1602.03408, [arxiv.org](https://arxiv.org/abs/1602.03408)(2016).
- [2] P. Garga, S. Madan, R. Arorac, D. K. Singh, Covid-19 cases in Morocco: A comparative analysis, Results in Nonlinear Analysis 5 (2022) No. 3, 337–346
- [3] E. ABADA, H. LAKHAL AND M. MAOUNI, Topological Degree Method For Fractional Laplacian System, Bulletin of Mathematical Analysis and Application, Volume 13 Issue 2(2021), Pages 10-19.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



The solution integral for an initial value neutral nonlinear hybrid with a ψ -Caputo derivative.

Communication Info

Authors:

Hayat MALGHI¹
Khalid HILAL²
Abdelaziz QAFFOU^{3,4}

¹LMACS, Sultan Molay Slimane
University, Beni Mallal, Morocco

²LMACS, Sultan Molay Slimane
University, Beni Mallal, Morocco

³LMACS, Sultan Molay Slimane
University, Beni Mallal, Morocco

Keywords:

(1) ψ -fractional integral
(2) ψ -Caputo fractional derivative
(3) bounded delay

Abstract

In this manuscript, we discuss the initial value problem for a class of fractional neutral functional differential equations with bounded delay, as well as some basic definitions and properties of Ψ -fractional integral and Ψ -Caputo fractional derivative. We conclude this article by giving an illustrative example to demonstrate the applicability of in the obtained results.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] A. A. Kilbas, H. M. Srivastava, and J. J. Trujillo, Theory and Applications of Fractional Differential Equations, vol. 204 of North-Holland Mathematics Studies, Elsevier Science B.V., Amsterdam, The Netherlands, 2006.
- [2] A. Belarbi, M. Benchohra, A. Ouahab. Uniqueness results for fractional functional differential equations with infinite delay in Frechet spaces. *Appl. Anal.* 58 (2006) 1459--1470.
- [3] K. Hilal, A. Kajouni. Boundary value problems for hybrid differential equations with fractional order. *Advances in Difference Equations* (2015) 2015:183
- [4] K. Hilal, A. Kajouni. Boundary value problems for hybrid differential equations with fractional order. *Advances in Difference Equations* (2015) 2015:183
- [5] R.P. Agarwal, Y. Zhou, J. Wang and X. Luo. Fractional functional differential equations with causal operators in Banach spaces. *Mathematical and Computer Modelling*. 54 (2011) 1440--1452.
- [6] Yong Zhou, Fengjiao, Jing Li, Existence and uniqueness for p -type fractional neutral differential equations, *Nonlinear Anal.* 71 (2009) 2724-2733.



On some geometrical eigenvalue problems governed by p-Laplacian operator

Communication Info

Authors:

Ibrahim KHALIL*¹
Abdelkrim CHAKIB¹

¹University Sultan Moulay
Slimane Faculty of Science and
Technology, Morocco

Keywords:

- (1) Shape optimization
- (2) shape derivative
- (3) nonlinear eigenvalue problem
- (5) volume constraint
- (6) gradient method
- (7) inverse power algorithm
- (8) Dirichlet p-Laplacian operator

Abstract

In this paper, we deal with some shape optimization geometrical inverse spectral problems involving the first eigenvalue and eigenfunction of a p-Laplace operator, over a class of open domains with prescribed volume. We first briefly show the existence of the optimal shape design for the L^p norm of the eigenfunction. We carried out the shape derivative calculation of this shape optimization problem using deformation of domains by vector fields [1,3-5]. Then we propose a numerical method using Lagrangian functional, Hadamard's shape derivative and gradient method to determine the minimizers for this shape optimization problem. We investigate also numerically the problem of minimizing the first eigenvalue of the Dirichlet-p-Laplacian operator with volume-constraint on domains, using constrained and unconstrained shape optimization formulations. The resulting proposed algorithms of the optimization process are based on the inverse power algorithm [2] and the finite elements method performed to approximate the first eigenvalue and related eigenfunction. Numerical examples and illustrations are provided for different constrained and unconstrained shape optimization formulations and for various cost functionals to show the efficiency and practical suitability of the proposed approach.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Allaire, G. (2007). Conception optimale de structures. Mathématiques et Applications. Berlin, Springer, 58.
- [2] Biezunzer, R. J. Brown, J. Ercole, G. E. Martins, M. (2018). Computing the first eigenpair of the p-Laplacian via inverse iteration of sublinear supersolution. Journal of scientific computing, 52(1), 2018, 180-201.
- [3] Delfour, M. Zolésio, J. (2011). Shapes and geometries: metrics, analysis, differential calculus, and optimization. SIAM, 22.
- [4] Henrot, A. Pierre, M. (2018). Shape Variation and Optimization. Une analyse géométrique, Mathematics and Applications, 48, Springer, Berlin. European Mathematical Society (EMS), Zurich.
- [5] Sokolowski, J., and Zolesio, J. (1992) Introduction to Shape Optimization. Springer, Berlin, Heidelberg 5-12.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



A class of fractional differential evolutionary mixed variational problem with application to frictional contact problem

Communication Info

Authors:

Abderrahmane. Oultou¹
Othmane.Baiz²
Hicham. Benaissa^{3,4}

¹*MATIC, Sultan Moulay Slimane University, Beni-Mellal, Morocco*

²*LMATIC, Ibno Zohr University, Agadir, Morocco*

³*L MATIC, Sultan Moulay Slimane University, Beni-Mellal, Morocco.*

Keywords:

- (1) Fractional nonlinear equation
- (2) mixed variational problem
- (3) Friction contact problem
- (4) Rothe method
- (3) Fractional differential equation

Abstract

The purpose of this paper is to introduce and investigate a new dynamic system called a fractional differential mixed variational problem, which is composed of a nonlinear fractional differential equation with Atangana-Baleanu fractional derivative and an evolutionary mixed variational problem. The existence and uniqueness of a solution to the system are proved based on the Rothe method and saddle-point theorem. Moreover, the approximation of this class of system is analyzed and an optimal error estimate is derived. As an application of the previous results, a viscoelastic frictional contact model with adhesion is studied.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] S.D. Zeng, S. Migroski, A class of time-fractional hemivariational inequalities with application to frictional contact problem, *Commun. Nonlinear Sci. Numer. Simul.* 56 (2018) 3448.
- [2] S. Migroski, V.T. Nguyen, S.D. Zeng, Solvability of parabolic variational-hemivariational inequalities involving space-fractional Laplacian, *Appl. Math. Comput.* 364 (2020) 124668.
- [3] C.P. Li, F.H. Zeng, The finite difference methods for fractional ordinary differential equations, *Numer. Funct. Anal. Optim.* 34(2) (2013) 149179. S.D. Zeng, Y.R. Bai, Maximum principles for multi-term space time variable order fractional diffusion equations and their applications, *Fract. Calc. Appl. Anal.* 19 (2016) 188211.
- [5] T. Abdeljawad, D. Baleanu, Integration by parts and its applications of a new nonlocal fractional derivative with Mittag-Leffler nonsingular kernel, *J. Nonlinear Sci. Appl.* 10 (2017) 10981107.
- [6] Zeng, S., Liu, Z. Migroski, S. A class of fractional differential hemivariational inequalities with application to contact problem. *Z. Angew. Math. Phys.* 69, 36 (2018).

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



An inverse formulation for identifying The silting process of river banks

Communication Info

Authors:

Cyr S. Ngamouyih Moussata¹
Mahamat Saleh Daoussa
Haggar²
Benjamin Mampassi¹

¹ Marien N'Gouabi university,
Brazzaville, Congo.
² N'Djamena University, Chad

Keywords:

- (1) River silting process
- (2) Sedimentation models
- (3) Inner asymptotic expansion
- (4) Adjoint and tangent equations
- (5) optimality system

Abstract

River silting is one of the increasingly common phenomena in the process of climate change. This phenomenon is the cause of degradation of the banks of river and their environments. The causes and origins of river silting are varied and complex[1].

After having developed the equations which govern the sedimentation of rivers, this paper proposes a formulation for the identification of the parameters and the source function of bank's silting phenomenon[3],[4]. The theoretical study of these equations highlights the existence of shock wave line near river banks. The use of inner asymptotic expansion around the shock wave lines leads to constructing the discrete forward problem from which an appropriate inverse formulation is derived [2],[5] [6]. Then, a calculation of the gradient of the objective function is provided as well as the equations allowing to calculate the parameters to be identified.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] S.N. Antontsev, G Gagneux, R Luce and G. Vallet, New unilateral problem in stratigraphy, M2AN. Math Model. Number. Anal. 40(4)(2006), 767 - 784.
- [2] G.I. Barenblatt, Scaling, self-similarity and Intermediate Asymptotics, Cambridge University Press 1996.
- [3] P. Blondeaux and G. Seminara, A unified bar-bend theory of river meander, J. Fluid Mech.157(1995)449-490 .
- [4] J.A. Cunge, F.M. Holly Jr. and A. Verwey, Practical Aspects of computational Rivers Hydraulics, Pitman Publishing Inc., Boston, MA, 1980 .
- [5] V. Isacov, Inverse problem for partial differential equations, Springer, New York, 1998.
- [6] Y.A.S. Wellot, C.S. Ngamouyih Moussata, H. NKoukou and T. DJaokamla, An asymptotic approach for describing silting of rivers, Int. J. Appl. Math. 28(6) (2015), 779 - 788.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



The Impact of imperfect COVID-19 vaccination on optimal containment

Communication Info

Authors:

LAHBIB BENAHMADI¹
Mustapha LHOUS²
Abdessamad TRIDANE³

^{1,2}FSAC, Faculty of Sciences Ain
Chock, Hassan II University of
Casablanca, B.P 5366 Maarif
Casablanca, Morocco.

³UAEU, United Arab Emirates
University, P.O. Box 15551, Al-
Ain, United Arab Emirates.

Keywords:

- (1) COVID-19
- (2) Basic reproductive
number
- (3) vaccination
- (4) sensitivity
- (5) optimal control

Abstract

Vaccination has been the major strategy for preventing the spread of the COVID-19 pandemic since its beginning. But since there are now several vaccines and new viruses are always being made, the question of how well these vaccines protect the population comes up.

In this study, a mathematical model of an imperfect COVID-19 vaccination is made to look at how the model works and what might be needed to control the effects of the imperfect vaccine. We perform stability analysis to determine what conditions would lead to the end of a disease and to figure out the R_0 threshold of disease spread. The sensitivity analysis of the basic reproduction number with respect to model parameters is simulated for the four most likely disease progression scenarios.

As the COVID-19 virus changes, we propose an optimal control problem with the goal of getting more people to get vaccinated, lowering the risk of infection by following a preventive protocol, and making vaccines work better. To highlight the importance of our findings, we performed numerical simulations of optimal control.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Arino, J., Cooke, K., Van Den Driessche, P. & Velasco-Hernández, J. An epidemiology model that includes a leaky vaccine with a general waning function. *Discrete Continuous Dynamical Systems-B*. 4, 479 (2004)
- [2] Da-peng Gao and Nan-jing Huang. Optimal control analysis of a tuberculosis model. *Applied Mathematical Modelling*, 58 :47–64, 2018.
- [3] Djilali, S. & Bentout, S. Global dynamics of SVIR epidemic model with distributed delay and imperfect vaccine. *Results In Physics*. 25 pp. 104245 (2021)
- [4] Takasar Hussain, Muhammad Ozair, Farhad Ali, Sajid ur Rehman, Taghreed A Assiri, and Emad E Mahmoud. Sensitivity analysis and optimal control of covid-19 dynamics based on seiqr model. *Results in physics*, page 103956, 2021.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Inequalities for Fractional Integrals of a Generalized Class of Strongly Convex Stochastic processes

Communication Info

Authors:

Oualid Rholam

University Ibn Tofail,
National School of Applied
Sciences (ENSA), Kenitra,
Morocco, B.P 242,
oualid.rholam@uit.ac.ma

Keywords:

(1) Hermite-Hadamard
Inequality
(2) Fractional Integral
(3) Strongly-convex Stochastic
Process.

Abstract

Les opérateurs intégraux fractionnaires(5) sont des outils utiles pour généraliser les inégalités intégrales classiques. Les fonctions convexes en général et les processus stochastiques en particulier jouent un rôle très important dans la théorie des inégalités mathématiques(1) (2) (3). Lors de ce travail on vise à présenter des inégalités de type Hermite-Hadamard(4) pour une classe généralisée de processus stochastiques à savoir fortement (a, h, m) p -convexes en utilisant les intégrales fractionnaires de Riemann–Liouville. Les résultats établis donnent des affinements de diverses inégalités bien connues qui ont été publiées dans le passé récent

ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Nagy B., "On a generalization of the Cauchy equation", *Aequationes Math.* 10 (1974), No. 2-3, 165-171.
- [2] Nikodem K., "On convex stochastic processes", *Aequationes Math.* 20 (1980), No. 1, 184-197.
- [3] Skowronski A., "On Wright-Convex Stochastic Processes", *Ann. Math. Sil.* 9 (1995), 29-32.
- [4] Set E., Tomar M. and Maden S., "Hermite Hadamard type Inequalities for s -Convex Stochastic Processes in the Second Sense", *Turkish Journal of Analysis and Number Theory* 2 (2014), No. 6, 202-207
- [5] Gorenflo R. and Mainardi F., "Fractional Calculus: Integral and Differential Equations of Fractional Order", in *CISM Courses and Lect.* 378, Springer, Vienna (1997), 223-276.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Approximate strong subdifferential calculus for convex set-valued mappings and applications to set optimization

Communication Info

Authors:

ECHCHAABAOU EL MAHJOUB¹
LAGHDIR MOHAMED²

^{1,2}Department of Mathematics,
Faculty of Sciences Chouib
Doukkali University, BP. 20, El
Jadida, Morocco

Keywords:

- (1) Set-valued convex mappings
- (2) Approximate subdifferential
- (3) Approximate efficiency
- (4) Set-optimization

Abstract

In this paper, we are mainly concerned with a rule for approximate strong sub-differential, concerning the sum and the composition of cone-convex set-valued vector mappings, taking values in finite or infinite-dimensional preordered spaces.

The obtained formulas is exact and holds under the connectedness conditions. This formula is applied to establish approximate necessary and sufficient optimality conditions for the existence of the approximate strong efficient solutions of a set-valued vector optimization problem.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] M. El Maghri, Pareto-Fenchel ε -subdifferential sum rule and ε -efficiency. *Optim. Lett.* 6, 763–781 (2012)
- [2] A. Taa, On subdifferential calculus for set-valued mappings and optimality conditions. *Nonlinear Anal.* 74, 7312–7324 (2011)
- [3] A. Taa, Subdifferential calculus for set-valued mappings and optimality conditions for multiobjective optimization problems. *J Optim Theory Appl.* 180, 428–441 (2019)

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Résolution de l'équation de transport dans le cas non positif au sens de Friedrich

Communication Info

Author:

Samira KHATMI
khatmi.samira@ucd.ac.ma
FSEJESJ University Chouaib
Doukkali El Jadida, Morocco

Keywords:

- (1) Friedrichs's theory
- (2) Transport equation
- (3) Hyperbolic systems

Abstract

Ce travail est consacré à la résolution de l'équation de transport en géométrie bidimensionnelle plane

$$\mu \frac{\partial u}{\partial x} + \nu \frac{\partial u}{\partial y} + \sigma u = f \quad \text{pour } (x, y) \in \Omega$$
$$u(x, y) = 0 \quad \text{sur } \partial_- \Omega$$

et en géométrie sphérique monodimensionnelle

$$\mu \frac{\partial}{\partial r} (r^2 \varphi) + r \frac{\partial}{\partial \mu} (1 - \mu^2) \varphi + \sigma r^2 \varphi = r^2 f \quad \text{sur } \Omega =]0, R[\times]-1, 1[$$
$$\varphi(R, \mu) = 0 \quad \text{pour } \mu \leq 0$$

dans le cas où la section efficace est nulle, en tant que système hyperbolique non positif au sens de Friedrichs [1]. L'intérêt de la méthode de résolution présentée dans ce travail réside dans le fait que, contrairement à la méthode classique où on effectue un changement de fonction sur le problème direct, ce changement n'est utilisé que dans le problème adjoint en tant qu'outil de démonstration de l'existence, l'unicité et de la dépendance continue par rapport au second membre de la solution adjointe.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] K. O. FRIEDRICHS : Symmetric positive linear differential equations. Comm. Pure Appl. Math. 11, 333-418, (1958).

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



The existence and uniqueness results for the nonlinear elliptic equation in Orlicz spaces

Communication Info

Authors:

Hind Farjil*¹
Sidi Mohamed DOURI¹
Mohammed MOUMNI¹

¹MAIS, Department of
Mathematics, Faculty of
Sciences and Techniques,
Moulay Ismail University of
Meknes, P.O. Box 509
Boutalamine, Errachidia 52000
Morocco.

Keywords:

(1) Perona-Malik
(2) Orlicz-Sobolev spaces

Abstract

The edges and textures of a digital image may be destroyed by traditional denoising methods, which is a difficult problem in image denoising. Then in this following communication we present the existence and uniqueness solution for the diffusion models derived from Perona-Malik and p-Laplacian operator combination in Orlicz spaces, which can be used for restoration in image processing. Also, we have implemented the MATLAB program for the experimental results on examples images.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

Reference

- [1] H. Brezis, Equations et inéquations non linéaires dans les espaces vectoriels en dualité, Ann. Inst. Fourier (Grenoble) 18 (Fasc. 1) (1968) 115–175.
- [2] R. Aboulaich, D. Meskine, A. Souissi, New diffusion models in image processing, Comput. Math. Appl. 56 (4) (2008) 874–882.
- [3] A. Elmahi, D. Meskine, Parabolic equations in Orlicz spaces, J. London Math. Soc. (2) 72 (2) (2005) 410–428.
- [4] F. Karami, L. Ziad, K. Sadik, A splitting algorithm for a novel regularization of Perona–Malik and application to image restoration. EURASIP J. Adv. Signal Process. 46, 1–9 (2017).
- [5] S. Lecheheb, M. Maouni, H. Lakhal, Image restoration using a novel model combining the Perona Malik equation and the heat equation. Int. J. Anal. Appl. 19(2), 228–238 (2021).
- [6] C. D'Apice, P.I. Kogut, R. Manzo, On coupled two-level variational problem in Sobolev–Orlicz space. Differ. Integr. Equ. (2022).



Renormalized solution for a triply nonlinear thermistor problem

Communication Info

Authors:

Ibrahim DAHI¹
Moulay Rchid SIDI AMMI²

¹Department of Mathematics,
MAMCS Group,
Faculty of Sciences and
Technology,
Moulay Ismail University of
Meknés, B.P. 509, Errachidia,
Morocco.

²Department of Mathematics,
AMNEA Group,
Faculty of Sciences and
Technology,
Moulay Ismail University of
Meknés, B.P. 509, Errachidia,
Morocco.

Keywords:

- (1) Thermistor problem
- (2) Sobolev Lebesgue spaces
- (3) Nonlinear parabolic equation.

Abstract

A thermistor is an electric circuit device made of ceramic material whose electric conductivity depends on the temperature. The mathematical model of this device takes the form of a system that consists of a nonlinear parabolic equation describing the temperature. In this paper, we study a much more general version of a thermistor problem than the one considered by Moulay Rchid Sidi et al. Especially, we prove the existence and uniqueness of a renormalized solution for a non-local parabolic thermistor-type problem in a Sobolev Lebesgue spaces, with the presence of triply non-linear terms. We establish the existence of a renormalized solution to our problem by using the weak convergence of a considered truncation.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Dahi, I., & Ammi, M. R. S.: Existence of renormalized solutions for nonlocal thermistor problem via weak convergence of truncations. *Rendiconti del Circolo Matematico di Palermo Series 2*, 1-20 (2022)
- [2] F. Murat, Equations elliptiques non linéaires avec second membre L1 ou mesure, *Comptes rendus du 26ème Congrès national d'analyse numérique*, Les Karellis, France, 1994.
- [3] M.T. González Montesinos and F. Ortegon Gallego, Algunos resultados sobre el problema del thermistor, *Bol. Soc. Esp. Mat. Apl.*, 31 (2005), 109–138.
- [4] G. Cimatti and G. Prodi, Existence results for a nonlinear elliptic system modeling a temperature dependent electrical resistor, *Ann. Mat. Pura Appl.*, 63 (1988), 227–236
- [5] G. Cimatti, Existence of weak solutions for the nonstationary problem of the Joule heating of a conductor, *Ann. Mat. Pura Appl.*, 162 (1992), 33–42.
- [6] A. Dall'Aglio, D. Giachetti and J.P. Puel, Nonlinear parabolic equations with natural growth conditions in general domains, *Boll. Unione Mat. Ital. Sez. B*, in corso di stampa (2002)



ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Existence of solutions for nonlinear parabolic equation with two lower order terms and L^1

Communication Info

Authors:

Mustafa AIT KHELLOU¹
Sidi Mohamed DOUIRI²
Ismail HADDANI^{2,*}

¹Department of Sciences,
Higher Normal School, Moulay
Ismail University of Meknes,
P.O. Box 3104, Toulal, Meknes
50000, Morocco.

²Laboratory MAIS, Department
of Mathematics, Faculty of
Sciences and Techniques,
Moulay Ismail University of
Meknes, P.O. Box 509
Boutalamine, Errachidia
52000, Morocco.

Keywords:

- (1) Parabolic equations
- (2) Lower order terms
- (3) Musielak-Orlicz-Sobolev spaces

Abstract

In this research, we study the existence of solutions for some nonlinear parabolic equation with L^1 data of the form

$$\frac{\partial u}{\partial t} + A(u) + g(x, t, u, \nabla u) + H(x, t, \nabla u) = f,$$

in the framework of Musielak spaces involving Leray-Lions operator acting from $W_0^{1,x} L_\varphi(Q)$ to its dual and two lower order terms. We assume a sign condition on u and the growth condition on ∇u in the nonlinear term g , while the function H is only growing at most as $Y_x^{-1} Y_x (|\nabla u|)$. Note that the Δ_2 -condition is not assumed on the Musielak function and the source term f belongs to $L^1(Q)$.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Adams, R.: Sobolev Spaces. Academic Press, New York (1975).
- [2] Ait Khellou, M., Douiri, S.M., Farjil, H. et al. Non-linear elliptic unilateral problems with two lower-order terms in Orlicz spaces. J Elliptic Parabol Equ (2022). <https://doi.org/10.1007/s41808-022-00197-2>
- [3] Ait Khellou, M., Douiri, S. M., & El Hadfi, Y. (2022). Existence of solutions to parabolic equation with L^1 data in Musielak spaces. Journal of Elliptic and Parabolic Equations, 8(1), 1-21.
- [4] El Haji, B., El Moumni, M., & Talha, A. (2020). Entropy solutions for nonlinear parabolic equations in Musielak Orlicz spaces without Δ_2 -conditions. Gulf Journal of Mathematics, 9(1), 1-26.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Model COVID-19 dynamics and optimal control strategies

Communication Info

Authors:

Id ouaziz Saida¹
EL Khomssi Mohammed¹

*1MMS, Sidi Mohamed Ben
Abdellah University of Fez, Fez,
Morocco.*

Keywords:

- (1) COVID-19 Model
- (2) Lokta Volterra model
- (3) Dynamical systems

Abstract

In regards to the human lives lost, the coronavirus disease (COVID-19) exacted a heavy toll on the entire world. The current study suggests a brand-new mathematical approach that treats COVID-19 as an infectious disease. Five ODEs formally characterize the dynamics of the interaction between the compartments. We demonstrate the existence and uniqueness of the solution to our problem using the fixed-point theorem. The optimal controls are described using Pontryagin's maximal principle, and the optimality system is found repeatedly. Finally, using MATLAB, some numerical simulations are carried out to validate the theoretical study.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] A. Iggidr, J. Mbang, G. Sallet, et al. Multi-compartment models, *Discr. Contin. Dyn. Syst.* 2007(suppl. 2) (2007), 506–519.
 - [2] OUAZIZ, S. I., HAMOU, A. A., & EL KHOMSSI, M. Dynamics and optimal control strategies of Corruption model. *Results in Nonlinear Analysis*, 5(4), 423-451.
 - [3] Ingh, Harendra, H. M. Srivastava, Zakia Hammouch, et Kottakkaran Sooppy Nisar. « Numerical simulation and stability analysis for the fractional-order dynamics of COVID-19 ». *Results in Physics* 20 (2021): 103722.
 - [4] N. Özdemir ve E. Uçcar, "Investigating of an immune system-cancer mathematical model with Mittag-Leffler kernel", *AIMS Mathematics*, vol. 5, no. 2, pp. 1519–1531, (2020).
-

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Reduction of redundancy in CNNs based on multi-objective optimization

Communication Info

Authors:

Ali BOUFSSASSE¹
Mohamed ETTAOUIL¹

¹MMSL, Sidi Mohamed Ben
Abdellah University, Fez, Morocco

Keywords:

- (1) Convolutional neural networks
- (2) Multi-objective optimization
- (3) Image classification

Abstract

In the last few years, convolutional neural networks have led to very good performance on a variety of problems, such as medical image segmentation, image classification and many others. However, successful CNNs use an immense number of parameters which lead to overfitting, high computational cost and huge redundancy. In this communication, we propose a multi-objective optimization model that consists to minimize the number of connections while maximize the capability of generalization. At the end, the NSGA-II is adopted to solve the proposed model. The experiments demonstrate the effectiveness of the proposed model in term of classification and optimization.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] LeCun, Y., Bottou, L., Bengio, Y., Haffner, P.: Gradient-based learning applied to document recognition. Proceedings of the IEEE 86(11), (1998). 2278– 2324.
 - [2] E. Hssayni, N. Joudar and M. Ettaouil KRR-CNN: kernels redundancy reduction in convolutional neural networks, Neural Computing and Applications, Springer London (2022), 2443--2454.
 - [3] E. Hssayni, N. Joudar and M. Ettaouil Localization and reduction of redundancy in CNN using L1-sparsity induction, Journal of Ambient Intelligence and Humanized Computing, Springer (2022).
 - [4] Denil, M., Shakibi, B., Dinh, L., Ranzato, M., De Freitas, N.: Predicting parameters in deep learning. Advances in neural information processing systems 26 (2013).
 - [5] Simonyan, K., Zisserman, A.: Very deep convolutional networks for large-scale image recognition. arXiv preprint arXiv:1409.1556 (2014).
-

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Buckling analysis of thin functionally graded plates under in-plane loading with a general model of higher order shear deformation theories

Communication Info

Authors:

Khadija ZAHARI¹
Oussama BOURIHANE²
Rachid EL IDRISSI EL
KHAOULANI¹

¹LMSM, Sidi Mohamed Ben
Abdellah University, Fez,
Morocco

²LGM, Sidi Mohamed Ben
Abdellah University, Fez,
Morocco

Keywords:

- (1) Functionally graduated material (FGM) plate
- (2) Static buckling
- (3) Higher order shear deformation theory

Abstract

The buckling of functional gradient plates (FGP) under uniaxial and biaxial mechanical loading is examined in this study using a novel unified framework of higher order shear deformation theories. Based on the fundamental equations of elasticity theory, the displacement field is extended in a unified form that can be applied to many different plate shear deformation theories. The mechanical properties of functionally graded material are assumed to vary according to a power law distribution of the volume fraction of the constituents. Governing equations are derived from the principle of minimum total potential energy. The analytic solutions are developed for buckling analysis of simply supported FGM plates with various type of loading. To confirm the precision and efficiency of the proposed unified plate model many numerical results are generated using the fifth order shear deformation theory based on the unified formulation. It is found that the unified formulation can cover all existing HSDTs models and is thus sufficient to describe the nonlinear behavior of a plate during the buckling. Moreover, the proposed higher order shear deformation theories properly predicts the critical buckling loads for FGM plates when compared to existing theories in the literature.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] K. Zahari, Y. Hilali, S. Mesmoudi, R. El khaoulani, and O. Bourihane. Review and comparison of thin and thick FGM plate theories using a unified buckling formulation. *Structures*, 46:1545–1560, 2022..
- [2] T.-K. Nguyen, H.-T. Thai, and T. P. Vo. A novel general higher-order shear deformation theory for static, vibration and thermal buckling analysis of the functionally graded plates. *Journal of Thermal Stresses*, 44(3):377–394, 2020..
- [3] T. N. Nguyen, C. H. Thai, and H. Nguyen-Xuan. On the general framework of high order shear deformation theories for laminated composite plate structures: A novel unified approach. *International Journal of Mechanical Sciences*, 110:242–255, 2016.
- [4] B. S. Shariat and M. Eslami. Buckling of thick functionally graded plates under mechanical and thermal loads. *Composite Structures*, 78(3):433–439, 2007.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Development of a thermal model for Electric Machines using Model Order Reduction

Communication Info

Authors:

Lotfi Abdelhakim

*Széchenyi István University,
Department of Mathematics
and Computational Science,
Győr, Hungary*

Keywords:

- (1) Heat-transfer
- (2) Electromagnetic losses
- (3) Co-simulation
- (4) Reduced order modeling
- (5) Singular value decomposition
- (6) Empirical interpolation method

Abstract

The objective of this work is to develop a thermal model for permanent magnet synchronous machines based on finite element method. Overheating is one of the most common causes of winding insulation failure and demagnetization of magnets in electric motor. In order to prevent degradation of these parts, the prediction of the temperature inside an electric motor is required at the machine design stage in order to control the temperature rise and to avoid overheating. The first goal of this study is to develop a coupled electromagnetic-thermal model to estimate the electromagnetic and temperature fields of the motor. The second goal is to implement a reduced order modeling methods to reduce the computation time. Finally, the validation of the proposed algorithm and comparisons between the full-order model and the reduced-order ones are presented.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Rosu, M. Zhou, P. Lin, D. Ionel, D. Popescu, M. Blaabjerg, F. Rallabandi, V. Staton, D. Multiphysics Simulation by Design for Electrical Machines. In Power Electronics and Drives; Wiley-IEEE Press, New Jersey, 2018.
- [2] K.G. Murty, Linear Complementarity, Linear and Nonlinear Programming, Helderman-Verlag, 1988.
- [3] A. Lotfi, D. Marcsa, Z. Horváth, C. Prud'Homme, and V. Chabannes, Numerical Simulation of Coupled Electromagnetic and Thermal Problems in Permanent Magnet Synchronous Machines. In: Vermolen, F.J., Vuik, C. (eds) Numerical Mathematics and Advanced Applications ENUMATH 2019, Springer 2021, pp. 693–701.
- [4] Bernhard P. (2022) Coupling Multiphysical Systems in Automotive Simulation Software, Johannes Kepler University Linz.
- [5] Barrault, M., Maday, Y., Nguyen, N. C., and Patera, A. T. (2004). An empirical interpolation method: application to efficient reduced-basis discretization of partial differential equations. *Comptes Rendus Mathematique*, 339(9):667–672.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



A cubic class of iterative procedure for finding the generalized inverses

Communication Info

Authors:

Munish KANSAL¹

Manpreet KAUR²

¹*School of Mathematics,
Thapar Institute of
Engineering and Technology,
Patiala-147004, India*

²*Department of Mathematics,
Lovely Professional University,
Phagwara-144411, India*

Keywords:

- (1) Generalized inverse
- (2) Moore–Penrose inverse
- (3) Convergence analysis
- (4) Singular matrices

Abstract

The article considers the iterative approach for finding the Moore–Penrose inverse [1, 2] of a matrix. A convergence analysis [3] is proven under certain conditions, demonstrating that scheme attains the third-order convergence. Moreover, theoretical discussions give an idea about the improvement of convergence order for a particular choice of parameter. The proposed scheme for $\nu = 0$, $\frac{1}{2}$, and $\frac{1}{4}$ defines the special cases of third-order methods [4]. From the Matrix-Market Library [5], various large sparse ill-conditioned and rectangular matrices obtained from real-life problems are included. The scheme's performance is measured on randomly generated complex and real matrices to verify the theoretical results and which also allow us to show its superiority over the existing methods. Furthermore, a large number of distinct approaches derived through the proposed family are tested numerically to determine the best parametric value and lead to a successful conclusion.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] E. H. Moore, On the reciprocal of the general algebraic matrix, Bull. Am. Math. Soc. 26 (1920) 394–395.
- [2] M. Kaur, M. Kansal, S. Kumar, An efficient matrix iterative method for computing Moore–Penrose inverse, Mediterr. J. Math. 18 (2) (2021) 1–21.
- [3] A. Ben-Israel, Generalized inverses of matrices: a perspective of the work of Penrose, Mathematical Proceedings of the Cambridge Philosophical Society 100 (3) (1986) 407–425.
- [4] H.-B. Li, T.-Z. Huang, Y. Zhang, X.-P. Liu, T.-X. Gu, Chebyshev-type methods and preconditioning techniques, Appl. Math. Comput. 218 (2) (2011) 260–270.
- [5] Matrix Market, <https://math.nist.gov/matrixmarket>.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Heat Transfer analysis on Steady MHD Casson nanofluid (Cu+Water) flow past between an isothermal parallel plates geometry Considering Thermal Radiation, Magnetic and Viscous Dissipations Effects via Cattaneo–Christov's approach

Communication Info

Authors:

AMINE EL HARFOUF ¹
SANAA HAYANI MOUNIR ¹

¹Sultan Moulay Slimane University of Beni Mellal, Polydisciplinary Faculty of Khouribga, Research Team of Energy, Materials, Atomic and Information Fusion, BP: 145 Main Khouribga, 25000, Morocco.

Keywords:

- (1) Casson nanofluid,
- (2) Cattaneo–Christov theory
- (3) AGM method
- (4) HPM method
- (5) magnetic field

Abstract

The Classical Fourier's theory of heat flux is well-known in continuum physics and thermal sciences. However, the primary inconvenience of this law is that it contradicts the principle of causality. To investigate the thermal relaxation time characteristic, Cattaneo–Christov theory is assumed thermally. In this regard, the characteristics of magnetohydrodynamic (MHD) mixed convective flows of Casson nanofluids between two fixed impermeable parallel plates are revealed analytically and numerically. The resulting system of partial differential equations is changed via practical transformations into nonlinear ordinary differential equations. An advanced numerical algorithm is utilized in this study to get higher approximations for velocity and temperature fields, in addition to their corresponding wall gradients. For validating our numerical code, the current outcomes are compared with the other methods utilized in this work Akbari Ganji Method and Homotopy Perturbation Method. Moreover, it is revealed that the velocity field decreases for large values of casson and magnetic parameter. We can also see that Casson nanofluid is accelerated in case of lower yield strength. Larger values of thermal relaxation parameters create a lessening trend in the temperature distribution. The results of this study can help engineers improve, and researchers can conduct research faster and easier on this type of problem. Also This work helps researchers to master the theoretical calculation of this type of problem.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Bingham E, study of the deformation and flow of the material under the effect of an applied stress, (1939).
- [12] El Harfouf, A., A. Wakif, and S. Hayani Mounir. "Analytical and Numerical Analysis of Magneto Hydrodynamic Flow and Heat Transfer in a Nanofluid via the Christov-Cattaneo Heat Flux Theory." *Sensor Letters* 18.8 (2020): 643-657.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Harmonic curvature on Lie groups

Communication Info

Authors:

Ilyes ABERAOUZE¹
Mohamed BOUCETTA²

¹ Cadi Ayyad University of
Marrakesh, Marrakesh, Morocco

² Cadi Ayyad University of
Marrakesh, Marrakesh, Morocco

Keywords:

- (1) Lie groups
- (2) Harmonic curvature
- (3) Ricci-tensor

Abstract

To our knowledge, there is no example of a non Ricci-parallel homogeneous Riemannian manifold with harmonic curvature which supports the following conjecture.

Conjecture 1. *Any homogeneous Riemannian manifold M with harmonic curvature is Ricci-parallel.*

This conjecture is true in dimension four and when M is a sphere or a projective space. It was proven in [2] for nilpotent Lie groups with left invariant metrics. Moreover, any conformally flat Riemannian manifold with constant scalar curvature has a harmonic curvature (see [8, Theorem 5.1]) and any homogeneous conformally flat Riemannian manifold has Ricci-parallel curvature.

In this talk, we prove that this conjecture is true when the manifold M is a solvable Lie group or a Lie group of dimension less or equal 6.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Ilyes Aberaouze, Mohamed Boucetta, Left invariant Riemannian metrics with harmonic curvature are Ricci-parallel in solvable Lie groups and Lie groups of dimension ≤ 6 , Journal of Geometry and Physics, Volume 177,2022,
- [2] J. E. d'Atri, Codazzi tensors and harmonic curvature for left invariant metrics, Geometriae Dedicata 19 (1985) 229-236..
- [3] Bourguignon, J. P., Les variétés de dimension 4 à courbure harmonique et à signature non-nulle sont d'Einstein, Invent. Math. 63 (1981), 263-286.
- [4] Derdzinski, A., Classification of Certain Compact Riemannian Manifolds with Harmonic Curvature and Nonparallel Ricci Tensor, Math. Z. 172 (1980), 273-280.
- [5] Derdzinski, A., On Compact Riemannian Manifolds with Harmonic Curvature, Mathematische Annalen volume 259, 145-152 (1982).
- [6] Dotti I. M., Ricci Curvature of Left Invariant Metrics on Solvable Unimodular Lie Groups, Math. Z. 257-263 (1982). 180
- [7] Fabio Podesta and Andrea Spiro, Four-Dimensional Einstein-Like Manifolds and Curvature Homogeneity, Geometriae Dedicata 54 225-243 (1995).
- [8] Gray, A., Einstein-like manifolds which are not Einstein, Geom. Dedicata 7 (1978), 259-280.
- [9] J. Lauret, Einstein solvmanifolds are standard, Annals of Mathematics, 172 (2010), 1859-1877.
- [11] Milnor J., Curvature of left invariant metrics on Lie groups, Adv. in Math. 21 (1976), 283-329..

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Identifiability and sensitivity analysis of singular inverse problems arising from partial differential equations in Banach spaces

Communication Info

Authors:

Lahcen BOUGHROUM¹

Youssef OUAKRIM¹

(1) Laboratoire de
Mathématiques, Modélisation et
Physique Appliquée, Ecole
Normale Supérieure de Fès,
Université Sidi Mohamed Ben
Abdellah, Maroc.

Keywords:

1. Singular inverse problem.
2. Parameter identification.
3. Optimization with PDE constraint.

Abstract

This work deals with the identification and sensitivity analysis of a class of singular inverse problems arising from the identification of parameters in partial differential equations. The space of solutions of the state equations and the set of admissible parameters are considered as Banach spaces. A variational regularization model is introduced and the solution of the regularized inverse problem is approached by a constrained optimization problem. Then, the convergence and stability of the solution with respect to singularities are established. We construct a topological quotient space depending on the singularities and we employ it to derive the convergence rates as a function of the data perturbations and the singular set. Numerical experiments for a diffusion parameter identification are discussed at the end.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

1. Burger, M., Osher, S.: Convergence rates of convex variational regularization. *Inverse Problems* 20(5), 1411 (2004).
2. Engl, H.W., Hanke, M., Neubauer, A.: *Regularization of Inverse Problems*, 1 edn. 375. Springer Netherlands (2000).
3. Resmerita, E., Scherzer, O.: Error estimates for non-quadratic regularization and the relation to enhancing. *Inverse Problems* 22, 311–329 (2006).
4. Hofmann, B., Kaltenbacher, B., Poschl, C., Scherzer, O.: A convergence rates result for tikhonov regularization in banach spaces with non-smooth operators. *Inverse Problems* 23(3), 987 (2007).
5. Kunisch, K.: Inherent identifiability of parameters in elliptic differential equation. *Journal of Mathematical Analysis and Applications* 132(1), 453–472 (1988).

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Heat Transfer of Nanofluid in a Cubic Cavity

Communication Info

Authors:

Youssef ELGUENNOUNI¹
Mohamed HSSIKOU²
Jamal BALITI²
Mohammed ALAOUI¹

¹Moulay Ismail University of
Meknes, Faculty of Sciences,
Morocco

²University of Sultan Moulay
Slimane, Polydisciplinary
Faculty, Beni Mellal, Morocco

Keywords:

- (1) Lattice Boltzmann Method
- (2) Natural convection
- (3) 3D simulation
- (4) Rayleigh number
- (5) Nusselt number

Abstract

To comprehend the physical process better than in two dimensions [1,2], numerical analysis of numerous physical phenomena in three dimensions has become necessary [3-5]. Thus, in this paper, the code is elaborated to be adapted to simulate the natural convection of Al₂O₃-water nanofluid in three dimensions. The numerical simulations are performed using the lattice Boltzmann method, and two parameters control this study, Rayleigh number (Ra) and solid volume fraction (ϕ) which are in the range 10^3 - 5×10^5 and 0-0.2, respectively. The effects of these parameters on flow and heat transfer characteristics are investigated. The findings are presented in the form of streamlines, isotherms, velocity profiles, temperature plots, and the average Nusselt number. The 3D simulation gives a very clear idea of the phenomenon studied and shows that the Rayleigh number and solid volume fraction have significant effects on the rate of heat transmission.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] J. BALITI, Y. ELGUENNOUNI, M. HSSIKOU, M. ALAOUI, Simulation of Natural Convection by Multirelaxation Time Lattice Boltzmann Method in a Triangular Enclosure, *Fluids*, 7(2) (2022) 74.
- [2] M. HSSIKOU, Y. ELGUENNOUNI, J. BALITI, M. ALAOUI, Heat Transfer of Gas Flow within a Partially Heated or Cooled Square Cavity, *Modelling and Simulation in Engineering*, (2020).
- [3] Z. LI, M. YANG, Y. ZHANG, Lattice Boltzmann method simulation of 3-D natural convection with double MRT model, *International Journal of Heat and Mass Transfer*, 94 (2016) 222-238.
- [4] J. BENHAMOU, E. B. LAHMER, M. JAMI et al., 3D Numerical Investigation of Free Convection using Lattice Boltzmann and Finite Difference Methods, *International Journal of Renewable Energy Development*, 11(4) (2022).
- [5] S. M. SEYYEDI, S. SOLEIMANI, E. GHASEMI et al., Numerical investigation of laminar mixed convection in a cubic cavity by MRT-LBM: effects of the sliding direction, *Numerical Heat Transfer, Part A: Applications*, 63(4) (2013) 285-304.



Exploring the interplay between memory effects and vesicle dynamics: Exact analytical solutions

Communication Info

Authors:

Elhoussine AZROUL¹
Sara BOUDA¹
Ghizlane DIKI¹
Mohamed GUEDDA²

¹ Laboratory of Mathematical Analysis and Applications, Sidi Mohamed Ben Abdellah University

² Jules Verne University, Amiens 7352, France LAMFA, CNRS UMR, Department of Mathematics.

Keywords :

Fractional calculus, Jumarie fractional derivative, Red blood cells, Vesicles dynamics.

Abstract

Using a small deformation approach, a fractional ordinary differential system is proposed to investigate the motion and deformation of a vesicle in shear flow. Closed analytical expressions of the orientation angle and the ellipticity of the vesicle contour (shape deformation) are provided. Three different motions are identified, the classical Tank Treading state (TT); in which the vesicle deforms into a prolate ellipsoid inclined at a stationary angle smaller than $\pi/4$ with the flow, and two new types of motions, namely the overdamped tank-treading (OD-TT); in which the vesicle's orientation angle ψ and its shape deformation R tend more slowly toward equilibrium and the under-damped tank-treading (UD-TT) mode; in which ψ oscillates all the time along the flow direction with decreasing amplitude, while R starts making a breathing motion and then tends to an attractive amplitude.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] M. Guedda M. Abaidi, M. Benlahsen, C. Misbah, Dynamic modes of quasispherical vesicles: Exact analytical solutions, *Physical Review E* 86 (2012) 051915.
- [2] C. Misbah, Vacillating breathing and tumbling of vesicles under shear flow, *Physical review letters* 96 (2006) 028104.
- [3] G. Jumarie, Modified riemann-liouville derivative and fractional taylor series of nondifferentiable functions further results, *Computers & Mathematics with Applications* 51 (2006) 1367–1376.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Robust bi-level programming problems

Communication Info

Authors:

Mohsine JENNANE¹
El Mostafa KALMOUN²

¹ FSDM, Department of
mathematics, Sidi Mohamed
Ben Abdellah University, PO.
Box 1796-Atlas-Fez, Morocco

² School of Science and
Engineering, Al Akhawayn
University in Ifrane, PO Box
104, Ifrane 53000, Morocco

Keywords:

- (1) Nonlinear programming
- (2) Optimality conditions
- (3) Robustness

Abstract

Bi-level programming problems are a type of optimization problems that involve two levels of decision makers. The upper-level decision maker has full knowledge of the lower-level parameters, while the lower-level decision maker is responsible for finding a feasible solution to the problem. These types of problems are often used in applications arising in engineering, economics, and finance (for more details, readers may refer to the books [1-2] and the references therein). Robust bi-level programming problems are characterized by their ability to handle uncertainty and changes in the environment. In this communication, we propose a new approach for the study of necessary optimality conditions of these problems using robust optimization techniques. Furthermore, we provide a numerical example to illustrate the application of their results. Finally, we discuss some open problems related to this topic.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] S. Dempe, Bilevel optimization: theory, algorithms and applications (Vol. 3). TU Bergakademie Freiberg, Fakultät für Mathematik und Informatik, 2018.
- [2] S. Dempe, A.B. Zemkoho, Bilevel optimization. Springer Cham, 2020.
- [3] M. Jennane, E. M Kalmoun, L. El Fadil, Optimality conditions for nonsmooth multiobjective bilevel optimization using tangential subdifferentials, RAIRO-Oper. Res., 55(5) (2021) 3041-3048.
- [4] A. Aboussoror, S. Adly, New necessary and sufficient optimality conditions for strong bilevel programming problems, J. Glob. Optim., 70 (2018) 309-327.
- [5] J.J. Ye, D.L. Zhu, New necessary optimality conditions for bilevel programs by combining the MPEC and value function approaches, SIAM J. Optim., 20 (2010) 1885-1905.
- [6] S. Dempe, A.B. Zemkoho, KKT reformulation and necessary conditions for optimality in nonsmooth bilevel optimization, SIAM J. Optim., 24 (2014) 1639-1669.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Modelling the Adaptive Immune Response in an HBV Infection Model with Virus to Cell Transmission in Both Liver with CTL Immune Response and the Extrahepatic Tissue With Therapy

Communication Info

Authors:

Fatima Ezzahra FIKRI¹

Karam ALLALI¹

¹LMCSA, Hassan II University of
Casablanca, Casablanca,
Morocco

Keywords:

(1) HBV

(2) Stability

(3) Lyapunov functions

Abstract

The objective of this paper is to investigate a mathematical model describing the infection of hepatitis B virus (HBV) in intrahepatic and extrahepatic tissues. Additionally, the model includes the effect of the cytotoxic T cell (CTL) immunity, which is described by a linear activation rate by infected cells. The positivity and boundedness of solutions for nonnegative initial data are proved, which is consistent with the biological studies. The local stability of the equilibrium is established. In addition to this, the global stability of the disease free equilibrium and the endemic equilibrium is fulfilled by using appropriate Lyapunov functions. Finally, numerical simulations are performed to support our theoretical findings. It has been revealed the fractional order derivative has no influence on the stability but only on the speed of convergence toward the equilibria.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] R. P. Beasley, C. C. Lin, K. Y. Wang, F. J. Hsieh, L. Y. Hwang, C. E. Stevens, T. S. Sun and W. Szmuness, Hepatocellular carcinoma and hepatitis B virus, distributions, *The Lancet*, 2 (1981), 11291133.
- [2] World Health Organization Media Centre. Available: 2017. Available from: <http://www.who.int/mediacentre/factsheets/fs204/en/> Accessed 2018.
- [3] J.P. LaSalle, *The Stability of Dynamical Systems*, SIAM, Philadelphia, 1976.
- [4] S. Zhang and Y. Zhou, The analysis and application of an HBV model, *Appl. Math. Modell.*, 36 (2012), 13021312.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Two metaheuristics for the no-idle permutation flow shop scheduling problem with makespan criterion.

Communication Info

Authors:

Hajar Sadki ¹
Karam Allali ¹

¹ University, Hassan II of
Casablanca, FST Mohammedia,
Morocco

Keywords:

- (1) flow shop scheduling
- (2) makespan
- (3) the iterative local search

Abstract

In this work, our subject is to solve a flow shop scheduling problem under the constraint of no-idle. In the industry manufacturing the constraint of no-idle is very important. The goal is to minimize the makespen of all jobs with a mixed integer linear programming model (MILP). for this we will use tow efficient metaheuristics; The first is the iterative local search algorithm (ILS) and the second is the genetic algorithm (GA). We will choose different size of the instance and we will compare the result given by the metaheuristics. The numerical test show that the genetic algorithm give the best performance comparent with the the iterative local search algorithm.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Iterated Greedy methods for the distributed permutation flow shop scheduling problem, Ruiz, Rubén and Pan, Quan-Keand Naderi, Bahman, Omega, 83, 213–222, 2019.
- [2] A heuristic algorithm for the m-machine, n-job flow-shop sequencing problem, Nawaz, Muhammad and Enscore Jr, Emory and Ham, Inyong, Omega, 11, 1, 91–95, 1983.



Growth of Meromorphic Solutions of Complex Linear Differential-Difference Equations

Communication Info

Authors:

Hakima LASSAL¹
Benharrat BELAÏDI²

¹Department of Mathematics, University of Mostaganem (UMAB), Laboratory of Pure and Applied Mathematics, B. P. 227 Mostaganem-Algeria.

²Department of Mathematics, University of Mostaganem (UMAB), Laboratory of Pure and Applied Mathematics, B. P. 227 Mostaganem-Algeria

Keywords:

- (1) Order of meromorphic function.
- (2) Difference equation.
- (3) Differential equation.

Abstract

In the present paper, we investigate the order of meromorphic solutions of the homogeneous linear differential-difference equation of the form

$$\sum_{j=0}^n A_j(z) f^{(j)}(z + c_j) = 0,$$

where c_j ($j = 0, \dots, n$) are distinct complex numbers and $A_j(z)$ ($j = 0, \dots, n$) are entire functions having the same order. Under some conditions on the coefficients, we improve and extend some results of Lan and Chen in [3].

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Y. M. Chiang and S. J. Feng, *On the Nevanlinna characteristic of $f(z + \eta)$ and difference equations in the complex plane*. Ramanujan J. 16 (2008), no. 1, 105-129.
- [2] R. G. Halburd and R. J. Korhonen, *Difference analogue of the lemma on the logarithmic derivative with applications to difference equations*. J. Math. Anal. Appl. 314 (2006), no. 2, 477-487.
- [3] S. T. Lan and Z. X. Chen, *On the growth of meromorphic solutions of difference equation*. Ukrainian Math. J. 68 (2017), no. 11, 1808-1819.
- [4] C. C. Yang and H. X. Yi, *Uniqueness theory of meromorphic functions*. Mathematics and its Applications, 557. Kluwer Academic Publishers Group, Dordrecht, (2003).



Anisotropic discrete boundary value problems

Communication Info

Authors:

Omar HAMMOUTI

Mohammed First University,

Keywords:

- (1) Discrete boundary value problems
- (2) Critical point theory
- (3) Variational methods

Abstract

This work is concerned with the existence and multiplicity of nontrivial solutions for the following discrete problem

$$-\Delta(|\Delta u(t-1)|^{p(t-1)-2}\Delta u(t-1))=f(t, u(t)), t \in [1, N]_{\mathbb{Z}}$$

And

$$u(0)=u(N+1)=0,$$

where $N \geq 2$ is an integer, $[1, N]_{\mathbb{Z}}$ is the discrete interval $\{1, 2, 3, \dots, N\}$, Δ is the forward difference operator defined by

$$\Delta u(t)=u(t+1)-u(t),$$

$f: [1, N]_{\mathbb{Z}} \times \mathbb{R} \rightarrow \mathbb{R}$ is a continuous function in the second variable and $p: [0, N]_{\mathbb{Z}} \rightarrow [2, +\infty[$.

The analysis makes use of variational methods and critical point theory.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] O. Hammouti, A. El Amrouss, Existence of Solutions to a Discrete Problems for Fourth Order Nonlinear p-Laplacian Via Variational Method. Bol. Soc. Par. Mat. 41 (2023), 1-9.
- [2] O. Hammouti, Existence and multiplicity of solutions for nonlinear $2n$ -th order difference boundary value problems. J. Elli. Par. Equa., (2022), 1-17.
- [3] A. El Amrouss, O. Hammouti, Spectrum of discrete $2n$ -th order difference operator with periodic boundary conditions and its applications. Opuscula Math., 41 (4) (2021), pp. 489-507.
- [4] A. El Amrouss, O. Hammouti, Existence of multiple solutions to a discrete $2n$ -th order periodic boundary value problem via variational method. Sci. Bulletin Appl Math. And Phys., 83(3) (2021), pp. 159-170.
- [5] A. El Amrouss, O. Hammouti, Multiplicity of solutions for the discrete boundary value problem involving the p-Laplacian. Arab J. of Math. Sci.. Doi 10.1108/AJMS-02-2021-0050.
- [6] J.R. Graef, L. Kong, M. Wang, Multiple Solutions to a Periodic Boundary Value Problem for a Nonlinear Discrete Fourth Order Equation, Adv. in Dyn. System. and Appli., 8 (2013), no. 2, pp. 203-215.



Existence results for some Anisotropic Singular problems via the sub-super-solution method

Communication Info

Authors:

A. Hamidi ¹

A. El Amrouss ²

F. Kissi, ³

¹ University Mohamed I,

Faculty of sciences

Department of Mathematics

Oujda, Morocco

² University Mohamed I, Faculty
of sciences

Department of Mathematics

Oujda, Morocco

email: elamrouss@hotmail.com

³ University Mohamed I, Faculty
of sciences

Department of Mathematics

Oujda, Morocco

email: kissifouad@hotmail.com

Keywords:

(1) Anisotropic problem

(2) Singular nonlinearity

(3) Strong maximum

principle

Abstract

Using the sub-super solution method, we prove the existence of the solutions for the following anisotropic problem with singularity:

$$\begin{cases} -\sum_{i=1}^N \partial_i (|\partial_i u|^{p_i-2} \partial_i u) = f(x, u) & \text{in } \Omega, \\ u > 0 & \text{in } \Omega, \\ u = 0 & \text{on } \partial\Omega, \end{cases}$$

where $\Omega \subset \mathbb{R}^n$ is a bounded domain with smooth boundary and a given singular nonlinearity $f: \Omega \times (0, \infty) \rightarrow [0, \infty)$.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] S. Ciani, G. M. Figueiredo, and A. Suarez. Existence of positive eigenfunctions to an anisotropic elliptic operator via the sub-supersolution method. *Archiv der Mathematik*, 116(1):85-95, 2021.
- [2] G. M. Coclite and M. M. Coclite. On a dirichlet problem in bounded domains with singular nonlinearity. *Discrete and Continuous Dynamical Systems*, 33(11&12):4923, 2013.
- [3] A. Di Castro. Existence and regularity results for anisotropic elliptic problems. *Advanced Nonlinear Studies*, 9(2) : 367 - 393, 2009.
- [4] A. Di Castro. Local holder continuity of weak solutions for an anisotropic elliptic equation. *Nonlinear Differ. Equ. Appl*, 20:463-486, 2013.
- [5] A. Mohammed. Positive solutions of the p-laplace equation with singular nonlinearity. *Journal of mathematical analysis and applications*, 352(1):234-245, 2009.
- [6] K. Perera and E. A. Silva. Existence and multiplicity of positive solutions for singular quasilinear problems. *Journal of mathematical analysis and applications*, 323(2):1238-1252, 2006.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



A Fixed Points in Modular Fuzzy b -Metric Spaces

Communication Info

Authors:

Noreddine Makran

Department of Mathematical
Sciences, Mohammed Premier
University,
Oujda, Morocco

Keywords:

- (1) Fuzzy metric space
- (2) modular b -metric space
- (3) modular fuzzy b -metric
space

Abstract

The modular fuzzy b -metric space is defined in this study, and we are interested in proving a general fixed point theorem for a pair unvalued mappings in modular fuzzy b -metric spaces.

The findings in this work generalize the findings in [1] and produce additional specific findings that are supported by examples. An application to prove the existence of an integral equation's solution is shown to demonstrate the importance of our result.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] H. Kerim, W. Shatanawi, A. Tallafha and A. M. Shatnawi, Fixed point theorems on modular fuzzy metric spaces, U.P.B. Sci. Bull., Series A, Vol. 84, Iss. 1, 2022.
- [2] N. Makran, A. El Haddouchi, B. Marzouki, A common fixed point of multi-valued maps in b -Metric space. U.P.B. Sci. Bull., Series A, Vol. 82, Iss. 1, 2020
- [3] N. Makran, A. El Haddouchi, B. Marzouki, A generalized common fixed points for multivalued mappings in G_b -metric spaces with an Application}. U.P.B. Sci. Bull., Series A, Vol. 83, Iss. 1, 2021.
- [4] N. Makran, A. El Haddouchi, B. Marzouki, A generalized common fixed point of multi-valued maps in b -Metric space. Bol. Soc. Paran. Mat,

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Initial-boundary Value Problem with a Nonlocal Condition for a Nonlinear Fractional

Communication Info

Authors:

Aicha Sakhri ¹

¹ Larbi Ben Mhidi University
Oum El Bouagui , Algeria.

Keywords:

- (1) Existence and uniqueness
- (2) A priori estimate
- (3) Fractional derivatives and integrals.

Abstract

Many researchers used the functional analysis method to investigate initial boundary value problems for nonlocal classical partial differential equations [1]. For the case of the fractional equation with boundary conditions, only a few results are dealing with the existence and uniqueness of solutions [2, 3]. In this work, an nonlocal initial boundary value problem for a Caputo time-fractional order equation is studied by applying the energy inequality method; we prove the existence, uniqueness and continuous dependence of a strong solution. We establish a priori estimate and prove that the range of the operator generated by the considered problem is dense. The technique of deriving the a priori estimate is based on constructing a suitable multiplier. From the resulted energy estimate, we establish the solvability of the main problem.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] A. Bouziani Initial-boundary value problem with a nonlocal condition for a viscosity equation, International Journal of Mathematics and Mathematical Sciences., 30(6), 327-338, (2002).
 - [2] A. Sakhri, A. Merad, Solvability of nonlinear fractional integro-differential equation with nonlocal condition; Arab Journal of Mathematical Sciences. Emerald Publishing Limited 305.11.3 :(2021)
 - [3] S. Mesloub, A. Obaid, On a singular nonlocal time fractional order mixed problem with a memory term, Math. Methods Appl. Sci, 41, 4676-4690, (2018).
-

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



An efficient class of numerical methods with multidimensional generalization for solving systems of nonlinear models

Communication Info

Authors:

Munish KANSAL¹

Litika RANI¹

¹*School of Mathematics,
Thapar Institute of
Engineering and Tehnology,
Patiala-147004, India*

Keywords:

- (1) System of nonlinear equations
- (2) Multipoint methods
- (3) Convergence order
- (4) Computational efficiency

Abstract

In this work, we present two multipoint iterative families of fourth and sixth-order convergence to approximate the solutions of nonlinear systems [1] while keeping the mathematical computations as small as possible. The proposed iterative classes have been developed by utilizing only two Jacobian matrices and a single matrix inversion apart from some function evaluations. These families are further generalized by performing $q + 1$ steps to obtain the convergence order $2q + 2$. In the literature [2-5], techniques with these characteristics are infrequent. Theoretical analyses regarding convergence and computational efficiency [6] are studied and tested using a wide range of numerical problems, such as Hammerstein integral, boundary value problems, Burger's equation, etc. Numerical results indicate that the new methods lead to significantly better outcomes when compared to their existing counterparts, mainly when applied to large-scale nonlinear systems.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] J.M. Ortega, W.C. Rheinboldt, Iterative solutions of nonlinear equations in several variables, Academic Press, New York, 1970.
- [2] M. Dehghan, A. Shirilord, Three-step iterative methods for numerical solution of systems of nonlinear equations, Eng. Comput. 38 (2020) 1015–1028.
- [3] M. Narang, S. Bhatia, V. Kanwar, New two parameter Chebyshev-Halley like family of fourth and sixth-order methods for systems of nonlinear equations, Appl. Math. Comput. 275 (2016) 394–403.
- [4] A. Cordero, J.L. Hueso, E. Martínez, A modified Newton-Jarratt's composition, Numer. Algor. 55 (2010) 87–99.
- [5] G.H. Nedzhibov, A family of multi-point iterative methods for solving systems of nonlinear equations, J. Comput. Appl. Math. 222 (2008) 244–250.
- [6] A.M. Ostrowski, Solution of equation and systems of equations, Academic Press, New York, 1960.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Clustering using persistent Homology to rebuild the beta sheet 2JOX

Communication Info

Authors:

LAMINE Zakaria
Faculty of sciences, Ibn tofail
Kenitra, Morocco

Pr. My Ismail MAMOUNI
¹CRMEF, RABAT MOROCCO ²

Pr. MANSOURI Mohammed
WADIA
FSK, MOROCCO

Keywords:

- (1) point cloud
- (2) persistent homology
- (3) manifold
- (4) Beta sheet

Abstract

Nowadays giving interpretations of results of traditional statistical mathematical tools has become a cheap way to extract meaningful results able to be exploited in an interesting field such as medicine, for that reason persistent homology raised as a powerful tool to be extracting “the shape of data”, the last term itself is already a truth. et al. [1], Using functoriality and set theory is the key idea behind the new theory et al. [2], in this context we will be giving a contribution through this work by the analysis of a point clouds, constructed using persistent homology from the pdb file 2JOX in order to rebuild the manifold supporting the beta sheet, we will be using javaplex to compute statistical tests and methods et al. [3], an attempt to understand the “statistics” of the new born was made by Andrew robinson and Katharine Turner et al. [4].

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Persistent homology analysis of protein structure, flexibility and folding, Kelin Xia and Guo-Wei Wei, 2014
- [2] Gunnar Carlsson, Topology and data. 2009.
- [3] Violeta kovacev-Nicolic, Peter Bubenik, Dragan Nikolic and Giseon Heo, Using persistent homology and dynamical distances to analyze protein binding 2016.
- [4] Hypothesis testing for TDA, Andrew Robinson, Katharine Turner. 2016.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Image classification and segmentation for Brain Tumor Prognosis using DCNN

Communication Info

Authors:

Hanane ZAHRAOUI¹
Mohammed ZIANI¹

¹LMSA, Department of
Mathematics, Faculty of
Sciences, Mohammed V
University in Rabat

Keywords:

- (1) DCNN Segmentation
- (2) DCNN Classification
- (3) Brain images by MR
- (4) Automatic brain tumor segmentation and classification.

Abstract

The categorization of brain images by MR has been an active area of research over the last decade since the MR technique has become more popular due to its non-invasive principle [1]. Several techniques have been designed in the past for the categorization of MR images, ranging from classical methods to deep learning methods such as convolutional neural networks (CNNs). Widely used for the segmentation of biomedical images, convolutional neural networks have significantly improved the state-of-the-art accuracy of the brain tumor segmentation task. The CNNs also can perform the classification by extracting the characteristics of the image directly from raw images via the adjustment of the parameters of the convolution and grouping layer [2]. CNNs carry out the classification by extracting the characteristics of the image directly from raw images via the adjustment of the parameters of the convolution and grouping layer. The characteristics extracted by CNN are highly dependent on the size of the training dataset. If the training dataset is small, CNN tends to overfit after several epochs. Thus, deep CNNs (DCNNs) with transfer learning has evolved. This work aims to accurately diagnose brain tumors by exploring the capacity of different pre-trained DCNN models with transfer learning for the classification and segmentation of pathological brain images.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] T. Kaur, T. Kumar Gandhi, Deep convolutional neural networks with transfer learning for automated brain image classification, Machine Vision and Applications, Year: 2020, Volume: 31, Issue: 3.
- [2] A. Kermi, I. Mahmoudi, M.T Khadir, Deep Convolutional Neural Networks Using U-Net for Automatic Brain Tumor Segmentation in Multimodal MRI Volumes, Springer Nature Switzerland AG 2019.
- [3] Munir, K.; Frezza, F.; Rizzi, A. Deep Learning Hybrid Techniques for Brain Tumor Segmentation. Sensors 2022, 22, 8201.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Méthode de recouvrement non-uniforme d'optimisation globale

Communication Info

Authors:

Djaouida GUETTAL¹
Mohamed RAHAL¹

¹Laboratoire de Mathématiques
Fondamentales et Numériques,
Département de Mathématiques,
Faculté des Sciences,
Université Ferhat Abbas, Sétif 1,
Algérie

Keywords:

- (1) Optimisation Globale
- (2) Méthode de recouvrement non-uniforme
- (3) Méthode de la transformation réductrice
- (4) Fonction höldérienne

Abstract

Dans ce travail, nous présentons une méthode itérative pour résoudre un problème d'optimisation globale, en s'inspirant de l'algorithme de recouvrement itératif non-uniforme d'Evtushenko pour les fonctions lipschitziennes, nous montrons qu'elle peut être étendue aux fonctions höldériennes. La mise en œuvre de l'algorithme et la technique a l'avantage de ne pas utiliser des calculs intermédiaires difficiles, telle la construction des fonctions minorantes ou exiger de la fonction d'être dérivable, ce qui permet de réduire considérablement le temps de calcul par rapport aux autres techniques. Pour le cas multidimensionnel, nous présentons la méthode de la transformation réductrice, Le principe fondamental de cette technique consiste à effectuer une transformation qui permet de ramener le problème d'optimisation multidimensionnel à un problème unidimensionnel afin d'appliquer les méthodes d'optimisation plus efficaces adaptées au cas d'une seule variable.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] R. Horst, P. M. Pardalos, Handbook of Global Optimization, Kluwer Academic Publishers, Dordrecht. (1995).
- [2] D. Guettal and A. Ziadi, Reducing Transformation and Global Optimization, Applied Mathematics and Computation, 218, (2012) 5848-5860.
- [3] D. Guettal, Efficacité et fiabilité des méthodes utilisant l'approche 'Branch-and-Bound' pour l'optimisation globale non convexe. Thèse de doctorat en sciences, Université Ferhat Abbas Sétif1, (2014).
- [4] M. Rahal, Extension de certaines méthodes de recouvrement en optimisation globale. Thèse de Doctorat en sciences, Université Ferhat Abbas, Sétif, (2009).
- [5] M. Rahal, A. Ziadi and R. Ellaia, Generating α -dense curves in non-convex sets to solve a class of non-smooth constrained global optimization, Croatian Operational Research Review, 10, (2019) 289-314.
- [6] A. Ziadi, D. Guettal and Y. Cherruault, Global optimization: The Alienor mixed method with Piyavskii-Shubert technique, Kybernetes, 34 (7/8) (2005) 1049-1058.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Solving transient infiltration flow with an imposed flux boundary using Localized meshless method.

Communication Info

Authors:

Hani HAFIDI¹
Ahmed NAJI¹
Abdelkrim AHARMOUCH²

¹LMA, Abdelmalek Essaadi,
FST, Tanger, Morocco

²LISAC, Sidi Mohamed Ben
Abdellah, FS, FES, Morocco

Keywords:

- (1) Localized Meshless method
- (2) RBF, MQ
- (3) Richards equation

Abstract

The main focus of this talk is solving water infiltration with an imposed flux boundary in soil that is not fully saturated. This type of water movement can be described using the Richards equation, which is a nonlinear mathematical equation that cannot be solved easily. To tackle this equation, the presentation proposes using two specific numerical techniques. The first technique involves using a localized meshless method for dividing up the space, which is known for its precision, efficiency and ease of use. The second technique involves using the Euler backward scheme to handle the transient term and the non-iterative Picard method to simplify the gradient term. A numerical test is given involving transient infiltration flow with Neumann conditions in 1D and 2D. The results of these numerical simulations were compared to experimental and numerical data, and it was found that the results are accurate and reliable for predicting water movement in unsaturated soils.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] A. Aharmouch and B. Amaziane, "Efficient mass conservative numerical model for solving variably saturated groundwater flow," *Journal of Hydrology*, vol. 603, p. 126976, Dec. 2021
- [2] R.W. Matthew W. Farthing, Fred L. Ogden, Numerical Solution of Richards' Equation, A Review of Advances and Challenges., *Soil Science Society of America Journal Volume 81, Issue 6 Nov 2017 Pages 1257-1697.*
- [3] M.Li, W. Chen, and C. S. Chen, The localized RBFs collocation methods for solving high dimensional PDEs, *Engineering Analysis with Boundary Elements*, vol. 37, no. 10, pp. 13001304, Oct.
- [4] G. R. Liu and Y. T. Gu, *An Introduction to Meshfree Methods and Their Programming*. Springer Science and Business Media, Dec. 2005, google-Books-ID : 0xS 2XlQ Q0C.
- [5] C. K. Lee, X. Liu, and S. C. Fan, Local multiquadric approximation for solving boundary value problems. *Computational Mechanics*, vol. 30, no. 5, pp. 396409, Apr. 2003.
- [6] E. J. Kansa, Multiquadrics-A scattered data approximation scheme with applications to computational fluid-dynamicsII solutions to parabolic, hyperbolic and elliptic partial differential equations. *Computers and Mathematics with Applications*, vol. 19, no. 8, pp. 147161, Jan. 1990.
- [7] R. Haverkamp, M. Vauclin, J. Touma, P. J. Wierenga, and G. Vachaud, "A Comparison of Numerical Simulation Models For One-Dimensional Infiltration," *Soil Science Society of America Journal*, vol. 41, no. 2, pp. 285-294, 1977

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Novel Results on Qualitative Problems of Integro-Differential Equations

Communication Info

Authors: Osman Tunç

Department of Computer,
Baskale Vocational School,
Van Yuzuncu Yil University,
65080, Campus, Van – Turkey

Keywords:

- (1) Lyapunov-Krasovkii functional
- (2) Stability
- (3) Integrability
- (4) Boundedness

Abstract

In this paper, various properties of solutions to an integro-differential equation are discussed by the Lyapunov-Krasovkii functional approach. We demonstrate some new results in relation to the qualitative behaviors of the considered equation's solutions. The applicability of the findings of this research are shown by some examples.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] O. Tunç, C. Tunç, J. C. Yao, C. F. Wen, New Fundamental Results on the Continuous and Discrete Integro-Differential Equations, *Mathematics*, 2022, 10(9), 1377.
- [2] C. Tunç, O. Tunç, On the Fundamental Analyses of Solutions to Nonlinear Integro-Differential Equations of the Second Order, *Mathematics*, 2022, 10(22), 4235.
- [3] S. Pinelas, O. Tunç, Solution estimates and stability tests for nonlinear delay integro-differential equations. *Electron. J. Differential Equations* 2022, Paper No. 68, 12 pp.
- [4] O. Tunç, Stability, instability, boundedness and integrability of solutions of a class of integro-delay differential equations. *J. Nonlinear Convex Anal.* 23 (2022), no. 4, 801–819.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



The Optimal Control Strategy of New Model of HIV/AIDS Transmission Based on Caputo-Fabrizio Derivative Order

Communication Info

Authors:

Nassira MADANI¹
Zakia HAMMOUCH^{2,3}
Elhoussine AZROUL⁴

¹LAMA, Sidi Mohamed Ben Abdellah University of Fes, Fes Morocco

²ENS, Moulay Ismail University of Meknes, Meknes, Morocco

³Thu Dau Mot University, Vietnam.

⁴LAMA, Sidi Mohamed Ben Abdellah University of Fes, Fes Morocco.

Keywords:

- (1) Caputo-Fabrizio derivative
- (2) Dynamical systems
- (3) Stability analysis
- (4) Reproduction number

Abstract

The aim of this article is to produce a new epidemic model of HIV/AIDS transmission, we take into consideration the individuals who don't know of their infection. In this paper, we propose a Caputo-Fabrizio order fractional model for HIV/AIDS, the analysis of local stability about the equilibrium. Furthermore, we cited the fractional optimal control problem associated with the control strategies. Numerical simulation to illustrate the stability of equilibria and the behavior of the obtained solutions is also discussed.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Van den Driessche, Pauline, and James Watmough. "Reproduction numbers and sub-threshold endemic equilibria for compartmental models of disease transmission." *Mathematical biosciences* 180.1-2 (2002).
- [2] Zakia Hammoucha, Rando R.Q. Rasul, Abdelouahed Alla Hamou, Canan Unlu, Karwan H.F. Jwamer. "Dynamics investigation and numerical simulation of fractional-order 2 Predator-Prey model with Holling type II functional response." *International Journal of Biomathematics*.
- [3] Huo, Hai-Feng, Rui Chen, and Xun-Yang Wang. "Modelling and stability of HIV/AIDS epidemic model with treatment." *Applied Mathematical Modelling* 40.13-14 (2016).
- [4] Naik, Parvaiz Ahmad, Jian Zu, and Kolade M. Owolabi. "Global dynamics of a fractional order model for the transmission of HIV epidemic with optimal control." *Chaos, Solitons and Fractals* 138 (2020).
- [5] J.E. Solís-Pérez, J.F. Gómez-Aguilar, A. Atangana, Canan Unlu. "Novel numerical method for solving variable-order fractional differential equations with power, exponential and Mittag-Leffler laws." *Journal of Chaos, Solitons and Fractals*, (2018).

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Analysis of the impact of migration using the SIA fractional model

Communication Info

Authors:

Safae L'kima¹
Elhoussine Azroul²
Abdelouahed Alla Hamou^{3,4}

¹LAMA, Sidi Mohamed Ben
Abdellah University, Fez,
Morocco

²LAMA, Sidi Mohamed Ben
Abdellah University, Fez,
Morocco

³LAMA, Sidi Mohamed Ben
Abdellah University, Fez,
Morocco

Keywords:

- (1) Caputo fractional derivative
- (2) Stability analysis
- (3) Reproduction number

Abstract

Every year, millions of people die in the world because of infectious diseases, such as human immunodeficiency virus infection and acquired immunodeficiency syndrome (HIV/AIDS).

In this article, we discuss how migration affects the growth of HIV and AIDS cases. In order to account for migration's role in the spread of HIV and AIDS cases, we created a simple fractional model for HIV and AIDS. Data on the incidence of HIV and AIDS in Malaysia were used to calibrate the model. The fractional models are demonstrated to have a disease-free and endemic equilibrium point, and the existence and uniqueness of solutions for the fractional model with migration and without migration are proven. The local and global stability of the disease-free equilibrium of the model are calculated. For the numerical simulation of the models under consideration, the fractional Adams-Bashforth approach is created

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Ofosuhene O. Apenteng, Prince P. Osei, Noor Azina Ismail, and Aline Chiabai. *Analysing the impact of migration on hiv/aids cases using epidemiological modelling to guide policy makers*. Infectious Disease Modelling, 7 :252-261, 32022.
- [2] Jagdev Singh, Devendra Kumar, Zakia Hammouch, and Abdon Atangana. A fractional epidemiological model for computer viruses pertaining to a new fractional derivative. *Appliedmathematicsandcomputation*, 316:504-515, 2018.
- [3] I. Podlubny. *Fractional differential equations : an introduction to fractional derivatives, fractional differential equations, to methods of their solution and some of their applications*, Elsevier, 1998.
- [4] Michael S Gottlieb, Howard M Schanker, Peng Thim Fan, Andrew Saxon, Joel D Weisman, Irving Pozalski, et al, Pneumocystis pneumonias angles, *Mmwr*, 30(21):250-2, 1981.
- [5] Kai Diethelm, Neville J Ford, Alan D Freed, A predictor-corrector approach for the numerical solution of fractional differential equations, *Nonlinear Dynamics*, 29(1):3-22, 2002.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Robustness of a Tumor Growth Model

Communication Info

Authors:

Sema YAYLA¹

¹Department of Mathematics,
Faculty of Science,
Hacettepe University,
Beytepe 06800, Ankara, Turkey

Keywords:

- (1) Cahn-Hilliard equations
- (2) Long-time dynamics
- (3) Stability of global ttractors
- (4) Robustness of exponential attractors.

Abstract

In this study, we investigate the robustness of the global and exponential attractors of a tumor growth model. Namely, by considering the chemotaxis term as a perturbation parameter, we obtain a family of global attractors for the tumor growth model. Then, we prove that the family of the global attractors is upper-semicontinuous. Moreover, we construct a robust family of exponential attractors for this tumor growth model. Furthermore, by using Łojasiewicz-Simon inequality, we establish some further geometric properties of the global attractors.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] I. Chueshov, I. Lasiecka, Von Karman Evolution Equations: Well-posedness and long-time dynamics. Springer, Berlin, 2010.
- [2] R. Chill, On the Łojasiewicz–Simon gradient inequality. *J. Funct. Anal.*, 201(2) (2003) 572–601.
- [3] R. Chill, E. Fasangová, J. Prüss, Convergence to steady states of solutions of the Cahn–Hilliard equation with dynamic boundary conditions. *Math. Nachr.* 279(13–14) (2006) 1448–1462.
- [4] E. Feireisl, F. Simondon, Convergence for semilinear degenerate parabolic equations in several space dimensions. *J. Dyn. Differ. Equ.* 12(3), (2000) 647–673.
- [5] H. Garcke and S. Yayla. Long-time dynamics for a Cahn-Hilliard tumor growth model with chemotaxis. *Z. Angew. Math. Phys.*, 71(4):Paper No. 123, 32, (2020).
- [6] M. Efendiev, A. Miranville, and S. Zelik, Exponential attractors for a singularly perturbed Cahn-Hilliard system, *Math. Nachr.*, 272, (2004) 11–31.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Coupled systems of evolution problems involving ρ -Caputo fractional derivative

Communication Info

Authors:

M'hamed Elomari

Fatima Ezzahra Bourhim

Kassidi Abderazzak

Ali El Mfadel

LMACS, University Sultan
Moulay Slimane, Beni Mellal,
Morocco.

Keywords:

(1) Coupled systems.

(2) ρ -Caputo fractional derivative.

(3) Monch's fixed point theorem.

Abstract

In this article, we investigate the existence of solutions to a coupled system evolution problems involving ρ -Caputo fractional derivative equations.

The approach taken in this study is based on measure of noncompactness and the well-known Mönch's fixed point theorem. The theoretical results are illustrated by providing a suitable example.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Abbas, S., Benchohra, M., Hamidi, N., Zhou, Y.: Implicit coupled Hilfer-Hadamard fractional differential systems under weak topologies. *Adv. Differ. Equ.* (2018).
- [2] Almeida, R.: A Caputo fractional derivative of a function with respect to another function. *Commun. Nonlinear Sci. Numer. Simul.* 44, 460481 (2017).
- [3] Monch, H. Boundary value problems for nonlinear ordinary differential equations of second order in Banach spaces. *Nonlinear Anal.* 4, 985999 (1980).

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Generalized Solutions for Semilinear Fractional Evolution Equations

Communication Info

Authors:

Abdelmjid Benmerrous¹

Lalla saadia Chadli¹

Abdelaziz Moujahid¹

M'hamed Elomari¹

Said Melliani¹

¹Laboratory of Applied Mathematics and Scientific Computing, Sultan Moulay Slimane University, PO Box 532, Beni Mellal, 23000, Morocco.

Keywords:

- (1) Colombeau algebra
- (2) Generalized solution
- (3) Laplace transforms
- (4) ψ -cosine family

Abstract

The algebras of Colombeau are constructed by J. F. Colombeau [5, 6], as factor algebras of infinite powers of the space C^∞ modulo a particular class of ideals. Elements of these algebras are classes of nets of smooth functions. This theory was been used for solving the linear and nonlinear partial differential equations with singularities [1], for example M. Oberguggenberger and Y.G. Wang, studied the Delta-waves for semi linear hyperbolic Cauchy problems [7]. In this communication, we are interested to study the next equation $D_\phi^\alpha u(x, t) = Au(x, t) + F(x, u(x, t))$

in Colombeau algebra. The notion of ψ -Cosine family is introduced and demonstrated in Colombeau algebra. Using Banach's fixed point theorem and Laplace transforms, we gave the integral solution of the problem. In Colombeau's algebra, The existence and uniqueness of the solution are demonstrated using the Gronwall lemma.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] A Benmerrous, A., Chadli, L. S., Moujahid, A., M'hamed, E., & Melliani, S. (2022). Generalized solution of Schrödinger equation with singular potential and initial data. *International Journal of Nonlinear Analysis and Applications*, 13(1), 3093-3101.
- [2] Benmerrous, A., Chadli, L.s., Moujahid, A. et al. Generalized Cosine Family. *J Elliptic Parabol Equ* (2022). <https://doi.org/10.1007/s41808-022-00156-x>.
- [3] Benmerrous, A., Chadli, L. S., Moujahid, A., Elomari, M. H., & Melliani, S. (2022). Colombeau products of distributions. *International Journal On Optimization and Applications*, 11.
- [4] Benmerrous, A., Chadli, L. S., Moujahid, A., Elomari, M. H., & Melliani, S. (2022, October). Solution of Schrödinger type Problem in Extended Colombeau Algebras. In *2022 8th International Conference on Optimization and Applications (ICOA)* (pp. 1-5). IEEE.
- [5] J.F.Colombeau. Elementary introduction to new generalized functions. North-Holland.
- [6] KJ.F.Colombeau. Multiplication of Distributions: A tool in mathematics, numerical engineering and theoretical physics. Springer-Verlag Berlin Heidelberg.
- [7] M. Oberguggenberger and Y.G. Wang, Delta-waves for semi linear hyperbolic Cauchy problems, *Math. Nachr.*, 166 (1994) 317-327.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Existence of Renormalized Solutions for $p(x)$ -Parabolic Equations with General Data and

Communication Info

Authors:

Abdelaziz Sabiry¹
Said Melliani¹
Abderrazak Kassidi¹

Laboratory LMACS, FST of
Beni-Mellal

Keywords:

- (1) Renormalized solutions
- (2) Perturbed terms
- (3) Measure data.

Abstract

In this manuscript, we investigate the existence of renormalized solutions for a nonlinear parabolic problem involving $p(x)$ -growth conditions. We prove a theorem that guarantees the existence of a solution for a problem involving a Leray-Lions operator that satisfies the $p(x)$ -growth conditions with respect to u and ∇u , an unbounded term $b(x,u)$, and a general measure as the right-hand side.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Blanchard, D., Murat, F.: Renormalized solutions of nonlinear parabolic problems with L^1 data, existence and uniqueness. Proc. R. Soc. Edinb. Sect. A 127, 11371152 (1997)
- [2] Blanchard, D., Porretta, A.: Stefan problems with nonlinear diffusion and convection. J. Dier. Equ. 210(2), 383428 (2005)
- [3] Blanchard, D., Redwane, H.: Renormalized solutions for a class of nonlinear evolution problems. J. Math. Pures Appl. 77(2), 117151 (1998)
- [4] Blanchard, D., Petitta, F., Redwane, H.: Renormalized solutions of nonlinear parabolic equations with diffuse measure data. Manuscr. Math. 141(34), 601635 (2013)
- [5] Boccardo, L., Gallouët, T.: Nonlinear elliptic and parabolic equations involving measure data. J. Funct. Anal. 87, 149169 (1989)

[6]

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Existence and uniqueness of solutions of nonlinear Langevin fractional differential equation

Communication Info

Authors:

Ihya TALIBI¹
Brahim EL BOUKARI¹
Jalila EL GHORDAF¹

¹LMACS, Sultane Moulay
Slimane University, Beni Mellal,
Morocco

Keywords:

- (1) Differential equation
- (2) Fractional Langevin equation
- (3) Existence and uniqueness

Abstract

In this presentation [1], we introduce a fractional Caputo problem with some initial conditions, we are interested in the existence and uniqueness of solutions to the problem using Krasnoselskii fixed point and contraction mapping principle. Moreover, we present several examples to show the clarification and effectiveness.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] H. Fazli, J.J. Nieto, Fractional Langevin equation with anti-periodic boundary conditions, Chaos Solitons Fractals, 114:332–337, 2018.



Periodic Solutions for Parabolic Fractional p-Laplacian Problems Via Topological Degree

Communication Info

Authors:

Ghizlane ZINEDDAINE¹
Said MELLIANI¹
Abderrazak KASSIDI¹

¹LMACS, FST, Sultan Moulay
Slimane University, Beni Mellal,
Morocco.

Keywords:

- (1) Periodic solutions
- (2) Fractional p-Laplacian
- (3) Topological degree
- (4) Parabolic equations

Abstract

In this work, we consider the nonlinear parabolic initial boundary value problem involving the fractional p-Laplacian operator. We employ topological degree methods to establish the existence of a time periodic nontrivial weak solutions in the appropriate space

$$X := L^p(0, T; W^{s,p}(\Omega)).$$

Our approach to proving the main result is based on transforming this nonlinear parabolic problem into an operator equation of the shape

$$Ku + Bu = h,$$

where B is of type (S_+) relative in the domain of densely defined linear maximal monotone operator K.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] A. Abbassi, C. Allalou, and A. Kassidi, Existence results for some nonlinear elliptic equations via topological degree methods. *Journal of Elliptic and Parabolic Equations*, 7(1), (2021) 121-136
- [2] A. Abbassi, C. Allalou, and A. Kassidi, Topological degree methods for a Neumann problem governed by nonlinear elliptic equation. *Moroccan Journal of Pure and Applied Analysis*, 6(2), (2020a) 231-242
- [3] H. El Hammar, C. Allalou, A. Abbassi, and A. Kassidi, The topological degree methods for the fractional $p(\cdot)$ Laplacian problems with discontinuous nonlinearities, *Cubo (Temuco)*, 24(1), (2022) 63-82.
- [4] M. A. Hammou, Quasilinear parabolic problem with $p(x)$ -Laplacian operator by topological degree, *Kragujevac Journal of Mathematics*, 47(4), (2023) 523-529.
- [5] M. Tao, and B. Zhang, Positive Solutions for Perturbed Fractional p-Laplacian Problems. *Fractal and Fractional*, 6(10), (2022) 571
- [6] E. Zeidler, *Nonlinear Functional Analysis and its Applications, II\B: Nonlinear Monotone Operators*, Springer, New York (1990).



Existence of non-negative periodic solutions for a degenerate double phase Laplacian parabolic equation with strongly nonlinear source

Communication Info

Authors:

Hamza JOURHMANE¹
Abderrezak KASSIDI¹
M'hamed ELOMARI¹
Khalid HILAL¹

¹LMACS, Faculty of Science and
Technology of Beni Mellal,
Sultan Moulay Slimane
University, Beni Mellal,
Morocco.

Keywords:

- (1) Topological degree,
- (2) Periodic solution,
- (3) Generalized Sobolev spaces,
- (4) Dirichlet conditions,
- (5) Interior-point method.

Abstract

The goal of this communication is the study of a degenerate parabolic equation[1] with double phase phenomena[2,3] and strongly nonlinear source[4] under Dirichlet boundary conditions, the existence of a non-negative periodic[5] weak solution is proved. Our proof will be based on the Leray-Schauder topological degree[6], which presents many issues for this kind of equations, but were overcome by using different techniques or known theorems. The considered system is a possible model for problems where the entity studied has different growth coefficients, p and q in our case, in different areas.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] E. Di Benedetto, Degenerate Parabolic Equations, Springer-Verlag, New York, (1993).
- [2] P. Baroni, M. Colombo, G. Mingione, Harnack inequalities for double phase functionals, Nonlinear Anal. 121(2015), 206–222.
- [3] M. Colombo, G. Mingione, Bounded minimisers of double phase variational integrals, Arch. Ration. Mech. Anal. 218 (2015), no. 1, 219–273.
- [4] Z. Junjng, On the Cauchy problem and initial traces for the evolution p -Laplacian equations with strongly nonlinear sources, J. Differential Equations 121 (1995) , 329-383.
- [5] M. Esteban, A remark on the existence of positive periodic solutions of superlinear parabolic problems, Proc. Amer. Math. Soc. 102(1988), 131-136.
- [6] J. Berkovits, Extension of the LeraySchauder degree for abstract Hammerstein type mappings. Journal of Differential Equations, 2007, vol. 234, no 1, p. 289-31.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Study of the Cauchy problem involving Ψ -Caputo fractional derivative in Colombeau algebra

Communication Info

Authors:

Latifa El Bezdaoui 1
Mhamed ElOmari 1
Lalla Saadia chadli 1

*1 Laboratory of Applied Mathematics and
Scientific Computing,
Sultan Moulay Slimane University, 23000,
Beni Mellal, Morocco*

Keywords:

(1) Ψ -Caputo Fractional
derivative

Abstract

Colombeau algebra G is introduced by F. Colombeau in 1982. This algebra is a differential algebra which contains the spaces D of distribution. In this communication, we embed Ψ -Caputo Fractional derivative in Colombeau algebra and proved the existence and uniqueness of the solution of the Cauchy problem involving Ψ -Caputo Fractional derivative in Colombeau algebra. Finally, we present an example for application of the ideas presented in communication to confirm the reason of introducing Ψ -Caputo into Colombeau algebra of generalized functions.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] J. F. Colombeau, New Generalized Functions and Multiplication of Distributions. North Holland, 1983.
- [2] S. Melliani, A.Moujahid, L. S. Chadli and M.Elomari, Generalized solution for fractional Cauchy problem J. Adv. Math. Stud. 9(10)(2016),17-25
- [3] M. Stojanovic, Extension of Colombeau algebra to derivatives of arbitrary order D^α , $\alpha \in \mathbb{R}^+$. Application to ODEs and PDEs with entire and fractional derivatives, Nonlinear Analysis 71 (2009), 5458-5475.
- [4] M. Stojanovic, Fondation of the fractional calculus in generalized function algebras. Anal. Appl. 10(4)(2012),439-467

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Existence and uniqueness of the solution of a conformable fractional problem with a non-local condition

Communication Info

Authors:

El mehdi IBRAHIMI*¹
Ahmed KAJOUNI¹
Khalid HILAL¹

¹LMACS, University Sultan
Moulay Slimane Faculty of
Science and Technology,
Morocco

Keywords:

- (1) Conformable fractional derivative
- (2) Non-local condition
- (3) Strongly continuous semi group
- (4) Infinitesimal generator
- (5) Sectorial operator

Abstract

Fractional calculus is a generalization of the classical differential calculus, it models physical phenomena well, that is why we study fractional problems because it gives results close to reality for example crowd behavior a new language for explaining complex crowd behavior is fractional calculus. The nonlocal condition, has been a hot topic in recent years. Their association with the classic problems has brought a lot of improvement to the level of the modeling, thus making it more realistic. The nonlocal condition attached to the main equation instead of the classical initial condition turns out to be necessary to model and describe mathematically well physical phenomena such as electronics, mechanics in the way closest to the reality of many phenomena in multiple disciplines. The nonlocal condition means that the initial condition depends on some future time. In this work, we show the existence and uniqueness for a coupled system of nonlinear fractional differential equations with a conformable fractional derivative, with a nonlocal condition.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Nagel, R. and Sinestrari, E. – Inhomogeneous volterra integro-differential equations for Hille-Yosida operators, Marcel Dekker, Lecture Notes Pure Appl. Math.,150, 1994.
- [2] T.Abdeljawad, on conformable fractional calculus, journal of computational and applied mathematics 279(2015)57-66.
- [3] M. Bouaouid, k. Hilal et S. Melliani nonlocal conformable fractional cauchy problem with sectorial operator, department of mathematics, Sultan Moulay Slimane University, BP 523,23000 Beni Mellal, Morocco.
- [4] T.A Burton, FIXED POINT THEOREM OF KRASNOSELSKI, department of mathematics Southern Illinois University Carbondale, IL 62901.
- [5] J.A.Goldstein, semigroups of operators and applications, Oxford University Press, 1985.
- [6] A.Granas and J.Dugundji, Fixed Point Theory, Springer-Verlag, New York, 2003.
- [7] R. Khalil, M. Al Horani, A. Yousef, M. Sababheh, A new derivative, Journal of Computational and Applied Mathematics 264(2014)65-70.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Optimization method for a nonlinear elliptic problem in weighted Sobolev spaces with variable exponent

Communication Info

Authors:

Lhoucine HMIDOUCH¹
Ahmed JAMEA^{1,2}
Mohamed LAGHDIR¹

¹Lite, Faculty of Sciences
Chouaib Doukkali University,
El Jadida, Morocco
²Equipe STIE, CRMEF
Casablanca-Settat
S.P. El Jadida, Morocco

Keywords:

(1) Nonlinear degenerate
elliptic problem.
(2) Weak solutions.
(3) Weighted Sobolev space
with variable exponent.

Abstract

Let $\Omega \subset R^N$ ($N \geq 2$) be a bounded open set, p be a real number such that $2 < p < \infty$. Our aim in this work is to study the existence for weak solution in weighted Sobolev spaces of the nonlinear degenerate elliptic problem

$$\begin{cases} -\operatorname{div} \omega |\nabla u - \theta(u)|^{p(x)-2} (\nabla u - \theta(u)) + \omega |u|^{p(x)-2} u = f \text{ in } \Omega \\ u = 0 \text{ in } \partial\Omega, \end{cases}$$

where ω , is a measurable positive and a.e finite function defined in R^N , is real function satisfying the following assumptions:

$$(H_1) \omega \in L^1_{loc}(\Omega) \text{ and } \omega^{\frac{-1}{p(x)-1}} \in L^1_{loc}(\Omega).$$

$$(H_2) \omega^{-s(x)} \in L^1(\Omega) \text{ where } s \in \left(\frac{N}{p(x)}, \infty\right) \cap \left(\frac{1}{p(x)-1}, \infty\right].$$

(H₃) θ is a function defined on R such that $\theta(0) = 0$ and there exists positive constant λ such that $|\theta(x) - \theta(y)| \leq \lambda|x - y|$
for all $x, y \in R, 0 < \lambda < \frac{1}{2}$.

$$(H_4) f \in L^\infty(\Omega).$$

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

[1] M. Xu, S. Zho, Existence and uniqueness of weak solutions for a generalized thin Δ_p equation, Nonlinear Anal. 60 (2005), 755-774.

[2] C. Zhang, S. Zhou, Renormalized and entropy solutions for nonlinear parabolic equations with variable exponents and An L1 data. J. Differential Equations 248 (2010), 1376-1400.

[3] V. Zhikov : On some variational problems, Russ. J. Math. Phys. 5 (1997), 105-116.



Obstacle Two Phase Equations with Hardy Potential

Communication Info

Authors:

Ahmed ABERQI¹

¹National School of Applied Sciences, Sidi Mohamed Ben Abdellah University, Fez, Morocco.

Keywords:

- (1) Double Phase Equation
- (2) Hardy Potential
- (3) Obstacle function
- (4) Ricceri's variational principle

Abstract

We investigate the existence and the multiplicity of solutions to the following singular unilateral double phase problem:

$$\begin{aligned} -\operatorname{div}(|\nabla u|^{p-2} \nabla u + \beta(x)|\nabla u|^{q-2} \nabla u) &= \mu h(x, u) \\ &+ \beta \frac{|u|^{p-2} u}{|x|^p} && \text{in } \Omega, \\ u &= 0 && \text{on } \partial \Omega; \\ u(x) &\leq \varphi(x) && a. e. \text{ in } \Omega. \end{aligned}$$

Where, Ω is a bounded domain IR^n , containing the origin and with smooth boundary $\partial \Omega$. Based on Ricceri's variational principle and Bonanno's three critical points Theorem, we prove the existence and multiplicity of solutions under some general assumptions on the nonlinearity $h(x, u)$, which does not satisfy the Ambrosetti-Rabinowitz condition.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] A. Aberqi, J. Bennouna, O.Benslimane and M. A. Ragusa; Weak solvability of nonlinear elliptic equations involving variable exponents, Discrete and Continuous Dynamical Systems - Series S, doi: 10.3934/dcdss.2022105.
- [2] A.Aberqi, O.Benslimane, A. Ouaziz and D.D. Repovs; On a new fractional Sobolev space with variable exponent on complete manifolds, Boundary Value Problems volume 7(2022).
- [3] P. Baroni, M. Colombo, G. Mingione, Harnack inequalities for double phase functionals, Nonlinear Anal. 121 (2015), 206-222.
- [4] O. Benslimane, A. Aberqi, J. Bennouna, Existence results for double phase obstacle problems with variable exponents. Journal of Elliptic and Parabolic Equations. 7(2), (2021),875-890.
- [5] Bonanno, G. Some remarks on a three critical points theorem. Nonlinear Anal. 2003, 54, 651-665. Appl. Math., 236 (2012) 1919-1925.
- [6] B. Ricceri, A general variational principle and some of its applications. J. Comput. Appl. Math. 2000, 113, 401-410.. Sci., 4 (2010) 3289-3306.



On a class of double phase problem involving potentials terms

Communication Info

Authors:

Ahmed Aberqi¹
Omar Benslimane²
Mohamed Knifdaz

¹ Laboratory LAMA, National
School of Applied Sciences, Sidi
Mohamed Ben Abdellah
University, Fez, Morocco

² Laboratory LAMA,
Department of Mathematics,
Faculty of Sciences Dhar El
Mahraz, Sidi Mohamed Ben
Abdellah University, B.P 1796,
Atlas Fez, Morocco

Keywords:

- (1) Existence of solutions
- (2) Double phase operator
- (3) Laplacian

Abstract

In this study, we show that there exists a non-negative, non-trivial solution to a class of double phase problems

$$\begin{cases} -\operatorname{div}(|Dw(z)|^{r(z)-2}Dw(z) + \mu(z)|Dw(z)|^{s(z)-2}Dw(z)) \\ = \lambda|w(z)|^{s(z)-2}w(z) - |w(z)|^{r(z)-2}w(z) \\ w = 0 \end{cases}$$

Involving potentials allowing for vanishing behavior at infinity, in the context of Sobolev-Orlicz spaces with variable exponents in complete compact Riemannian n-manifolds. The Nehari manifold and other variational method are used in our approach.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Aberqi, A., Benslimane, O., Ouaziz, A., Repovš, D.D.: On a new fractional Sobolev space with variable exponent on complete manifolds. *Boundary Value Prob.* 2022, 1–20 (2022)
- [2] Aberqi, A., Bennouna, J., Benslimane, O., Ragusa, M.A.: Existence Results for double phase problem in Sobolev-Orlicz spaces with variable exponents in Complete Manifold. *Mediterranean J. Math.* 19, 1–19 (2022).
- [3] Benslimane, O., Aberqi, A., Bennouna, J.: Existence results for double phase obstacle problems with variable exponents. *J. Elliptic Parabolic Equ.* 7, 875–890 (2021)
- [4] Benslimane, O., Aberqi, A., Bennouna, J.: On some nonlinear anisotropic elliptic equations in anisotropic Orlicz space. *Arab Journal of Mathematical Sciences* (2021). <https://doi.org/10.1108/AJMS-12-2020-0133>
- [5] Liu, W., Dai, G., Papageorgiou, N.S.: and P. Winkert Existence of solutions for singular double phase problems via the Nehari manifold method, *Analysis and Mathematical Physics* 12, 75 (2022)
- [6] Arora, R., Fiscella, A., Mukherjee, T., Winkert, P.: On critical double phase Kirchhoff problems with singular nonlinearity. *Rendiconti del Circolo Matematico di Palermo Ser. 2*, 1–28 (2022)
- [7] Zeng, Sh., Bai, Y., Gasiński, L., Winkert, P.: Existence results for double phase implicit obstacle problems involving multivalued operators. *Calc. Variations Partial Differ. Equ.* 59, 1–18 (2020)



Existence results of a new class of double phase problems

Communication Info

Authors:

Omar BENSLIMANE¹

¹Sidi Mohamed Ben Abdellah
University

Keywords:

- (1) Double-phase problem
- (2) Singularity
- (3) Sobolev space with variable exponents on a complete manifold

Abstract

In recent years, the study of double-phase problems has attracted great interest, not only because they have applications in biophysics [5] and chemical reaction design [4], but also for its theoretical aspects. However, they are also significant mathematically in the theory. For instance, when p and q are constants, Zhikov [6] was the first person to look into so-called "double phase operators" to simulate highly anisotropic materials using the following functional

$$u \mapsto \int (|\nabla u|^p + \mu(x)|\nabla u|^q) dx,$$

where $1 < p < q < N$. After that, many authors are interesting to develop this kind of problem, see [1,2,3].

This talk is focused on proving the existence of at least two non-trivial positive solutions to a double-phase problem with singularity, in the Sobolev space with variable exponents on a complete manifold setting.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] A. Aberqi, J. Bennouna, O. Benslimane and M. A. Ragusa , On $p(z)$ -Laplacian System Involving Critical Nonlinearities, Journal of Function Spaces, 2022, 12 (2022). <https://doi.org/10.1155/2022/6685771>.
- [2] A. Aberqi, J. Bennouna, O. Benslimane and M. A. Ragusa, Weak solvability of nonlinear elliptic equations involving variable exponents, Discrete and Continuous Dynamical Systems - S, (2022). <https://doi.org/10.3934/dcdss.2022105>.
- [3] A. Aberqi, J. Bennouna, O. Benslimane and M. A. Ragusa, Existence Results for double phase problem in Sobolev-Orlicz spaces with variable exponents in Complete Manifold. Mediterranean Journal of Mathematics, 19 (2022) 1-19.
- [4] R. Aris, Mathematical modelling techniques, Research Notes in Mathematics, 24. Pitman (Advanced Publishing Program), Boston, Mass.-London, (1979).
- [5] P. C. Fife , Mathematical aspects of reacting and diffusing systems, Lecture Notes in Biomathematics, Springer-Verlag, Berlin-New York, 28, (1979) 749-760.
- [6] V. V. Zhikov, Averaging of functionals of the calculus of variations and elasticity theory, Mathematics of the USSR-Izvestiya, 29, (1987) 33.



Solvability of non linear parabolic systems in Musielack-spaces

Communication Info

Authors:

Ahmed El ouardani¹

Ahmed Aberqi²

Mhamed Elmassoudi^{3,4}

¹LAMA, FSDM -USMBA, Fez
Morocco

²LAMA, ENSA-USMBA, Fez
Morocco

^{3,4}LAMA, FSDM -USMBA, Fez
Morocco

Keywords:

(1) Renormalized solutions

(2) Parabolic systems

(3) Musielack- Spaces

Abstract

In this talk, we discuss the solvability of the nonlinear parabolic systems associated to the nonlinear parabolic equation : for $i = 1, 2$

$$(S) \begin{cases} \frac{\partial u_i}{\partial t} - \operatorname{div}(a(x, t, u_i, \nabla u_i) + g(x, t, u_i, \nabla u_i)) = f(x, u_1, u_2) \\ u_i(x, t) = 0 \text{ on } \partial\Omega \times (0, T) \\ u_i(x, 0) = u_{i,0}(x) \text{ in } \Omega \end{cases}$$

with the source f is merely integrable. The operator $A(u) = -\operatorname{div}(a(x, t, u, \nabla u))$ is a generalized Leray-Lions operator defined on the inhomogeneous Musielack-Orlicz spaces (the vector field $a(x, t, u, \nabla u)$ have a growth prescribed by a generalized N function .The nonlinearity g_i is a Carathéodory function satisfy the some conditions .

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

[1] Musielak J., "Modular spaces and Orlicz spaces". Lecture Notes in Math. (1983)

[2] A.Aberqi .J.Bennouna and M Hammoumi,"Existence Result for Nonlinear Degenerated Parabolic Systems". Non-linear Dynamics and Systems Theory, 17(3)(2017) 217-229.

[3] Ahmed Aberqi,Mhamed Elmassoudi, Jaoud Bennouna, Mohamed Hammoumi: Doubly Nonlinear Parabolic, Systems in Inhomogeneous, Musielak-Orlicz-Sobolev Spaces, ASTESJ Vol. 2,No. 5, 180-192(2017).

[4] . T. Donaldson and N. S. Trudinger; Orlicz-Sobolev spaces and imbedding theorem; J.Functioal Analysis, 8(1971), 52-75.

[5] J. P. Gossez; Some approximation properties in Orlicz-Sobolev spaces; Studia Mathematica, T. LXXIV.(1982)..

[6] J. Rakotoson, A. Eden and B. Michaux; Doubly nonlinear parabolic-type equations as dynamical systems; Journal of dynamics and differential equations . 3 (1991) .



Three solutions for a fractional $(p(x, \cdot), q(x, \cdot))$ -Kirchhoff type elliptic system

Communication Info

Authors:

Houria EL-YAHYAOU
Elhoussine AZROUL
Athmane BOUMAZOURH

¹LAMA, Faculty of Sciences
Dhar El Mahraz, Sidi Mohamed
Ben Abdellah University, FEZ,
Morocco

²LAMA, Faculty of Sciences
Dhar El Mahraz, Sidi Mohamed
Ben Abdellah University, FEZ,
Morocco

²LAMA, Faculty of Sciences
Dhar El Mahraz, Sidi Mohamed
Ben Abdellah University, FEZ,
Morocco

Keywords:

- (1) Elliptic systems- Weighted variable exponent spaces
- (2) Generalized fractional Sobolev spaces
- (3) Three critical-points

Abstract

This talk, is concerned with the existence and the multiplicity of weak solutions for a nonlocal fractional elliptic system of $(p(x, \cdot), q(x, \cdot))$ -Kirchhoff type with weight and homogeneous Dirichlet boundary conditions. The approach is based on the three critical points theorem introduced by Recceri and on the theory of general fractional Sobolev spaces with variable exponents.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] G. Kirchhoff, *Mechanik*. Teubner, Leipzig, 1883
- [2] B. Ricceri, On an elliptic Kirchhoff-type problem depending on two parameters, *J. Global Optim.* 46 (2010), 543-549.
- [3] B. Ricceri, A three critical points theorem revisited, *Nonlinear Anal.* 70 (2009), 3084-3089
- [4] G.S. Chen, H.Y. Tang, D.Q. Zhang, Y.X. Jiao, H.X. Wang, Existence of three solutions for a nonlocal elliptic system of (p, q) -Kirchhoff type, *Boundary Value Probl.* 2013 (2013), 175.
- [5] J. Liu, X. Shi, Existence of three solutions for a class of quasilinear elliptic systems involving the $(p(x), q(x))$ -Laplacian, *Nonlinear Anal.* 71 (2009), 550-557.
- [6] U. Kaufmann, J. D. Rossi and R. Vidal. Fractional Sobolev spaces with variable exponents and fractional $p(x)$ -Laplacians. *Elec. Jour. of Qual. Th. of Diff. Equa.* 76 (2017), 1-10.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



On a class of $p(x, \cdot)$ -integro-differential Kirchhoff-type problem with singular kernel

Communication Info

Authors:

Nezha KAMALI¹
Elhoussine AZROULL²
Mohammed SHIMI³

^{1,2}Laboratory of Mathematical
Analysis and Applications, Faculty
of Sciences Dhar El Mahraz, Sidi
Mohammed Ben Abdellah
University, 30000 Fez, Morocco.

³Laboratory of Mathematical
Analysis and Applications,
ENS, Sidi Mohammed Ben
Abdellah University, 30000
Fez, Morocco.

Keywords:

- (1) General nonlocal integro-differential equation,
- (2) Variational methods,
- (3) $p(x, \cdot)$ -Kirchhoff type problem.

Abstract

In this paper, we consider a class of $p(x, \cdot)$ -integro-differential Kirchhoff-type problem with Dirichlet boundary conditions, considering that this type of problems received much attention due to its various applications. By making use of various variational methods, namely, Mountain pass theorem, fountain theorem, and dual fountain theorem, we establish the existence of multiple solutions taking into account the different situations concerning the non-linearity and growth conditions. Furthermore, an example is presented in order to illustrate the conditions of the nonlinear term source.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] E. Azroul, A. Benkirane, M. Shimi and M. Sрати, On a class of fractional $p(x)$ -Kirchhoff type problems, *J. Applicable Analysis*, vol. 100 (2021), no. 2, pp. 383–402.
- [2] A. Bahrouni and V. D. Rădulescu, On a new fractional Sobolev space and applications to nonlocal variational problems with variable exponent. *Discrete and Continuous Dynamical Systems-S*, vol. 11 (2018), no. 3, pp. 379–389.
- [3] G. Dai and R. Hao, Existence of solutions for a $p(x)$ -Kirchhoff-type equation, *Journal of Mathematical Analysis and Applications*, vol. 359 (2009), no. 1, pp. 275–284.
- [4] A. Fiscella and E. Valdinoci, A critical Kirchhoff type problem involving a nonlocal operator, *Nonlinear Analysis: Theory, Methods & Applications*, vol. 94 (2014), pp. 156–170.
- [5] G. Kirchhoff and K. Hensel, Vorlesungen über mathematische Physik, *Bulletin des sciences mathématiques*, vol. 1 (1883).
- [6] M. Xiang, B. Zhang, and M. Ferrara, Multiplicity results for the non-homogeneous fractional p -Kirchhoff equations with concave–convex nonlinearities, *Proceedings of the Royal Society A: Mathematical, Physical and Engineering Sciences*, vol. 471 (2015), no.2177.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Nonnegative solution of a class of double phase problems with logarithmic nonlinearity

Communication Info

Authors:

Ahmed ABERQI¹

Omar

BENSLIMANE²

Mhamed

ELMASSOUDI²

Maria

ALESSANDRA

RAGUSA³

¹LAMA, National School of Applied Sciences, Sidi Mohamed Ben Abdellah University, Fez, Morocco.

²LAMA, Faculty of Sciences Dhar El Mahraz, Sidi Mohamed Ben Abdellah University, Fez, Morocco

³Dipartimento di Matematica e Informatica, Università di Catania, Catania, Italy

Abstract

This manuscript proves the existence of a nonnegative, nontrivial solution to a class of double-phase problems involving potential functions and logarithmic nonlinearity in the setting of Sobolev space on complete manifolds. Some applications are also being investigated. The arguments are based on the Nehari manifold and some variational techniques

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Aberqi, A., Benkirane, A., Elmassoudi, M.: On some nonlinear degenerate elliptic equations having a lower term in Musielak spaces. *Adv. Oper. Theory* 7 (2022), 1–20.
- [2] Aberqi, A., Bennouna, J., Benslimane, O., Ragusa, M.A.: Existence results for double phase problem in Sobolev–Orlicz spaces with variable exponents in complete manifold. *Mediterr. J. Math.* 19 (2022), 158.
- [3] Aberqi, A., Bennouna, J., Benslimane, O., Ragusa, M.A.: Weak solvability of nonlinear elliptic equations involving variable exponents. *Discrete Contin. Dyn. Syst., Ser. S* (2022). <https://doi.org/10.3934/dcdss.2022105>
- [4] Aberqi, A., Benslimane, O., Ouaziz, A., Repovš, D.D.: On a new fractional Sobolev space with variable exponent on complete manifolds. *Bound. Value Probl.* 2022, 7.
- [5] Ragusa, M.A., Tachikawa, A.: Regularity for minimizers for functionals of double phase with variable exponents. *Adv. Nonlinear Anal.* 9, 710–728 (2019).

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Lagrange RBF and Multilevel Lagrange RBF methods for the solution of elliptic BVPs

Communication Info

Authors:

Kawther Al Arfaj¹
Ruslan L Davidchack²

¹Department of Mathematics,
College of Science, King Faisal
University, Saudi Arabia

²Department of Mathematics,
University of Leicester, United
Kingdom

Keywords:

- (1) RBF
- (2) Elliptic BVPs
- (3) Lagrange fonctions

Abstract

Any function ϕ that satisfies the property $\phi(x) = \phi(|x|)$ is a radial function. The norm is usually Euclidean distance, although other distance functions are also possible. Some of the most commonly used RBFs are the Gaussian RBF [1], There have been many developments for radial basis functions (RBF) in recent years, it can be used to propose a symmetric method to solve PDEs, known as Kansa's method or RBF collocation method [2]. In this work, we present an approximation of the solution for a one-dimensional elliptic boundary value problem, following Lagrange and Multilevel Lagrange RBF methods. Next, we present some numerical experiments in the case of Gaussian RBF. It is noticed that the Lagrange RBF method becomes unstable very quickly, which leads to a faster loss of stability than the RBF method.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] M. D. Buhmann, Radial basis functions: theory and implementations, Cambridge university press, 12, (2003).
- [2] E. J. Kansa. Multiquadrics - a scattered data approximation scheme with applications to computational fluid-dynamics - I. Computers and Mathematics with Applications, (1990), 19(8-9):127-145.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Analysis and numerical simulation of a system of two coupled nonlinear elliptic equations

Communication Info

Authors:

Hajar TALBI¹
Mohamed RHOUDAF²
Francisco ORTEGÓN
GALLEGO³

^{1,2}Laboratory of Mathematics
and their Interactions, Moulay
Ismail University, Meknes,
Morocco

³Departamento de
Matemáticas,
Universidad de
Cádiz, Cádiz,
Spain.

Keywords:

- (1) Capacity solution
- (2) Thermistor problem
- (3) Nonlinear elliptic equation

Abstract

In this paper, we analyze, in the context of anisotropic Sobolev spaces, the existence and the numerical simulation of a capacity solution to a coupled nonlinear elliptic system. We consider the case of a non-uniformly elliptic problem with a quadratic growth in the gradient. The system may be regarded as a generalization of the well-known thermistor problem.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] X. Xu, *A strongly degenerate system involving an equation of parabolic type and an equation of elliptic type*, Comm. Partial Differential Equations 1993, 18, 199–213.
- [2] X. Xu, *On the existence of bounded temperature in the thermistor problem with degeneracy*. Nonlinear Anal.: T. M. A., 2000, 42(2), 199–213.
- [3] H. Moussa, F. Ortégón Gallego and M. Rhoudaf, *Capacity solution to a coupled system of parabolic-elliptic equations in Orlicz-Sobolev spaces*, Nonlinear Differ. Equ. Appl., 2018, 25(14), 1–37.
- [4] H. Moussa, F. Ortégón Gallego and M. Rhoudaf, *Capacity solution to a nonlinear elliptic coupled system in Orlicz-Sobolev spaces*, Mediterr. J. Math., 2020, 17(67), 1–28.
- [5] F. Hecht, *New development in Freefem++*, J. Numer. Math., 2012, 20(3-4), 251–265.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Solutions in sense of distributions for anisotropic elliptic Neumann problem with data in $L^m(\Omega)$

Communication Info

Authors:

Mohamed Badr

BENBOUBKER¹

Hayat **BENKHALOU**²

Hassane Hjjaj³

¹LTI, Sidi Mohamed Ben
Abdellah University, Fez,
Morocco

²AFNLA, Abdelmalek Essaâdi
University, Tetouan, Morocco

³AFNLA, Abdelmalek Essaâdi
University, Tetouan, Morocco.

Keywords:

- (1) Anisotropic Sobolev spaces
- (2) Neumann problem
- (3) Nonlinear elliptic problem
- (4) Solution in sense of distributions.

Abstract

The study of anisotropic elliptic nonlinear equation with data in $L^m(\Omega)$ has previously been considered by Li Feng Quan in [5].

More recently, H. Ayadi et al. in [1] studied the existence and the regularity of solutions in sense of distributions for a class of non-linear anisotropic elliptic equations with degenerate coercivity in Lebesgue Sobolev spaces using variable exponents, where the data is assumed to either be in $L^{m(\cdot)}(\Omega)$ or in $L^1(\Omega)$.

In this related communication, we will present some additional steps to prove the existence of solutions in sense of distributions with the data in $L^\infty(\Omega)$ and the data in $L^1(\Omega)$, showing new results and regularity results.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] H. Ayadi, F. Mokhtari, Nonlinear Anisotropic elliptic equations with variable exponents and degenerate coercivity, Elec. Jo. Diff. Eq, volume 2018(2018), No 45, pp 1-23.
- [2] H. Ayadi et al, the obstacle problem for non-coercive elliptic equation with variable growth and L^1 -data, Socie. Portu. De. Mate, 2022.
- [3] M.B. Benboubker et al, Existence of solutions in the sense of distributions of anisotropic nonlinear elliptic equations with variable exponents, Top. Math. In. No. Anal. Vol 46. No. 2, 2015, 665-693.
- [4] A. Dakkak, H. Hjjaj and A. Sanhaji, Existence of $T. \overline{p(\cdot)}$ -solutions for some quasilinear anisotropic elliptic problem, Rend. Mat. App. Vol 40(2019), 113-140.
- [5] Li Feng Quan, Anisotropic Elliptic Equations in L^{m^*} , Jo. Of. Co. Anal, volume 8(2001), No.2, 417-422.
- [6] F. Mokhtari et al, Nonlinear Elliptic Equation With Variable Exponents And Measure or L^m Data, Jo. Of. Math. Sci. Adv and Apps, volume 35, 201, pp 73-101.



Entropy Solutions For Some Strongly Noncoercive Parabolic Problems In Anisotropic Sobolev Spaces

Communication Info

Authors:

Youssef HAJJI¹
Hassane HJIAJ²

¹ Abdelmalek Essaadi
University, Tétouan, Morocco
² Abdelmalek Essaadi
University, Tétouan, Morocco

Keywords:

- (1) Quasilinear parabolic equations
- (2) Non-coercive equations
- (3) Entropy solutions

Abstract

In this work, we study the following non-coercive quasilinear parabolic problem

$$\frac{\partial u}{\partial t} - \sum_{i=1}^N D^i a_i(x, t, u, \nabla u) + v |u|^{s-1} u = \rho \frac{|u|^{p_0-2} u}{|x|^{p_0}} - \sum_{i=1}^N D^i f(x, t, u) \quad \text{in } Q_T = \Omega \times (0, T).$$

Where $f(x, t, \cdot)$ satisfying only some growth condition, $s > \max(\frac{N(p_0-1)}{N-p_0}, \frac{1}{p_0-1})$ and ρ is a nonnegative constant. We show the existence of entropy solutions for this anisotropic non-coercive parabolic problem with Hardy potential.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] B. Abdellaoui, A. Attar and S. E. Miri, Nonlinear singular elliptic problem with gradient term and general datum. *J. Math. Anal. Appl.* 409 (2014), no. 1, 362-377.
- [2] J. P. G. Azorero and I. P. Alonso Hardy inequalities and some critical elliptic and parabolic problems. *J. Differential Equations* 144 (1998), no. 2, 441-476.
- [3] P. Baras and J. A. Goldstein, The heat equation with a singular potential. *Trans. Amer. Math. Soc.* 284 (1984), no. 1, 121-139.
- [4] L. Boccardo, T. Galloüet and J. L. Vázquez, Some regularity results for some nonlinear parabolic equations in L^1 . Some topics in nonlinear PDEs (Turin, 1989). *Rend. Sem. Mat. Univ. Politec. Torino* 1989, Special Issue, 69-74 (1991).
- [5] J. Droniou and A. Prignet, Equivalence between entropy and renormalized solutions for parabolic equations with smooth measure data, *NoDEA Nonlinear Differential Equations Appl.* 14 (1-2) (2007) 181-205. *Sci.*, 4 (2010) 3289-3306.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Entropy solutions for some quasilinear and non-coercive unilateral elliptic problem

Communication Info

Authors :

Rajae ZEROUALI¹
Bouchaib FERRAHI²
Hassane HJIAJ³

¹Department of Mathematics,
Faculty of Sciences T'etouan,
University Abdelmalek Essaadi,
BP

2121, Tetouan, Morocco

² Department of Mathematics,
Faculty of Sciences T'etouan,
University Abdelmalek Essaadi,
BP

2121, Tetouan, Morocco

³ Department of Mathematics,
Faculty of Sciences T'etouan,
University Abdelmalek Essaadi,
BP

2121, Tetouan, Morocco

Keywords:

- (1) Anisotropic Sobolev spaces
- (2) Obstacle problem.
- (3) Non-coercive problems
- (4) Entropy solutions

Abstract

This paper is devoted to studying the existence results to the obstacle problem associated with the equation having degenerate coercivity, whose prototype is given by

$$\begin{cases} \mathbf{A}u + \mathbf{g}(x, u) = f(x) - \mathbf{div} F(x, u) & \text{in } \Omega \\ u = 0 & \text{on } \partial\Omega \end{cases}$$

in the anisotropic Sobolev space, where Ω is a bounded open subset set of IR^N ($N \geq 2$), where

$1 < p < N$, $f \in L^1(\Omega)$ and $F(x, u)$ satisfying only some growth condition. We show the existence of entropy solution for this non-coercive unilateral elliptic equation, and we will conclude some regularity.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] L. Aharouch and Y. Akdim, *Strongly Nonlinear Elliptic Unilateral Problems without Sign Condition and L1 Data*, Journal of Convex Analysis Volume 13 (2006), No. 1, 135-149.
- [2] L. Aharouch and J. Bennouna, *Existence and uniqueness of solutions of unilateral problems in Orlicz spaces*. Nonlinear Anal. 72 (2010), no. 9-10, 3553-3565.
- [3] Y. Akdim, C. Allalou and A. Salmani, *Existence of Solutions for Some Nonlinear Elliptic Anisotropic Unilateral Problems with Lower Order Terms*, Moroccan J. of Pure and Appl. Anal Volume 4(2), 2018, Pages 171-188.
- [4] A. Benkirane, M. El.Moumni and A. Youssfi, *Existence result for strongly nonlinear elliptic unilateral problems with L1 data*, Complex Variables and Elliptic Equations April 2014.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Ulam stabilities of nonlinear Volterra integro-differential equations

Communication Info

Authors:

Merve ŞENGÜN¹
Cemil TUNÇ²

^{1,2} Department of Mathematics
Faculty of Sciences
Van Yuzuncu Yil University
65080, Campus, Van – Turkey

Keywords:

- (1) Volterra integro-differential equation
- (2) Hyers-Ulam stability
- (3) Delay

Abstract

The Hyers-Ulam and Hyers-Ulam-Rassias stabilities of a nonlinear Volterra integro-differential equation with multiple constant delays are the problems of this research. Here, we establish two new theorems in the relation to the Hyers-Ulam and Hyers-Ulam-Rassias stabilities of that equation on a finite interval. The main results of this research include sufficient conditions and they are proved by fixed point method using the Pachpatte's inequality. The outcomes of this research have new contributions to the Hyers-Ulam and Hyers-Ulam-Rassias stabilities. A numerical example is given to show applications of the new results.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Biçer, E., Tunç, C., New theorems for Hyers-Ulam stability of Lienard equation with variable time lags. *Int. J. Math. Comput. Sci.* 13 (2018), no. 2, 231–242.
- [2] Castro, L. P., Simões, A. M., Hyers-Ulam-Rassias stability of nonlinear integral equations through the Bielecki metric. *Math. Methods Appl. Sci.* 41 (2018), no. 17, 7367–7383.
- [3] Chauhan, H. V. S., Singh, B., Tunç, C., Tunç, O., On the existence of solutions of non-linear 2D Volterra integral equations in a Banach space. *Rev. R. Acad. Cienc. Exactas Fís. Nat. Ser. A Mat. RACSAM* 116 (2022), no. 3, Paper No. 101, 11 pp
- [4] Deep, A., Deepmala, Tunç, C., On the existence of solutions of some non-linear functional integral equations in Banach algebra with applications. *Arab Journal of Basic and Applied Sciences.* 27 (2020), no. 1, 279–286.
- [5] Ulam, S.M., *Problems in modern mathematics.* Science Editions John Wiley & Sons, Inc., New York, 1964. [6] Rus, I. A., Petruşel, A., Petruşel, G., *Fixed point theory.* Cluj University Press, Cluj-Napoca, 2008.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Skew cyclic Linear codes over $R = R + wR + w^2R$

Communication Info

Authors:

Karima CHATOUH¹

¹ Faculty of Economic,
Commercial and Management
Sciences
University of Batna 1,
Batna, Algeria¹

Keywords:

- (1) Linear Codes
- (2) Gray map
- (3) Skew cyclic linear codes

Abstract

In current papers [1,2,3,4], several authors have studied some other generalizations of cyclic codes, such as skew cyclic codes, skew constacyclic codes over rings, etc., and obtained some good codes. In this work, we study skew cyclic codes over a commutative ring $R = R + wR + w^2R$. We give the definition of these codes over the ring $R = R + wR + w^2R$. Some structural properties of the skew polynomial ring $R[x, \theta]$ are discussed, where θ is an automorphism of $R = R + wR + w^2R$. Also, we define the Gray images of skew cyclic codes over the ring $R = R + wR + w^2R$. We obtained some new linear codes over $R = R + wR + w^2R$.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] K. Chatouh , K. Guenda, T.A Gulliver and L. Noui, Simplex and MacDonal codes over R_q , J. Appl. Math. Comput 55(1-2) (2017), 455-478.
- [2] K. Chatouh , K. Guenda, T.A Gulliver and L. Noui, New Classes of Codes Over $R_{q,p,m} = \mathbb{Z}_p^m[u_1, u_2, \dots, u_q] / \langle u_i^2 = 0, u_i u_j = u_j u_i \rangle$ and Their Applications, Computational and Applied Mathematics 39(3)(2020), 1-39.
- [3] R. Krishna Verma, O. Prakash, A. Singh. New non-binary quantum codes from skew constacyclic codes over the ring $F_p^m + vF_p^m + v^2F_p^m$, arXiv:2010.07175v1, 2020.
- [4] H. Islam and O. Prakash. Skew cyclic and skew-constacyclic codes over $F_q + uF_q + vF_q + uvF_q$, arXiv:1710.07785v2, 2018.



Fuzzy Near-rings Involving Fuzzy Binary Operations

Communication Info

Authors:

Mohssine OU-MHA¹
Abderrahmane RAJI¹

¹LMACS Laboratory, Faculty of
Sciences and Technology of
Beni Mellal, Sultan Moulay
Slimane University, Beni Mellal,
Morocco

Keywords:

- (1) prime near-rings
- (2) fuzzy group
- (3) fuzzy near-rings

Abstract

The fuzzy subset theory has been created by Zadeh [9] in 1965; and in 1971, Rosenfeld [7] defined the concept of fuzzy subgroup of a classical group by using Zadeh's definition of fuzzy subset of a set. In this paper, the concepts of left fuzzy near ring and right fuzzy near ring are studied using the definition of fuzzy binary operation of Yuan et al. [8] and some of their basic properties are presented. Also, we have built several new examples to illustrate the existence of the different notions presented in this article.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] H. Aktaş, N. Çagman, A type of fuzzy ring, Arch. Math. Logic, 46 (2007), 165-177.
- [2] H.E. Bell, G. Mason, On derivations in near-rings, North-Holland Math. Stud., 137 (1987), 31-35.
- [3] L. Oukhtite, A. Raji, On two sided α -n-derivation in 3-prime near-rings, Acta Math. Hungar., 157 (2) (2019), 465-477.
- [4] M. A. Öztürk, E. Inan, Soft Γ -rings and idealistic soft Γ -rings, Ann. Fuzzy Math. Inform., 1 (1) (2011), 71-80.
- [5] A. Öztürk, Y. B. Jun, H. Yazarh, A new view of fuzzy gamma rings, Hacet. J. Math. Stat., 39 (3) (2010), 365-378.
- [6] G. Pilz, Near-rings. The theory and its applications, North-Holland Math. Stud. 23, North-Holland Publishing Co., Amsterdam, 1983.
- [7] A. Rosenfeld, Fuzzy groups, J. Math. Anal. Appl., 35 (1971), 512-517.
- [8] X. Yuan, E. S. Lee, Fuzzy group based on fuzzy binary operation, Comput. Math. App., 47 (2004), 631-641.
- [9] L. A. Zadeh, Fuzzy sets, Inform. Control, 8 (1965), 338-353.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Jordan Ideals via Multiplicative Derivations and Commutativity in 3-Prime Near-Rings

Communication Info

Author:

Abderrahmane RAJI

*LMACS Laboratory, Faculty of
Sciences and Technology of
Beni Mellal, Sultan Moulay
Slimane University, Beni Mellal,
Morocco*

Keywords:

- (1) 3-prime near-rings
- (2) Multiplicative derivation
- (3) Commutativity

Abstract

In this work, we investigate the commutativity of 3-prime near-rings satisfying some differential identities on Jordan ideals involving multiplicative derivation. Some well-known results characterizing commutativity of 3-prime near-rings by derivations have been generalized by using multiplicative derivation. Further, we discuss an example to prove that the necessity of the 3-primeness hypothesis imposed on the various theorems cannot be marginalized.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] M. Ashraf, M.A. Siddeeqe, Generalized multiplicative derivations and commutativity of 3-prime near-rings. *Afr. Mat.*, 30 (2019), 571-580.
- [2] A. Asma, U.H. Inzamam, Commutativity of a 3-prime near-ring satisfying certain differential identities on jordan ideals. *Mathematics*, 8(1) (2020), 89.
- [3] H.E. Bell, On derivations in near-rings II. *Kluwer Academic Publishers Netherlands*, (1997), 191-197.
- [4] A. Boua, A. Raji, Several algebraic inequalities on a 3-prime near-ring. *JPJ. Algebra, Number Theory and Applications*, 39(1) (2017), 105-113.
- [5] A. Raji, Some commutativity criteria for 3-prime near-rings. *Algebra and Discrete Mathematics*, 32(2) (2021), 280-298.
- [6] L. Oukhtite, A. Raji, On two sided α - n -derivation in 3-prime near-rings. *Acta Math. Hungar.*, 157(2) (2019), 465-477.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Relaxed relative Hilali conjecture

Communication Info

Authors:

Abdelhadi ZAIM¹

¹LMFA, Hassan II University of
Casablanca, Casablanca,
Morocco

Keywords:

- (1) Algebraic topology
- (2) Rational homotopy theory
- (3) Generalized relative Hilali conjecture
- (4) Sullivan models
- (5) Rational cohomology

Abstract

In this talk, all spaces are simply connected CW-complexes and are of finite type over the field of rational, i.e., have finite dimensional rational cohomologies in each degree [1].

Our goal is to suggest a relaxed version of the relative Hilali conjecture [4]. It includes the Hilali [2] and Yamaguchi-Yokura conjecture [3] as special cases.

Further, we prove this conjecture for non trivial cases.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Y. Félix, S. Halperin, J.-C. Thomas, Rational homotopy theory, Springer-Verlag, New York, 2001.
- [2] M. R. Hilali, Action du tore T^n sur les espaces simplement connexes, Ph.D. Thesis, Université Catholique de Louvain, 1980.
- [3] T. Yamaguchi, S. Yokura, On a Relative Hilali Conjecture, Afr. Diaspora J. Math., **21** (2018), 81–86.
- [4] A. Zaim, Generalized relative Hilali conjecture, Journal of Mathematics and Computer Science, Volume 29, Issue 4, pp 399–406.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Moments and cumulants beyond the fourth order for additive models

Communication Info

Authors:

Sandra S. FERREIRA¹²

Dário FERREIRA¹²

Patrícia ANTUNES²

¹Department of Mathematics,
University of Beira Interior,
Portugal

²Center of Mathematics and its
Applications, University of
Beira Interior, Portugal

Keywords:

(1) Cumulants

(2) Mixed Models

(3) Additive Structure

Abstract

Motivated by classical cumulants and some properties, we explore models that are the sum of a fixed mean vector with w independent random terms, with an additive structure in their covariance matrix. We will only require that the components of the vectors of the random part have the first four cumulants and be independent. In this communication, we show that is often preferable to work with cumulants rather than moments since the two are entirely equivalent and for independent random variables, the cumulants of a sum are the sums of the cumulants. In order to show the flexibility of this method, different types of distributions of the component of vectors are presented. This approach can also be easily extended to obtain moments and cumulants beyond the fourth order for additive models providing an extension to the results available in the literature.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] P. Antunes, S. S. Ferreira, D. Ferreira, C. Nunes, J.T. Mexia. Estimation in additive models and ANOVA-like applications. *J. Appl. Stat.*, 47 (2020a) 1-10.
- [2] N. Balakrishnan, N.L. Johnson, S. Kotz. A note on relationships between moments, central moments, and cumulants from multivariate distributions. *Stat Probab Lett.* 39(1) (1998) 49-54.
- [3] C.C. Craig. On A Property of the Semi-Invariants of Thiele. *Ann. Math. Stat.*, 2 (2) (1931) 154-164.
- [4] Y A. I. Khuri, T. Mathew, B. K. Sinha. *Statistical Tests for Mixed Linear Models.* Wiley Interscience Publication, John Wiley & Sons, Inc, 1998.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



On common index divisors of some quantic number fields defined by trinomials

Communication Info

Authors:

Hamid Ben Yakkou

Faculty of Sciences Dhar El
Mahraz, P.O. Box 1874 Atlas-
Fes, Sidi mohamed ben
Abdellah University, Morocco

Keywords:

- (1) Power integral basis
- (2) Trinomials
- (3) Theorem of Ore
- (4) Prime ideal factorization
- (5) Common index divisor
- (6) Quantic number field

Abstract

Let K be a quantic number field generated by a root of a monic irreducible polynomial of type $F(x) = x^5 + ax^3 + b \in \mathbb{Z}[x]$ and p a rational prime integer.

In this paper, based on Newton's polygon techniques applied to prime ideal factorization in the ring of integers of a number field, we give necessary and sufficient conditions only on a and b so that p is a common index divisor of K . We illustrate our results through examples.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] H. Ben Yakkou and L. El Fadil, On monogeneity of certain pure number fields defined by trinomials, *Funct. Approx. Comment. Math.* 67 (2), 199-221, (December 2022) DOI: 10.7169/facm/1987.
- [2] Ben Yakkou and L. EL Fadil, On monogeneity of certain pure number fields defined by $x^{p^r} - m$, *I. J. of Number theory*, (2021).
- [3] L. El Fadil, J. Montes and E. Nart, Newton polygons and p -integral bases of quartic number fields, *J. Algebra and Appl.* 11(4), (2012), 1250073.
- [4] A. Jakhar, S.K. Khanduja, and N. Sangwan, Characterization of primes dividing the index of a trinomial, *I. J. of Number Theory*, 13(10), (2017), 2505--2514.
- [5] L. Jones and D. White, Monogenic trinomials with non-squarefree discriminant, *International Journal of Mathematics*, doi: 10.1142/S0129167X21500890, (2021).



Twisted Hessian curves over the ring $F_q[X]/X^n$

Communication Info

Authors:

Abdelâli GRINI¹
Abdelhakim CHILLALI²
Moha Ben Taleb Elhamam¹

¹FSDM, S. M. Ben Abdellah
University of Fez, Fez,
Morocco

²FP, S. M. Ben Abdellah
University of Fez, Fez,
Morocco

Keywords:

- (1) Twisted Hessian curves
- (2) Finite Ring
- (3) Elliptic curves
- (4) Cryptography

Abstract

In [1] Bernstein et al. have defined the twisted Hessian curves over a field, then in [2-5-6] we studied these types of curves on a local ring $R_2 = F_q[X]/X^2$, where F_q is a finite field of order $q = p^b$, with p is a prime number ≥ 5 and $b \in \mathbb{N}^*$. In [3-4] we presented the twisted Hessian curves over the rings R_3 and R_4 . In this talk, our contribution is an extension of the twisted Hessian curve on the ring $R_n = F_q[X]/X^n$ for all integers $n \geq 5$. For the first time, we describe these curves over this ring. In addition, we prove that $H^n_{a,d}$ is a direct sum of H_{a_0,d_0} and the maximal ideal of R_n , where H_{a_0,d_0} is the twisted Hessian curve over F_q . Other results are deduced from, we cite the equivalence of the discrete logarithm problem on the twisted Hessian curves $H^n_{a,d}$ and H_{a_0,d_0} , which is beneficial for cryptography and cryptanalysis as well.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] D.J. Bernstein, C. Chuengsatiansup, D. Kohel and T. Lange, Twisted Hessian Curves, Springer, 9230 (2015), 269-294.
- [2] A. Grini, A. Chillali, H. Mouanis, and E. F. Lhoussain, Twisted Hessian curves over the ring $F_q[e]$, $e^2 = 0$, Int. J. Comput. Aided Eng. Technol., 18 (2023) 181-189.
- [3] A. Grini, A. Chillali, H. Mouanis, Cryptography Over the Twisted Hessian Curve $H^3_{a,d}$, Springer, 237 (2022) 351-363.
- [4] A. Grini, A. Chillali, H. Mouanis, A new cryptosystem based on a twisted Hessian curve $H^4_{a,d}$. J. Appl. Math. Comput., 68(4) (2021) 2667-2683
- [5] A. Grini, A. Chillali, H. Mouanis, Cryptography over twisted Hessian curves of the ring $F_q[e]$, $e^2 = 0$. Adv. Math.: Sci. J., 10 (1) (2021) 235-243..
- [6] A. Grini, A. Chillali, H. Mouanis, The Binary Operations Calculus in $H^2_{a,d}$. Bol. Soc. Paran, 40 (2020), 1-6.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Extension of the next generation approach to a class of discrete epidemic models

Communication Info

Authors:

Mohamed LADIB¹

Aziz OUHINOU^{1,2}

¹ Team of Mathematics and Interactions, Faculty of Sciences and Techniques, University Sultan Moulay Slimane, Beni-Mellal, Morocco.

² Department of Mathematics, Faculty of Sciences and Techniques, University Sultan Moulay Slimane, Beni-Mellal, Morocco.

Keywords:

(1) Discrete dynamical systems

(2) Reproduction number

(3) Next generation approach

Abstract

The reproduction number is a key parameter to study the progress of epidemics within communities, and test the effectiveness of control strategies to contain outbreaks. The next generation approach is a tool used to provide an explicit formula for that quantity, which was extended to discrete epidemic models [1].

In this communication, we present our recent investigations concerning its use in an example of a discrete epidemic model where the transition matrix is not necessarily non-negative. The obtained expression is evaluated through a stability analysis of the Disease free equilibrium.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

[1] Allen, Linda JS, and Pauline van den Driessche. "The basic reproduction number in some discrete-time epidemic models." *Journal of difference equations and applications* 14.10-11 (2008): 1127-1147.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Chaos analysis of fractional Lasota equation

Communication Info

Authors:

Manal MENCHIH¹
Khalid HILAL²
Ahmed Kajouni³

¹LMACS, Sultan Moulay
Slimane University, Beni Mellal,
Morocco

²LMACS, Sultan Moulay
Slimane University, Beni Mellal,
Morocco

³LMACS, Sultan Moulay
Slimane University, Beni Mellal,
Morocco

Keywords:

- (1) Chaos
- (2) Fractional partial differential equation
- (3) Lasota equation

Abstract

Lasota equation has been developed as model of the dynamics of a self-reproducing cells population such as the population of developing red blood cells. The aim of this work is to investigate chaos analysis for the fractional version of Lasota equation.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Abdeljawad, T., Al Horani, M. and Khalil, R., Conformable fractional semigroups of operators. J. Semigroup Theory Appl. 2015.
- [2] Chang, Y.H. and Hong, C.H.: The chaos of the solution semigroup for the quasi-linear lasota equation. Taiwan. J. Math. 16(5), 1707{1717(2012).
- [3] Khalil, R., Al Horani, M., Yousef, A. and Sababheh, M., 2014. A new definition of fractional derivative. Journal of computational and applied mathematics, 264, pp.
- [4] Matsui, M. and Takeo, F., 2001. Chaotic semigroups generated by certain differential operators of order 1. SUT Journal of Mathematics, 37(1), pp.51-67.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Existence and approximation of positive solutions of hybrid fractional differential equations with nonlocal condition

Communication Info

Authors:

Samira Zerbib¹
Khalid Hilal¹
Ahmed Kajouni¹

¹LMACS, Sultan Moulay Slimane
University of Beni Mellal, Beni
Mellal, Morocco

Keywords:

- (1) Hybrid fractional differential equation
- (2) ψ -Hilfer derivative
- (3) non-local condition

Abstract

Quadratically perturbed equations are interesting equations that form another step for solving, problems in the modeling field that are not easily solvable or analyzed. The non-linearity of such a dynamical system is not smooth for studying the existence or some other characterization of the solutions, however perturbing such a problem in some way allows the problem to be studied with available methods for different aspects of the solutions. The problem perturbed in this way are called hybrid differential equations.

In this paper, we study the existence of solutions to a hybrid fractional differential equation involving ψ -Hilfer derivative with non-local condition. We call upon Dhage's famous fixed point theorem to prove the existence of solutions. Finally, an illustrative example is presented to demonstrate our results.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] K. Hilal, A. Kajouni, Boundary value problems for hybrid differential equations with fractional order, Adv. Differ. Equ. (2015) 2015:183.
- [2] Kilbas A A, Srivastava H M, Trujillo J J. Theory and Applications of Fractional Differential Equations, North-Holland Mathematics Studies, 204. Amsterdam: Elsevier Science B V, 2006
- [3] Sabatier J, Agrawal O P, Machado J A T, eds. Advances in Fractional Calculus: Theoretical Developments and Applications in Physics and Engineering. Dordrecht: Springer, 2007
- [4] B.C. Dhage, On a fixed point theorem in Banach algebras with applications, Appl. Math. Lett. 18 (2005) 273-280.
- [5] B.C. Dhage, V. Lakshmikantham, Basic results on hybrid differential equations, Nonlinear Anal. Hybrid 4 (2010) 414-424.
- [6] Y. Zhao, S. Sun, Z. Han, Q. Li, Theory of fractional hybrid differential equations, Comput. Math. Appl., 62(3)(2011), 1312-1324.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Stability of reinforced concrete structure under seismic loads

Communication Info

Authors:

Adil Ziraoui¹
Benaissa Kissi¹
Hassan Aaya²

¹ LISPSII, Hassan II University
of Casablanca, Morocco

² LGC, International University
of Casablanca, Morocco

Keywords:

- (1) Non-linear static analysis
- (2) capacity spectrum
- (3) nonlinear behavior
- (4) RPS2000

Abstract

Earthquakes are one of the most destructive hazards in Morocco, whose north is located in a high seismicity zone. Today, if the mechanism of the earthquake is better known, both from the point of view of its origin and its propagation, it still remains an unpredictable phenomenon. The analysis of the seismic behavior of structures in these areas is a better tool for the prevention of seismic risk. The evaluation of the seismic vulnerability of existing buildings is an essential element that allows the construction of fragility curves, which constitute fundamental information and data to determine the degree of damage and to decide on a possible rehabilitation or demolition, depending on the extent of the damage, in the event of a scenario earthquake.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Règlement de construction parasismique RPS 2000, Ministère de l'ATUHE, Secrétariat d'État de l'Habitat, Royaume du Maroc, 2011.
- [2] Y. Riyad , B. Kissi , I. Mrani , M.A. Parron , R.C.M. Dolores . Seismic Retrofitting: Reinforced concrete shear wall versus CFRP reinforced concrete using pushover analysis
- [3] A. El Ghoulbzouri, B. Kissi, A. Khamlichi, Reliability Analysis of Reinforced Concrete Buildings
- [4] M. Mouzzoun, O. Moustachi, A. Taleb, Assessment of the behavior factor for seismic design of reinforced concrete buildings. J. Mater. Environ. Sci. 4 (1) (2013) 23-32 (in French)
- [5] Applied Technology Council, ATC-40. Seismic evaluation and retrofit of concrete Buildings, California, 1996; Vols. 1 and 2.
- [6] Federal Emergency Management Agency (FEMA), 1997. NEHRP provisions for the seismic rehabilitation of buildings. Rep FEMA 273 and 274. Washington, DC : FEMA.
- [7] CEN European Committee for Standardization. Eurocode 8. "Design of structures for earthquake resistance". Doc CE N/TC250/SC8/N335. DRAFT No 6. January. Brussels. 2003.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Discrete mathematical modelling and optimal control of a spatiotemporal prey-predator three species fishery model

Communication Info

Authors:

Ayoub Sakkoum¹
Hamza Toufqa¹
Mustapha Lhous¹
Mostafa Rachik²

¹(FAML), Department of
Mathematics and Computer
Science, Faculty of Sciences Ain
Chock, Hassan II University of
Casablanca, Morocco.

² LAMS, Department of
Mathematics and Computer
Science, Faculty of Sciences Ben
M'Sik, Hassan II University of
Casablanca, Morocco.

Keywords:

prey, predator, super-
predator, optimal control and
Pontryagin's maximum
principle

Abstract

In this work, we study an optimal control of a discrete mathematical model of the spatiotemporal model of prey predator. We first discuss the system in three compartments prey, predator and super-predator in a selected area and the relationships between these three compartments. On the other hand, by using the optimal control strategy, we will reduce the number of predators and super-predators and we will normalize the food chain in this region. Characterization of the sought optimal control is derived based on Pontryagin's maximum principle. Finally, a numerical simulation was performed to verify the theoretical analysis using Matlab.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] A.J. Lotka, Elements of physical biology, Williams and Wilkins Company, Baltimore, (1925), 460 p.
- [2] Chouayakh, K.Bekkali, C.E.Foutayeni, Y.E.Khaladi, M., and Rachik, M.(2015). Maximization of the Fishermen's Profits Exploiting a Fish Population in Several Fishery Zones.
- [3] Douglas J.McCauley and C.Jablonicky and Edward H.Allison and Christopher D.Golden and Francis H.Joyce and J.Mayorga and D.Kroodsma, Wealthy countries dominate industrial fishing, Science Advances, volume 4, 2018. [4] Y. El foutayeni, M. Khaladi, General Characterization of a Linear Complementarity Problem, Amer. J. Model. Optim., 1 (2013) 1-5.
- [4] Natali Hritonenko, Yuri Yatsenko, Mathematical Modeling in Economics, Ecology and the Environment, Springer New York, NY, 23 August 2016. [6] Y. El foutayeni, M. Khaladi, A New Interior Point Method for Linear Complementarity Problem, Appl. Math. Sci., 4 (2010) 3289-3306.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Linear boundary stabilization for a degenerate and singular Schrödinger equation

Communication Info

Authors:

Alhabib MOUMNI¹
Jawad SALHI¹

¹MAIS Laboratory, FST
Errachidia, University of
Moulay Ismail, Meknes,
Morocco

Keywords:

(1) Stabilization
(2) Wave equation
(3) Hardy-Poincaré
inequalities

Abstract

In this talk, we discuss the boundary stabilization for a one-dimensional degenerate and singular wave equation. To this aim, we use the multiplier methods developed during the past years in the framework of the stabilization of classical Schrödinger and wave equations [1,3]. Our main result in this context is proving the exponential decay of the energy. Thanks to the dominant energy approach, together with suitable elliptic estimates, we prove the exponential stability to the corresponding solution of the considered equation in the sub-critical case.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] F. Alabau-Boussouira, P. Cannarsa, G. Leugering, *Control and stabilization of degenerate wave equation*, SIAM J. Control Optim., 55 (2017), 2052-2087.
- [2] B. Allal, A. Moumni, J. Salhi, *Boundary controllability for a degenerate and singular wave equation*, Math Meth Appl Sci. 2022;45(17):11526-11544. doi:10.1002/mma.8464
- [3] E. Machtyngier, E. Zuazua, *Stabilization of the Schrodinger equation*, Port. Math. 51 (1994) 244-256.
- [4] E. Zuazua, *Exponential decay for the semilinear wave equation with locally distributed damping*, Comm. PDE, 15 (2), (1990), 205-235.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Mild solution and approximate controllability for neutral evolution system

Communication Info

Authors:

Zoubida Ech-chaffani ¹
Ahmed Aberqi ²
Touria Karite^{3,4}

¹LAMA Laboratory, Faculty of
sciences Dhar El Mahraz, Sidi
Mohamed Ben Abdellah
University, Fez Morocco

²LAMA Laboratory, National
School of Applied Sciences Sidi
Mohamed Ben Abdellah
University, Fez, Morocco

³Laboratory of Engineering,
Systems and Applications,
Department of Electrical
Engineering and Computer
Science, National School of
Applied Sciences Sidi Mohamed
Ben Abdellah University, Fez,
Morocco

Abstract

In recent years, the controllability problems, of fractional differential equations with Caputo derivatives has been extensively studied (see [1]-[4]). However the research on the approximate controllability of the Riemann-Liouville fractional differential equations is still in the initial stage and this fact is the motivation of the present work. This paper has two objectives. The first one is to obtain existence of the mild solution of a class of fractional neutral evolution equations with Riemann-Liouville derivative by using some fixed point theorems, Laplace transform, the fractional power of operators. The second objective is to prove the approximate controllability of the fractional neutral evolution system.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] K. Rykaczewski, Approximate controllability of differential of fractional inclusions in Hilbert spaces, *Nonlinear Anal.*, 75 (2012), pp. 2701-2702.
- [2] Y. Zhou and F. Jiao, Existence of mild solutions for fractional neutral evolution equations, *Comput. Math. Appl.*, 59 (2010), pp. 1063-1077..
- [3] Ech-chaffani, Z.;Aberqi, A.; Karite, T.; Torres,D.F.M. Minimum Energy Problem in the Sence of Caputo of fractional Neutral Evolution Systems in Banach Spaces. *Axiome* 2022, 11, 379. <https://doi.org/10.3390/axioms11080379>.
- [4] Y. Zhou, F. Jiao, Existence of mild solutions for fractional neutral evolution equations. *Computers and Math. with Applications* 59, No (2010), 1063-1077.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



The uniqueness problem of canonical forms for linear multi-variable systems

Communication Info

Authors:

Hamid MAAROUF¹

Lahcen MANIAR²

Sara MOUNTASSIR³

¹Department of Computer
Science, High School of
Technology of
Safi, Cadi Ayyad University,
Morocco.

^{2,3}Department of Mathematics,
Semlalia Faculty of Sciences,
Cadi Ayyad University, Morocco

Keywords:

- (1) Luenberger algorithm
- (2) Controllability indices
- (3) Luenberger canonical form
- (4) Affine subspace
- (5) Similarity transformation

Abstract

In this paper, we show that the possible outcomes of the Luenberger algorithm used in literature to determine canonical forms of given linear time-invariant controllable multi-variable systems having fixed controllability indices form an affine subspace that is completely determined by these controllability indices. We also solve the uniqueness problem by showing that a controllable system is similarly equivalent to a unique canonical form in that affine subspace.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Antsaklis P., Michel A. Linear Systems. Birkhauser, 2006.
- [2] Brunovsky P. A classification of linear controllable systems. Kybernetika, 3:173-187, 1970.
- [3] Datta K. B.. An algorithm to compute canonical forms in multivariable control systems. IEEE Transactions on Automatic Control, 22:129-132, 1977.
- [4] Jordan D., Sridhar B.. An efficient algorithm for calculation of Luenberger canonical form. IEEE Transaction on Automatic Control, AC-18:292-295, 1973.
- [5] Kalman R. E., Falb P. L., Arbib M. A. . Topics In Mathematical System Theory. New York: McGraw-Hill. International Series in Pure and Applied Mathematics, 1969.
- [6] Kalman R. E.. Kronecker Invariants and Feedback. Ordinary Differential Equations. Academic Press, 459-471, 1972.
- [7] Luenberger D. G.. Canonical forms for linear multivariable systems. IEEE Transactions on Automatic Control, 12:290-293, 1967.
- [8] Luenberger D. G.. Optimization by vector space methods. Wiley-Interscience, 1997.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Bilinear boundary optimal control problem of semilinear parabolic equations

Communication Info

Authors:

El Hassan Zerrik¹
Mohamed Ouhafsa¹
Abderrahman Ait Aadi²

¹MACS Team, Faculty of Sciences. University Moulay Ismail, Meknes, Morocco
²Department of Sciences, Hight Normal School. University Moulay Ismail, Meknes, Morocco

Keywords:

(1) Boundary bilinear control
(2) Infinite dimensional system
(3) Optimal control problem.

Abstract

The aim of this communication is to investigate an optimal control problem of semilinear equation evolving in a spatial domain $\Omega \subset \mathbb{R}^n, n \geq 1$. Such an equation is excited by time bilinear controls on the boundary $\partial\Omega$ of Ω . Then we prove that an optimal control exists, and is characterized as a solution to an optimality system. The used approach leads to an algorithm for the computation of such a control. Illustrations through simulations are also provided.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] E. Zerrik, and A. El Kabouss. Regional Optimal Control Problem of a Heat Equation with Bilinear Bounded Boundary Controls. In: Recent Advances in Intuitionistic Fuzzy Logic Systems and Mathematics. Cham: Springer; 2021. pp. 131-142.s
- [2] E. Zerrik, and A. El Kabouss, Bilinear Boundary Control Problem of an Output of Parabolic Systems. Recent Advances in Modeling, Analysis and Systems Control: Theoretical Aspects and Applications, Springer International Publishing, pp.193-203, Cham, 2020.
- [3] F. Troltzsch, Optimal control of partial differential equations: theory, methods, and applications. Vol. 112, American Mathematical Soc, 2010
- [4] S. Lenhart, and D. Wilson, Optimal control of a heat transfer problem with convective boundary condition. Journal of Optimization Theory and Applications, Springer. Vol. 79, pp. 581-597, 1993.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



A modified fixed-point method for the pattern formation model

Communication Info

Authors:

M.R. AMATTOUCH¹
Mohamed Harfaoui¹

¹LMCMAN, Faculty of science
and technics of Mohammedia
Hassan II University of
Casablanca, Morocco

Keywords:

- (1) Pattern formation
- (2) Turing Model
- (3) Fixed-point method

Abstract

The linear model, introduced by Turing for pattern formation, and known by the Turing bifurcation, is one of the most widely studied mathematical programming problems for pattern formation.

In this paper we deal with a nonlinear reaction diffusion for pattern formation. We prove first the bifurcation of this model in the sense of Turing. Secondly, we use a modified fixed point method to stabilize the equations in the case of instability.

Finally, we give some numerical tests cases that proves the efficiency of our modification

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] M.R. Amattouch, H. Belhadj, Combined Optimized Domain Decomposition Method and a Modified Fixed Point Method for Non Linear Diffusion Equation, Applied Mathematics and Information Sciences, 11, No. 1, 201-207 (2017).
- [2] M.R. Amattouch, N. Nagid, H. Belhadj, Optimized Domain Decomposition Method for Non Linear Reaction Advection Diffusion Equation, European Scientific Journal , Vol 12, No 26 (2016).
- [3] M.R. Amattouch, N. Nagid, H. Belhadj, a new splitting method for the Navier Stokes equation , Journal of space exploration, Vol 2, 24 august 2017.
- [4] M.R. Amattouch, N. Nagid, H. Belhadj, A modified fixed point method for The Perona Malik equation, Journal of Mathematics and System Science 7, 175-185, september 2017
- [5] Fisher R.A, The wave of advance of advantage genes., Ann. Eugenics, Vol. 7, pp. 353-369, 1937
- [6] Murray J.D, Mathematical Biology., Berlin: Springer. 1993.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Mathematical modelling of unemployment with cyclical reforms

Communication Info

Authors:

Mohamed El YAHYAOUI
Saida AMINE
Laboratory of Mathematics
and Applications, Faculty of
Sciences and Technologies
Mohammedia, Hassan II
University of Casablanca,

Keywords:

- (1) Mathematical model
- (2) Unemployment
- (3) Equilibrium
- (4) Stability

Abstract

Unemployment is a global problem. New technology and covid-19 have exacerbated this difficulty. In this work, we proposed and analyzed a new mathematical model of unemployment. We are interested in two types of unemployment: structural and conjectural unemployment. We considered three variables, the structural unemployment variable (S), the employed variable (E) the cyclical unemployment (C), and we derived a non-linear system of ordinary differential equations. Existence, positivity and boundedness this model solutions are proved. Local stability of the equilibrium point state is shown by using Routh-Hurwitz criteria. A suitable Lyapunov function is used to establish the global stability. The sensitivity of parameters is discussed to illustrate their impact on the equilibrium point. Some numerical simulations are given to support the analytical analysis.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] G. Pathan, P.H. Bhathawala. A mathematical model for unemployment-taking an action without delay Advances in Dynamical Systems and Applications, 12 (2017), 41-48.
- [2] A. Galindro and F. M. Torres, A simple mathematical model for unemployment: a case study in Portugal with optimal control, Statistics, Optimization and Information Computing, 6 (2018), no. 1. <https://doi.org/10.19139/soic.v6i1.47>
- [3] G.N. Pathan, P.H. Bhathawala, A mathematical model for unemployment with effect of self-employment, IOSR-JM 11 (2015) 37-43.
- [4] A. Daud, A. Ghazali, Stability analysis of a simple mathematical model for unemployment, Casp. J. Appl. Sci. Res. 4 (2015) 15-18.
- [5] R. Al-maalwi, H.A. Ashi, S. Al-Sheikh, Unemployment model, Appl. Math. Sci. 12 (2018) 989-1006.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Optimal Control of Infinite Dimensional Bilinear Systems and its Relation to Heisenberg Group

Communication Info

Author:

Aziza AIB¹

¹*Ferhat Abbas University, Setif 1, Numerical and Fundamental Mathematics Laboratory, Setif 19000, Algeria.*

Keywords:

- (1) Optimal control
- (2) Bilinear system
- (3) Nilpotent Lie algebra

Abstract

Our objective is to construct two explicit matrices A and B which generate a nilpotent Lie algebra of degree two such that: $(\text{Ad}\{A\})^2(B)=(\text{Ad}\{B\})^2(A)=0$ and $[A,B]\neq 0$, in finite and infinite dimensions.

That we look to the existence of such nilpotent bilinear systems of degree 2 in finite dimension, the idea we got inspired from the **Lie algebra of the Heisenberg group**. These results are generalized to the infinite dimensional for bounded linear operators in a Hilbert space. Finally we give an application and we conclude this work with some future works.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] A. Aib, N. Bensalem, Optimal Control Problem Governed by an Infinite Dimensional One-Nilpotent Bilinear Systems, Bull, Math, Soc, Sci, Math, Roumanie, Tome 55 (103), N°2, 107-128, (2012).
- [2] A. Aib, N. Bensalem, Optimal Control Problem Governed by an Infinite Dimensional Two-Nilpotent Bilinear Systems, NACO, Vol 13, Issue 2, 314 -327, (2023).
- [3] N. Bourbaki, Lie groups and Lie algebras, Springer, (1989).
- [4] L. S. Pontryagin, V. G. Bbltyanskii, R. V. Gamkrelidze, E. F. Mishchenko, The mathematical theory of optimal processes, ED. Mir, tard. Francaise, (1974).
- [5] M. Popescu, F. Pelletier, Contrôle optimal pour une classe de systèmes bilinéaires, Revue Roumaine des Sciences Techniques, Série de Mécanique Appliquée, tome 50, N°1-3, (2005).

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Numerical simulation of fiber-reinforced concrete under cyclic loading using XFEM and concrete damaged plasticity

Communication Info

Authors:

Soufiane El YASSARI¹
Abdelouafi EL GHOULBZOURI¹

¹MODSGC unit, laboratory of applied sciences, National school of applied sciences Al Hoceima, University Abdelmalek Essaadi, Morocco

Keywords:

- (1) fiber reinforced concrete;
- (2) cyclic loading;
- (3) concrete damage plasticity;
- (4) steel fiber;
- (5) polypropylene fiber;
- (6) XFEM.

Abstract

This paper presents an analytical model for various types of fiber-reinforced concretes (FRCs) using a comprehensive fiber-reinforcing index. Owing to its ability to solve fracture problems, the extended finite element method (XFEM) is efficient for simulating the crack initiation and evolution of FRC structures. In this study, the XFEM is combined with the concrete damaged plasticity (CDP) modeling approach to investigate the quasi-static and hysteretic performance of FRC columns. Three-dimensional nonlinear finite element models were created using commercial software Abaqus. Steel and polypropylene fibers individually and combined were used in these structures. The accuracy of the (XFEM-CDP)-based analysis in predicting hysteretic behavior was validated by different test results [1] [2] [3] [4].

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Zhang, Y.-y. Y., K. A. Harries, and W.-c. C. Yuan. Experimental and numerical investigation of the seismic performance of hollow rectangular bridge piers constructed with and without steel fiber reinforced concrete. *Engineering Structures* 48 (2013), 255–265.
- [2] Liang, X., P. Xing, and J. Xu. Experimental and numerical investigations of the seismic performance of columns with fiber-reinforced concrete in the plastic hinge region. *Advances in Structural Engineering* 19 (2016), 1484–1499.
- [3] Huang, L., L. Xu, Y. Chi, and H. Xu. Experimental investigation on the seismic performance of steel-polypropylene hybrid fiber reinforced concrete columns. *Construction and Building Materials* 87 (2015), 16–27.
- [4] Zhang, Y. and D. Dias-da Costa. Seismic vulnerability of multi-span continuous girder bridges with steel fibre reinforced concrete columns. *Engineering Structures* 150 (2017), 451–464.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Modelling and control of workaholism dynamics

Communication Info

Authors:

Isaac Takaidza

North-West University, School of Mathematical and Statistical Sciences, Vanderbijlpark, South Africa

Keywords:

- (1) workaholism
- (2) compartmental model
- (3) optimal control
- (4) efficiency analysis

Abstract

Workaholism, or work addiction, is a major issue that can result in overworking, which can have serious negative effects such as burnout and/or health issues [1]. The underlying dynamics of workaholism and how it progresses over time remain poorly understood. A compartmental model for workaholism progression is proposed and utilized to pinpoint important risk factors and viable interventions for reducing the spread. Pontryagin's maximum principle is used to solve the corresponding optimal control problem [2]. Time-dependent controls are studied using optimal control theory to minimize both the workaholism burden and the intervention costs. The optimality system is derived and solved numerically [3]. The characterization of the profile of controls, together with qualitative analysis, provides a picture of the possible outcomes of the model. Efficiency analysis is also done to determine the best control strategy [4]. Study findings should help inform policy makers in devising interventions to lessen the prevalence of workaholism.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Clockify.me, Workaholism facts and statistics: everything you need to know, 2022.
- [2] R. A. Böck and J. Lorenz, Optimal control of spread of misinformation in social network, *Journal of Artificial Societies and Social Simulation* (2015)
- [3] B. Buonomo, D. Lacitignola and C. Vargas-De-León, Qualitative analysis and optimal control of an epidemic model with vaccination and treatment, *Mathematics and Computers in Simulation* 100 (2014) 88–102.
- [4] J. K. Ghosh, U. Ghosh, M. H. A. Biswas and S. Sarker, Qualitative Analysis and Optimal Control Strategy of an SIR Model with Saturated Incidence and Treatment, *Differential Equations and Dynamical Systems* (2019)

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Stabilization for an infinite-dimensional semilinear system in Banach space

Communication Info

Authors:

Abdessamad EL Alami¹
Zoubida Echchaffan I²
Aberqi Ahmed²

¹ Research Center STIS, Team
M2CS, Department of Applied
Mathematics and Informatics,
ENSAM, Mohammed V
University in Rabat, Morocco

² Laboratory LAMA,
Department of Mathematics,
Sidi Mohamed Ben Abdellah
University, Morocco.

Keywords:

(1) infinite semi-linear system
(2) duality mapping
(3) strong and weak
stabilization

Abstract

This paper considers feedback stabilization for an infinite-dimensional semilinear system evolving in Banach state space. Sufficient conditions for appropriate feedback control to ensure strong and weak stabilization are given.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Ball, J. M. (1977). Strongly continuous semigroups, weak solutions, and the variation of constants formula. *Proceedings of the American Mathematical Society*, 63(2), 370-373.
- [2] Rabie Z, El Alami, Strong and weak stabilization of semi-linear parabolic systems. *IMA Journal of Mathematical Control and Information* (2018) 00, 1-14. doi:10.1093/imamci/dny038.
- [3] Ouzahra, M. Weak and strong stabilization of bilinear systems in a Banach space. *International Journal of Control* · April 2018. DOI: 10.1080/00207179.2018.1459858.
- [4] Barbu, V. (2009). *Nonlinear differential in Banach spaces*. Springer

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Global dynamics of a generalized SEIS epidemic model

Communication Info

Authors:

Soufiane ELKHAIR¹

¹ Ibn Zohr University of Agadir,
FSA Ait Melloul,
Morocco

Keywords:

- (1) SEIS epidemic model
- (2) Global stability
- (3) endemic equilibrium
- (4) geometric approach

Abstract

In this work, we study the dynamics of an SEIS epidemic model. We assume that the model includes a general incidence rates which satisfies certain assumptions and includes different forms presented in the literature. Firstly, we prove that the disease – free equilibrium point always exists and is globally asymptotically stable when the basic reproduction number R_0 is less than unity. When R_0 is greater than unity, there is a unique endemic equilibrium which is globally asymptotically stable. The above results are obtained by the Lyapunov theory, LaSalle's Invariance Principle [4] and the geometric approach of Li and Muldowney [5].

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] M. Fan, M. Y. Li, Ke Wang; Global stability of an SEIS epidemic model with recruitment and varying total population size, *Mathematical Biosciences* 170 (2001), 199-202.
- [2] A . Kaddar , S . Elkhair, F. Eladnani : Global Asymptotic Stability of a Generalized SEIRS Epidemic Model ; *Differ Equ Dyn Syst* 21 July 2016.
- [3] A . Kaddar, A., Abta, A., Talibi Alaoui, H.: A comparison of delayed SIR and SEIR epidemic models. *Nonlinear Anal. Model. Control* 16(2), 181–190 (2011)
- [4] Y. Kuang, *Delay Differential Equations with Applications in Population Dynamics*, Academic Press, San Diego, 1993.
- [5] M.Y . Li, J.S . Muldowney: Geometric approach to global stability problems. *SIAM J. Math. Anal.* 27, 1070–1083 (1996)

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Non-Linear Age-Dependent Population Dynamics With Spatial Diffusion

Communication Info

Authors:

Khalid Hilal¹

Hiba EL ASRAOUI²

Abdelmajid EL HAJJAJI^{3,4}

¹² *LMACS Laboratory,
university sultan moulay
sliman, FST, Morocco.*

³ *LESJEP Laboratory,
Chouaib Doukkali university,
Morocco.*

Keywords:

(1) age-structure

(2) spatial diffusion

(3) asymptotic behaviour

Abstract

Several models in population dynamics are governed by reaction-diffusion equations or parabolic equations. In this work, we present a population model containing both age-structure and spatial diffusion. Existence and uniqueness results are obtained, and also the asymptotic behavior of the solution is studied.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

[1] K.Hilal Contribution à l'étude des équations paraboliques à retard application à la dynamique de populations.

[2] Malthus. An essay on the principle of populations.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Study of a fractional SIR epidemic model

Communication Info

Authors:

Abderrahman EL GMAIRI¹
Mhamed EL OMARI²
Said MELLIANI³

¹FST, Sultane Moulay Slimane
University, Beni Mellal,
Morocco

²FST, Sultane Moulay Slimane
University, Beni Mellal,
Morocco

³FST, Sultane Moulay Slimane
University, Beni Mellal,
Morocco

Keywords:

- (1) Adomian Decomposition Method
- (2) Adams-Bashforth Method
- (3) Dengue fever

Abstract

In this study, we resolve a dengue fever SIR (Susceptible-Infectious-Recovered) epidemic model cited in [1] by S. Side and M. Noorani, the integer derivative is replaced by the fractional derivative in the Caputo-Fabrizio sense.

The SIR model is challenging to precisely solve analytically. As a result, we employ an approximation method. The domain decomposition method is the one we employ. The points of endemic and disease-free equilibrium are provided, together with information on their regional stabilities.

The Adams-Bashforth scheme is used to solve an approximate solution of the fractional dengue model in order to validate our analytical results.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Side, S., Noorani, S. M: A SIR model for spread of dengue fever disease World Journal of Modelling and Simulation, 2013.
- [2] M. Derouich, A. Boutayeb, E. H. Twizell, A model of Dengue fever, *BioMed. Eng. Online*, 2(2003).
- [3] Al-Sulami H, El-Shahed M, Nieto JJ, Shammakh W (2014) On fractional order dengue epidemic model. *Math Probl Eng*.
<https://doi.org/10.1155/2014/456537>
- [4] M. Khalid, M. Sultana, F. Sami, Numerical solution of SIR model of Dengue fever, *Int. J. Comput. Appl.* 118 (21) (2015) 1– 10.
- [5] M. Caputo and M. Fabrizio, A New Definition of Fractional Derivative without Singular Kernel, *Progr. Fract. Differ. Appl.* 1:2, 1-13 (2015).

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Impact of Temperature on profit estimation of two fishermen exploiting three competing species using Markov chain

Communication Info

Authors:

RIAHI CHAIMAA¹
AGMOUR IMANE²
EL FOUTAYENI YOUSSEF³

^{1,2,3}LAMS, Hassan II University
of Casablanca, Casablanca,
Morocco

Keywords:

- (1) Fishing Profit
- (2) Discrete Time Markov Chain
- (3) Temperature Factor

Abstract

The species extinction is caused sometimes by environmental forces such as habitat fragmentation, climate change, natural disaster, evolutionary changes, etc. . and sometimes by over-exploitation by humans, and pollution, to preserve the biodiversity in order to protect the ecosystem and the environmental life cycle, it is essential to predict the probabilities of the future in the way to interfere to save and protect the species from potential extinction. As the temperature factor is an important element for marine species, in this paper, we aim to estimate the temperature factor by discrete time Markov Chain, and then estimate the profit of two fishermen exploiting three species with some numerical simulations at the end.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Y.EL FOUTAYENI, M. KHALADI, A.ZEGZOUTI, A generalized Nash equilibrium for a bioeconomic problem of fishing, *Studia*, 186--204, *Studia Informatica Universalis-HERMANN*, 2012, 186--204.
- [2] I. AGMOUR, M.BENTOUNSI, N. ACHTAICH and Y.EL FOUTAYENI, Optimization of the Two Fishermen's Profits Exploiting Three Competing Species Where Prices Depend on Harvest, *International Journal of Differential Equations* Volume 2017, Article ID 3157294.
- [3] M. Bocar Sabaly BALDE, *Dynamique des petits poissons pélagiques (Sardinella aurita et Ethmalosa fimbriata) au Sénégal dans un contexte de changement climatique : diagnostic et synthèse bioécologiques*, these Doctorat 2019.
- [4] K. G. Murty, On a characterization of P-matrices, *SIAM J Appl Math*, 20 (1971) :378-383.
- [5] Fiorella KJ, Bageant ER, Schwartz NB, Thilsted SH, Barrett CB. Fishers' response to temperature change reveals the importance of integrating human behavior in climate change analysis. *Sci Adv*. 2021 Apr 30;7(18):eabc7425. doi: 10.1126/sciadv.abc7425. PMID: 33931440; PMCID: PMC8087411.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Contrôle optimal d'un nouveau modèle de la corona virus

Communication Info

Auteurs:

Youssef Jabrani¹

Rachid Bouajaji¹

,Hassan Laarabi¹

Mostafa Rachik¹

Abdelhadi Abta¹

¹LAMS, Hassan II University of
Casablanca, Casablanca,
Morocco

Mots-clés ::

(1) Biomathématiques

(2) Corona

(3) principe du maximum de
Pontryagin

Abstract

Cette étude propose un modèle de la pandémie de corona qui intègre les cas de virus déclarés et non déclarés pour être plus réaliste. Par ailleurs, on conseille d'employer les deux mesures préventives : la vaccination et le traitement et de les appliquer simultanément. Les contrôles optimaux ont été caractérisés par le principe du maximum de Pontryagin. Enfin, les résultats des simulations numériques démontrent l'utilité des mécanismes de contrôle proposés et de cette modélisation.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

Références :

[1] Zeidler, Agnieszka, and Tomasz M. Karpinski. "SARS-CoV, MERS-CoV, SARS-CoV-2 comparison of three emerging Coronaviruses." Jundishapur Journal of Microbiology 13.6 (2020).

[2] Bouajaji, Rachid, et al. "Necessary Optimality Conditions For a Delayed Alcoholism Model with Saturated Treatment." International Conference on Research in Applied Mathematics and Computer

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Dynamics of a novel SVIR model with stochastic perturbation and incorporation of vaccine boosters

Communication Info

Authors:

Mohamed MEHDAOUI¹
Abdesslem LAMRANI ALAOUI¹
Mouhcine TILIOUA¹

¹MAIS Laboratory, MAMCS
Group, Moulay Ismail
University of Meknes, P.O. Box
509, 52000 Boutalamine,
Errachidia, Morocco

Keywords:

- (1) Epidemic model
- (2) Stochastic differential equations
- (3) Lyapunov function

Abstract

A stochastic modeling approach describing the dynamics of new-emerged seasonal diseases with ineffective vaccines is presented. Namely, the standard SVIR model is adapted by dividing the vaccinated population into three sub-populations incorporating the required doses of vaccine leading to the gain of a long-period immunity. We begin by addressing the mathematical well-posedness and the biological feasibility of the proposed model. Then, we provide sufficient conditions guaranteeing the disease persistence and extinction. Furthermore, based on stochastic stability theory and by the construction of a suitable Lyapunov function, we establish the condition under which the model admits a non-trivial periodic solution. At last, the outcomes of the performed numerical simulations are presented to support and illustrate the theoretical results.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] M. Mehdaoui, A.L. Alaoui, M. Tilioua, Dynamical analysis of a stochastic non-autonomous SVIR model with multiple stages of vaccination. *J. Appl. Math. Comput.* (2022).
- [2] D. Shangguan, Z. Liu, L. Wang, R. Tan, Periodicity and stationary distribution of two novel stochastic epidemic models with infectivity in the latent period and household quarantine. *J. Appl. Math. Comput.* 1–20 (2021).
- [3] H. Qi, X. Leng, X. Meng, T. Zhang, Periodic solution and ergodic stationary distribution of SEIS dynamical systems with active and latent patients. *Qual. Theory Dyn. Syst.* 18(2), 347–369 (2019).
- [4] Q. Liu, D. Jiang, T. Hayat, B. Ahmad, Periodic solution and stationary distribution of stochastic SIR epidemic models with higher order perturbation. *Phys. A Stat. Mech. Appl.* 482, 209–217 (2017).
- [5] X. Liu, Y. Takeuchi, S. Iwami, SVIR epidemic models with vaccination strategies. *J. Theor. Biol.*, 253 (2008).

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Impact of Antiretroviral Therapy Strategies against HIV Pathogenesis with Macrophages and CD4+T Reactivation of Latent Reservoirs

Communication Info

Authors:

Hanane HMARRASS¹
Redouane QESMI²

¹LMSM, Sidi Mohamed Ben
Abdellah University of Fez,
Morocco

²LMSM, Sidi Mohamed Ben
Abdellah University of Fez,
Morocco

Keywords:

- (1) HIV
- (2) Latency
- (3) Macrophages
- (4) Bifurcation,
- (5) Drug therapy

Abstract

We propose an in-host model describing the dynamics of HIV and its interaction with both CD4+T and macrophage cells. This model incorporates CD4+T latent reservoir as well. It is shown that the model is locally asymptotically stable at disease-free equilibrium when the basic reproduction number $R_0 < 1$.

Moreover, the model exhibits either forward or backward bifurcation when $R_0 = 1$. The global asymptotic stability of equilibria is investigated using suitable Lyapunov functions. Finally, numerical simulations are carried out to assess several drug therapy strategies to reduce HIV infection and improve health outcomes for HIV infected patients.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] R. Qesmi, A. Hammoumi, A stochastic delay model of HIV pathogenesis with reactivation of latent reservoirs, Chaos Solit Fractals 2020.
- [2] TW. Chun, L. Stuyver, et al, Presence of an inducible HIV-1 latent reservoir during highly active antiretroviral therapy, Proc. Natl. Acad. Sci. 94(1997),3193-13197.
- [3] T. Guo, Z. Qiu, et al, Modeling the role of macrophages in HIV persistence during antiretroviral therapy, J. Math. Biol. 81 (2020), 369-402.
- [4] WC. Roda, S. Liu, et al, Modeling the Effects of Latency Reversing Drugs During HIV-1 and SIV Brain Infection with Implications for the " Shock and Kill" Strategy, Bull.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Global stability of a diffusion Epidemic

Communication Info

Authors:

Mohamed AALLAM¹
Mostafa TAHIRI²
Moulay Rchid SIDI AMMI³

Keywords:

(1) vaccination
(2) Lyapunov function
(3) reaction-difusion.

Abstract

The abstract, In this paper, we consider a reaction-diffusion SVIR infection model with distributed delay and nonlinear incidence rate.

The well-posedness of the proposed model is proved. By means of Lyapunov functionals, we show that the disease free equilibrium state is globally asymptotically stable when the basic reproduction number is less or equal than one, and that the disease endemic equilibrium is globally asymptotically stable when the basic reproduction number is greater than one.

Numerical simulations are provided to illustrate the obtained theoretical results.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Kribs-Zaleta C M, Velasco-Hernández J X. A simple vaccination model with multiple endemic states. *Mathematical Biosciences*, 2000, 164(2): 183–201
- [2] Arino J, McCluskey C C, van den Driess P. Global results for an epidemic model with vaccination that exhibits backward bifurcation. *SIAM Journal on Applied Mathematics*, 2003, 64(1): 260–276
- [3] Li J, Ma Z, Zhou Y. Global analysis of SIS epidemic model with a simple vaccination and multiple endemic equilibria. *Acta Mathematica Scientia*, 2006, 26B(1): 83–93



Feasibility of using a novel shielding design in intensity modulated brachytherapy

Communication Info

Authors:

Abderrahim EL YAZZAOUI¹
Amina KHARCAHF¹
Abdeali RAHMOUNI²

¹ Materials Physics and
Subatomic Laboratory,
Department of Physics, Faculty
of Sciences, Ibn Tofail,
University, Kenitra, Morocco

² Laboratory of Solid-State
Physics, Department of Physics,
Faculty of Sciences, Sidi
Mohamed Ben Abdellah
University, Fez, Morocco

Keywords:

- (1) IMB
- (2) applicator
- (3) Monte Carlo simulation
- (4) OAR

Abstract

Intensity modulated brachytherapy (IMB) is a cancer treatment technique where shielding is used to protect organs at risk from unwanted exposure [1]. The aim of this study is to develop a novel dynamic and guided applicator in tungsten of different geometries to treat complicated cancer cases in high dose rate brachytherapy by intensity modulated brachytherapy [2]. The results obtained in this GATE/GEANT4 Monte Carlo simulation shows an optimum dosimetry compared to conventional brachytherapy [3], wherein we have significantly minimized the doses received by organs at risk (OAR), including surrounding healthy tissues.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] M. Cameron et al, Systematic Review of Intensity-Modulated Brachytherapy (IMBT): Static and Dynamic Techniques, Int J Radiation Oncol Biol Phys, 105 (2019) 206–221.
- [2] Skinner Lawrie B, Intensity modulated Ir-192 brachytherapy using high-Z 3D printed applicators, Physics in Medicine & Biology, 65 (2020).
- [3] P. Papadimitroulas, Dosimetry applications in GATE Monte Carlo toolkit, Phys Med, 41 (2010) 136–140.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Fractional HCV infection model with adaptive immunity and treatment

Communication Info

Authors:

Zakaria Yaagoub
Karam Allali

*Laboratory of Mathematics,
Computer Science and
Applications, Faculty of Sciences
and Technologies, University
Hassan II
of Casablanca, PO Box 146,
Mohammedia 20650, Morocco*

Keywords:

- (1) Global stability
- (2) HCV
- (3) Numerical simulation

Abstract

Fractional HCV infection model is suggested and studied in this work. This model contains five ordinary differential equations, we will start our study of this model by proving the existence, uniqueness and boundedness of the positive solutions. We will show also the global stability of the different equilibrium points. Finally, some numerical simulations will be given to value our theoretical results.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Yang, X., Su, Y., Yang, L., & Zhuo, X. (2022). Global analysis and simulation of a fractional order HBV immune model. *Chaos, Solitons & Fractals*, 154, 111648.
- [2] Yaagoub, Z., & Allali, K. (2022). Fractional HBV infection model with both cell-to-cell and virus-to-cell transmissions and adaptive immunity. *Chaos, Solitons & Fractals*, 165, 112855.
- [3] Yaagoub, Z., Danane, J., & Allali, K. (2022). Global Stability Analysis of Two-Strain SEIR Epidemic Model with Quarantine Strategy. In *Nonlinear Dynamics and Complexity* (pp. 469-493). Springer, Cham.
- [4] Danane, J., Allali, K., & Hammouch, Z. (2020). Mathematical analysis of a fractional differential model of HBV infection with antibody immune response. *Chaos, Solitons & Fractals*, 136, 109787.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Stochastic SIR epidemic model with vaccination strategy

Communication Info

Authors:

Marya SADKI¹
Karam ALLALI¹

*1Department of Mathematics,
Computer Science and Applications,
Faculty of Sciences and Technology, PO
Box 146, 20650 Mohammedia, Hassan
II University, Casablanca,
Morocco.*

Keywords:

- (1) Extinction
- (2) Persistence
- (3) Numerical simulation.

Abstract

With the current struggles of the world nowadays with several epidemics, modeling the dynamics of disease outbreaks has become much more important than any time before. In this context, the present paper aims at studying a stochastic SIR epidemic model with vaccination strategy. Our model consists of three epidemic compartments describing the interaction between the susceptible, the infected and the recovered individuals; an SIR model where the infected individuals transmit the infection to the susceptible ones with a transmission rate perturbed by white noise. Our paper begins by establishing that our model has unique global solution. It moves then to giving sufficient conditions for the stochastic extinction and persistence of the disease. Finally, our paper provides some numerical results to support the analytical study.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Kermack, W. O., McKendrick, A. G. (1927). A contribution to the mathematical theory of epidemics. Proc. R. Soc. Lond. 115(772): 700-721.
- [2] Djordjevic, J., Silva, C. J., Torres, D. F. (2018). A stochastic SICA epidemic model for HIV transmission. Appl Math Lett. 84: 168-175.
- [3] Oksendal, B. (2003). Stochastic Differential Equations. Stochastic Differential Equations. Springer Berlin Heidelberg, pp. 65-84.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Stochastic SIRI epidemic model with global incidence rate and relapse

Communication Info

Authors:

Bilal HARCHAOUI¹
Saloua BOUTOUIL¹
Adel SETTATI¹
Adel LAHROUZ¹
Mourad EI IDRISSE¹
Mustapha EI JARROUDI¹

¹Laboratory of mathematics and applications, FSTT, Abdelmalek Essaadi University, Tetouan, Morocco.

Keywords:

- (1) Epidemic model
- (2) Global stability
- (3) Extinction
- (4) Persistence
- (5) Stationary distribution

Abstract

We present a stochastic SIRI model with non-linear relapse and a global incidence rate $g(S)I$. Some verifiable sufficient conditions are established to ensure extinction and persistence. We also demonstrate the existence of a stationary distribution. Finally, we show some computer simulation examples to verify the theoretical findings.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] S'anchez, F., Wang, X., Castillo-Ch'avez, C., Gorman, D. M., Gruenewald, P. J. (2007). Drinking as an epidemic—a simple mathematical model with recovery and relapse. In Therapist's Guide to Evidence-Based Relapse Prevention (pp. 353-368). Academic Press.
- [2] Dalal, N., Greenhalgh, D., Mao, X. (2007). A stochastic model of AIDS and condom use. *Journal of Mathematical Analysis and Applications*, 325(1), 36-53.
- [3] Gray, A., Greenhalgh, D., Hu, L., Mao, X., Pan, J. (2011). A stochastic differential equation SIS epidemic model. *SIAM Journal on Applied Mathematics*, 71(3), 876-902.
- [4] Lahrouz, A., Omari, L. (2013). Extinction and stationary distribution of a stochastic SIRS epidemic model with non-linear incidence. *Statistics Probability Letters*, 83(4), 960-968.
- [5] Lahrouz, A., Settati, A. (2014). Necessary and sufficient condition for extinction and persistence of SIRS system with random perturbation. *Applied Mathematics and Computation*, 233, 10-19.
- [6] Settati, A., Lahrouz, A., Assadouq, A., El Fatini, M., El Jarroudi, M., Wang, K. (2020). The impact of nonlinear relapse and reinfection to derive a stochastic threshold for SIRI epidemic model. *Chaos, Solitons Fractals*, 137, 109897.
- [7] Liu, W. M., Levin, S. A., Iwasa, Y. (1986). Influence of nonlinear incidence rates upon the behavior of SIRS epidemiological models. *Journal of mathematical biology*, 23(2), 187-204.
- [8] Ruan, S., Wang, W. (2003). Dynamical behavior of an epidemic model with a nonlinear incidence rate. *Journal of Differential Equations*, 188(1), 135-163.
- [9] Lahrouz, A., Omari, L., Kiouach, D., Belma'ati, A. (2012). Completeness of global stability for an SIRS epidemic model with generalized nonlinear incidence and vaccination. *Applied Mathematics and Computation*, 218(11), 6519-6525.
- [10] Liu, Q., Chen, Q. (2015). Analysis of the deterministic and stochastic SIRS epidemic models with nonlinear incidence. *Physica A: Statistical Mechanics and its Applications*, 428, 140-153.
- [11] Abta, A., Kaddar, A., Alaoui, H. T. (2012). Global stability for delay SIR and SEIR epidemic models with saturated incidence rates. *Electronic Journal of Differential Equations*, 2012(23), 1-13.
- [12] Lahrouz, A., Omari, L., Kiouach, D. (2011). Global analysis of a deterministic and stochastic nonlinear SIRS epidemic model. *Nonlinear Analysis: Modelling and Control*, 16(1), 59-76.
- [13] Has, R. Z. (1980). *minskii. Stochastic stability of differential equations*, volume 7 of Monographs and Textbooks on Mechanics of Solids and Fluids: Mechanics and Analysis. Sijthoff Noordhoff, Alphen aan den Rijn.
- [14] Liptser, R. S. (1980). A strong law of large numbers for local martingales. *Stochastics*, 3(1-4), 217-228.
- [15] Xia, P., Zheng, X., Jiang, D. (2013, January). Persistence and nonpersistence of a nonautonomous stochastic mutualism system. In *Abstract and applied analysis* (Vol. 2013). Hindawi.
- [16] Vom Scheidt, J. (1989). *Gard, TC, Introduction to Stochastic Differential Equations*. New York-Basel, Marcel Dekker Inc. 1988. XI, 234 pp., 78.- ISBN 0-8247-7776-X (Pure and Applied Mathematics 114).
- [17] Gover, M. J. C. (1988). Review of applied linear algebra by Riaz A. Usmani. *Linear Algebra and its Applications*, 106, 53-55.
- [18] Liu, S., Jiang, D., Xu, X., Alsaedi, A., Hayat, T. (2018). Dynamics of DSI-A epidemic model with multiple stochastic perturbations. *Mathematical Methods in the Applied Sciences*, 41(16), 6024-6049.
- [19] Higham, D. J. (2001). An algorithmic introduction to numerical simulation of stochastic differential equations. *SIAM review*, 43(3), 525-546.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Extinction and persistence of a stochastic SIRS model with jump perturbation

Communication Info

Authors:

Saloua BOUTOUIL¹
Bilal HARCHAOUI¹
Adel SETTATI¹
Adel LAHROUZ¹
Abdeladim Nait¹
Mustapha El JARROUDI¹
Mustapha Erriani¹

¹Laboratory of mathematics and applications, FSTT, Abdelmalek Essaadi University, Tetouan, Morocco.

Keywords:

- (1) Stochastic SIR model
- (2) Lévy jumps
- (3) Extinction
- (4) Persistence

Abstract

In this paper, we propose to study a SIRS model with two noises, white noise and Lévy noise. Firstly, the existence of a unique positive global solution is shown. We show the global stability condition of the trivial equilibrium state of the model. Moreover, we also investigate conditions for extinction in probability and in moment. We also establish sufficient conditions for the persistence of the disease. To support the principal findings, we presented several numerical simulations.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] W.O. Kermack, A.G. McKendrick, Contribution to mathematical theory of epidemics, P. Roy. Soc. Lond. A Mat. 115 (1927) 700-721.
- [2] H.W. Hethcote, Qualitative analyses of communicable disease models, Math.Biosci. 28 (1976) 335-356.
- [3] A. Lahrouz, L. Omari, D. Kiouach, A. Belmaati, Complete global stability for an SIRS epidemic model with generalized non-linear incidence and vaccination, Appl. Math. Comput. 218 (2012) 6519-6525.
- [4] Q. Lu, Stability of SIRS system with random perturbations, Physica A 388 (2009) 3677- 3686.
- [5] Zhang, Xianghua, and KeWang. Stochastic SIR model with jumps. Applied Mathematics Letters (2013).
- [6] D. Applebaum, M. Siakalli, Asymptotic stability of stochastic differential equations driven by Lévy noise, J. Appl. Probab. 46 (2009).
- [7] J. Bao, C. Yuan, Stochastic population dynamics driven by Lévy noise, J. Math. Anal. Appl. 391 (2012) 363-375.
- [8] B. Berrhazi, M. El Fatini, A. Laaribi, A stochastic threshold for an epidemic model with Beddington-DeAngelis incidence, delayed loss of immunity and Lévy noise perturbation, Phys. A 507 (2018) 312-320.
- [9] B. Berrhazi, M. El Fatini, T. Caraballo, R. Pettersson, A stochastic SIRI epidemic model with Lévy noise, Discrete Contin. Dyn. Syst. Ser. B 23 (6) (2018) 2415-2431.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Solving Job-Shop Scheduling Problem by recurrent neural networks

Communication Info

Authors:

Lotfi NOHAIR¹
Abderrahim ELADRAOUI²
Abdelwahed NAMIR³

¹LTIM, FSBM, Hassan II
University of Casablanca,
Casablanca, Morocco

²L3A, FSBM, Hassan II
University of Casablanca,
Casablanca, Morocco

³LTIM, FSBM, Hassan II
University of Casablanca,
Casablanca, Morocco

Keywords:

- (1) Job-shop scheduling problems
- (2) recurrent neural network
- (3) Metaheuristic

Abstract

Based on the research of Zhang [1] and Willems [2], this communication proposes a recurrent neural network to solve Job-shop scheduling problems [3]. Firstly, the problem was translated in an integer linear programming model, which the objective is to minimize the makespan, subject to three types of constraints: Starting time constraints (ST units); Sequence constraints (SC units) and Resource constraints (RC units). This integer linear representation has been translated to Hopfield neural network. The proposed network used two parts: main part and feedback part. The main part include neurons representing the starting time of corresponding operation. In the feedback part, we use the network structure for constraint violation. The feedback part consists of three layers: the first layer representing the ST units, the second layer representing SC and the third layer representing RC units. Therefore, we used simulated annealing as local search to improve the performance of the proposed network. The goal is to minimize the energy that includes the makespan and the energy that represents the constraint violation. Finally, we suggest a comparative study between the recurrent neural network and the new hybrid matrix metaheuristic proposed in our article [4].

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Wenle Zhang and Rutao Luo. An adaptive feedback neural network approach to job-shop scheduling problem. In 2008 IEEE International Joint Conference on Neural Networks (IEEE World Congress on Computational Intelligence), pages 3949–3954. IEEE, 2008.
- [2] TM Willems and JE Rooda. Neural networks for job-shop scheduling. Control Engineering Practice, 2(1):31–39, 1994.
- [3] Miss Rukhsana G Sache. Neural network for solving job-shop scheduling problem. IOSR Journal of Computer Engineering, 16(6):18–25, 2014.
- [4] Lotfi NOHAIR, Abderrahim EL ADRAOUI, and Abdelwahed NAMIR. Solving non-delay job-shop scheduling problems by a new matrix heuristic. Procedia Computer Science, 198:410–416, 2022.



Optimality conditions for non-convex generalized bilevel optimal control problems

Communication Info

Authors:

RACHID EL IDRISSE¹
LAHOUSSE LAFHIM¹

¹LASMA, FSDM, DEPARTMENT
OF MATHEMATICS, SIDI
MOHAMED BEN ABDELLAH
UNIVERSITY, FEZ, MOROCCO.

Keywords:

- (1) Quasi-variational inequalities
- (2) Optimal value function
- (3) Maximum principle
- (4) Optimality conditions
- (5) Optimal control problem

Abstract

In this work, we present Pontryagin optimality conditions for a generalized bilevel optimal control problem, where the leader has a pure state inequality constraint and the follower is a non-convex quasi-variational inequality parameterized by the final state. To transform the problem under consideration to a single-level optimal control problem, we use the value function. Many tools were used, including non-smooth analysis, the exact penalization, and some regularity conditions were applied in this study. Without forgetting to add some conditions to make sure that the derived maximum principle is not degenerate. In the last, we apply our results to a problem of control optimal.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] B.S. Mordukhovich. Generalized Differential Calculus for Nonsmooth and Set-Valued Mappings, *J. Math. Anal. Appl.*, 183(1) (1994) 250-288.
- [2] J.J. Ye, D.L. Zhu, Q.J. Zhu, Exact Penalization and Necessary Optimality Conditions for Generalized Bilevel Programming Problems, *SIAM J. Optim.*, 7(2) (1997) 481-507.
- [3] R.B. Vinter, *Optimal Control*, Boston : Birkhäuser, (2010).
- [4] F. Benita, S. Dempe, P. Mehrlitz, Bilevel Optimal Control Problems with Pure State Constraints and Finite-Dimensional Lower Level, *SIAM J. Optim.*, 26(1) (2016) 564-588.
- [5] J. Dutta, L. Lafhim, A. Zemkoho, S. Zhou, Nonconvex Quasi-Variational Inequalities: Stability Analysis and Application to Numerical Optimization, arXiv reprint, (2022) arXiv: 2210.02531.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



American option pricing under a generalized Black-Scholes model

Communication Info

Authors:

El Hassan AATIF¹
Abdelkarim EL MOUATASIM²

¹ Faculty of Science, Ibn Zohr
University, Morocco

² Faculty
Polydisciplinary Ouarzazate, I
bn Zohr University, Morocco

Keywords:

- (1) American option pricing
- (2) Linear Complementarity
- (3) Penalty method

Abstract

The aim of this work is to propose a generalized Black-Scholes type model [1,2,3] for establishing a numerical study of an American option price, which the dynamics of the underlying risky asset is described by a stochastic equation, which uses a nonstandard volatility. The mathematical modeling of the related option pricing problem leads to a partial differential equation. The early exercise constraint on the American option leads to formulate linear complementarity problem LCP. A penalty method [4] is then established to solve the LCP problem for American put option price. Finally, a comparative numerical study is carried using the values of the coefficients of our model.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] F. Black, M. Scholes, The pricing of options and corporate liabilities, Political Economy, 9 (1973) 69-107.
- [2] J.Cox, Notes I: constant elasticity of variance diffusions, working paper, Stanford university, 1975.
- [3] A. Benjaouad, M. Kabiri-Alaoui, D. Meskine, A. Souissi, Option pricing under model involving slow growth volatility, Int. J. Comput. Math, 88 (2011) 2770-2781.
- [4] P.A. Forsyth, K. R. Vetzal, Quadratic convergence for valuing American options using a penalty method, SIAM J. Sc. Computing 23(2002) 2096-2123.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



A time dependent copula

Communication Info

Authors:

MOHAMED EL MAAZOUZ

Keywords:

- (1) Copula
- (2) Brownian motion

Abstract

A parametrized copula is well known in literature especially archimedean ones. A time dependant copula is also studied earlier by linking two or more stochastic processes like the Markov copula and the Brownian one. Our contribution is to study the copula joining respectively the maxima and the minima of a standard Brownian motion to a conditioned Brownian motion, investigate limit cases and represent scatter plots for some values of time for possible applications in finance.

References

- [1] Roger B Nilsen An introduction to copulas. Springer series in statistics Springer Sciences+ Business Media Inc New York second edition 2006
- [2] Piotr Jaworski Fabrizio Durante Wolfgang Hardle Thomasz Rychlik Copula theory and its applications Lecture note in statistics Waesaw 25-26 September 2009.
- [3]. Schuss Z 2010 Theory and applications for stochastic processes An analytical approach Springer New York
- [4].Durante F and C Sempi (2016) Principle of Copula Theory CRS Press Boca Raton FL

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Mathematical modeling of the demographic dividend capture applied in economy

Communication Info

Authors:

Cheikh GUEYE¹
Babacar TOUMBOU²
Abdoulaye DIOUF³

¹Laboratory of Applied Mathematics, Cheikh Anta Diop University of Dakar, Senegal

²Laboratory of Mathematics and Applications, Iba Der Thiam University of Thies, Senegal.

³Laboratory of Mathematics and Applications, Assane Seck University of Ziguinchor, Senegal

Keywords:

- (1) Demographic Dividend
- (2) Economically dependent
- (3) Economically non-dependent,
- (4) Mathematical study.

Abstract

The aim of this work is to develop tools and techniques for modelling the capture of the Demographic Dividend. We have presented a system of ordinary differential equations modelling the variation of economically dependent and economically non-dependent populations. This system involves birth rate, natural mortality, infant mortality, migration (inward and outward) and transfers. The mathematical study of this system of ordinary differential equations shows the existence of an equilibrium point whose stability depends on a number of system parameters.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Andrew Mason, 2013, Demographic Dividend Working Group Barcelona, Spain June 5-8, " Overview of Demographic Dividend".
- [2] Aiyar S. S., & Mody A. (2011). The demographic dividend: Evidence from the Indian states.
- [3] Bloom D. E., Humair S., Rosenberg L., Sevilla J. P., & Trussell J. (2013). A demographic dividend for sub-Saharan Africa: Source, magnitude, and realization.
- [4] Cardona C., Rusatira J. C., Cheng X., Silberg C., Salas I., Li Q., ... & Rimon J. G. (2020). Generating and capitalizing on the demographic dividend potential in sub-Saharan Africa: a conceptual framework from a systematic literature review. *Gates Open Research*, 4(145), 145.
- [5] Dramani L. and F. Ndiaye (2012). " Estimating the First Demographic Dividend in Senegal: The National Transfers Account Approach", *British Journal of Economics, Management and Trade* 2(2): 39-59.
- [6] Lee Ronald, Mason Andrew, (2011); "Population Aging and the Generational Economy : A Global Perspective".

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Modelling Systemic Risk: The case of Moroccan banks

Communication Info

Authors:

Cherif El Msiyah ¹

Jaouad Madkour ²

Ayoub Kyoud ³

¹ National School of Commerce and Management, Moulay Ismail University, Méknes, Morocco.

² Department of Economics and Management, Faculty of Economics and Management, Abdelmalek Essaadi University, Tétouan, Morocco.

³ National School of Commerce and Management, Ibn Tofail University, Kenitra, Morocco.

Keywords:

(1) Systemic risk

(2) Neural networks

(3) Moroccan banks

Abstract

The Coronavirus crisis has negatively impacted the Moroccan banking system, increasing the systemic risk. In such a situation, the failure of one financial institution could lead to a chain of bankruptcies, which could have a severe repercussion on the global economy. This has made the management of systemic risk a major concern for researchers, see Keilbar and Wang [1], Rivera-Escobar et al. [2] and Naeem et al. [3]. In this communication, we present a double neural networks approach in order to identify the Moroccan systemically important banks and investigate the systemic risk evolution during the pandemic crisis.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

[1] Keilbar, G., & Wang, W. (2022). Modelling systemic risk using neural network quantile regression. *Empirical Economics*, 62(1), 93-118.

[2] Rivera-Escobar, O., Escobar, J. W., & Manotas, D. F. (2022). Measurement of systemic risk in the colombian banking sector. *Risks*, 10(1), 22.

[3] Naeem, M. A., Karim, S., & Tiwari, A. K. (2022). Quantifying systemic risk in US industries using neural network quantile regression. *Research in International Business and Finance*, 61, 101648.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Oil price prediction using machine learning models

Communication Info

Authors:

Soumaya BIDAHA
Pr. Mehdi ZAHID

Keywords:

- (1) Financial Series
- (2) Machine learning
- (3) Prediction

Abstract

In this article, we will use machine learning models to predict financial series and compare their performance. The thing that can help investors to make the appropriate investments' decisions, especially under crisis circumstances [1]. Several models were tested to confirm the appropriate one, starting from the very standard models, multiple linear regression for instance, and finally try the recent ones, namely gradient boosting [2][3]. We used as well a neural network model, Long short-term memory (LSTM) given that they approved their performance for this type of financial series [4]. We will try also to showcase the shortcomings of each used model and focus on its added value to make relevant predictions in the case of Brent oil time series. [5][6].

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Naeem, M.A.; Hasan, M.; Arif, M.; Balli, F.; Shahzad, S.J.H. Time and frequency domain quantile coherence of emerging stock markets with gold and oil price. *Phys. A Stat. Mech. Its Appl.* 2020, 553, 124235.
- [2] Chen, T.; Guestrin, C. XGB: A scalable tree boosting system. In *Proceedings of the 22nd ACM SIGKDD International Conference on Knowledge Discovery and Data Mining*, New York, NY, USA, 13–17 August 2016.
- [3] Ke, G.; Meng, Q.; Finley, T.; Wang, T.; Chen, W.; Ma, W.; Ye, Q.; Liu, T.-Y. LGBM: A highly efficient gradient boosting decision tree. In *Proceedings of the 31st Conference on Neural Information Processing Systems (NIPS 2017)*, Long Beach, CA, USA, 4–9 December 2017.
- [4] Song, X., Liu, Y., Xue, L., Wang, J., Zhang, J., Wang, J., ... Cheng, Z. (2020). Time-series well performance prediction based on Long Short-Term Memory (LSTM) neural network model. *Journal of Petroleum Science and Engineering*, 186, 106682. doi:10.1016/j.petrol.2019.106682
- [5]. Das, D.; Le Roux, C.L.; Jana, R.K.; Dutta, A. Does Bitcoin hedge crude oil implied volatility and structural shocks, A comparison with gold, commodity and the US Dollar. *Financ. Res. Lett.* 2020, 36, 101335.
- [6]. Lin, B.; Su, T. Does oil price have similar effects on the exchange rates of BRICS? *Int. Rev. Financ. Anal.* 2020, 69, 101461.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Probability Density Function Estimation based on local spline method

Communication Info

Authors:

Nezha MOHAOUI¹
Abdelilah MONIR¹
Hamid MRAOUI²

¹LMI, Moulay Ismail University
of Meknes, Morocco

²LARI, Mohamed 1 University of
Oujda, Morocco

Keywords:

- (1) Density Estimation
- (2) B-spline approximation
- (3) Cross validation

Abstract

This work presents a new non-parametric density estimator derived from the theory of local polynomial estimation and spline method. This model based on the blossoming approach, to achieve a smooth fit. We propose a kernel spline distribution based on the class of B-splines and local polynomials, and derive its theoretical properties, including the asymptotically optimal choice of bandwidth. A detailed theoretical analysis and comparisons of our estimator with existing local-based and kernel-based density estimators are presented.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Tsybakov A. B., Introduction to Nonparametric Estimation, Springer series in statistics, 2009.
- [2] C. Gu and C. Qiu, Smoothing Spline Density Estimation: Theory, The Annals of Statistics, 1993.
- [3] T. Lyche and K. Mørken, Spline Methods Draft, Department of Informatics, Center of Mathematics for Applications, University of Oslo, 2005.
- [4] J. Fan and I. Gijbels, Local Polynomial Modelling and Its Applications, London Chapman & Hall, 1996.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



L'impact de l'ISR sur l'indice composite de performance financière

Communication Info

Authors:

Mohammed ALAMI
CHENTOUFI¹
ANISS AIT ALLA²
JAOUAD LAAMIRE³
OMAR ZIRARI³

¹LM2CE, Université Hassan I de Settat, Maroc.

²LRMD, Université Hassan I de Settat, Maroc ?

³LARETA, Université Hassan I de Settat, Maroc.

Keywords:

(1) Investissement
Socialement Responsable
(2) Performance Financière
(3) ACP

Abstract

Le développement de l'investissement socialement responsable (ISR) au milieu des années 1990 a ouvert un vaste champ de recherche en matière de construction de portefeuille. En effet, les investisseurs rompent avec la théorie financière traditionnelle en intégrant des éléments extra-financiers dans leurs stratégies de gestion de portefeuille [1].

En ce sens, l'émergence de ce nouveau type d'investissement a déclenché un engouement de la communauté scientifique sur la performance de l'ISR [2], qui a conduit à des résultats mitigés [3]

Une des explications possibles de cette hétérogénéité des résultats est que la méthodologie employée par les différentes études a une influence inévitable sur son résultat, ou que la performance financière de l'ISR peut être influencée par la mesure de la performance financière employée (variable de risque ou de rentabilité). [4]

Pour cette raison, l'analyse de nos données est réalisée à l'aide d'une analyse en composantes principales de la performance financière, qui permet de construire un indice synthétique incluant la plupart des variables utilisées pour mesurer la performance financière dans la littérature empirique. L'objectif ici est de saisir une tendance générale de l'impact de l'ISR sur cet indice composite de performance financière. Les résultats du test multivarié sur l'indice composite montrent que les entreprises non ISR ont un impact négatif et statistiquement significatif sur l'indice de performance financière. De même, l'effet des investissements réalisés par les entreprises engagées a un impact négatif, mais non statistiquement significatif, sur la performance financière [5]; [6]

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] ALAMI CHENTOUFI.M., ZARI.T., & TIKOUK.J, The Performance of Socially Responsible Investments in the Eyes of Stakeholders. Journal of Economic Cooperation & Development, 2022.
- [2] Utz, S., & Wimmer, M. (2014). Are they any good at all? A financial and ethical analysis of socially responsible mutual funds. Journal of Asset Management, 15(1), 72-82.
- [3] Chentoufi, M. A., & Zari, T. (2020a). Is socially responsible investment (sri) a value-creating or value-destroying investment? International Journal of Management (IJM), 11(10).
- [4] Babcicky, P. (2013). Rethinking the foundations of sustainability measurement: The limitations of the Environmental Sustainability Index (ESI). Social Indicators Research, 113(1), 133-157.
- [5] Chentoufi, M. A., & Zari, T. (2020b). The financial performance of the investment between social responsibility and irresponsibility-new modeling. Commun. Math. Biol. Neurosci., 2020, Article-ID.
- [6] Chang, C. E., & Witte, H. D. (2010). Performance evaluation of US socially responsible mutual funds : Revisiting doing good and doing well. American Journal of Business.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Study of the volatility and the phenomenon of persistence of shocks in the Moroccan financial market: Model ARFIMA (p; d; q)-EGARCH (p; q)-M

Communication Info

Authors:

Mourad Maarouf¹

¹LARESSGD, Cadi Ayyad

University Marrakech, Morocco

Keywords:

- (1) Nonlinearity
- (2) Leverage effect
- (3) long memory
- (4) Volatility,
- (5) financial market

Abstract

In an environment characterized by the predominance of uncertainty and informational imperfections, taking into account volatility and the phenomenon of long memory is of great importance in the decision-making process of investors and speculators on the financial markets. The objective thus consists in making prevail the nonlinearity governing the determination of the price of the actions by trying to capture the asymmetrical effects of the shocks on the dynamics of the uncertainty translating the existence of a leverage effect, and the persistence of the shocks. Justifying the inefficiency of the financial market. In order to be able to answer this problem, we will adopt an econometric model ARFIMA-EGARCH-M making it possible to determine the nonlinear dynamics at the level of the mean and the conditional variance of the stock market return.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] C.W.J. GRANGER. Long memory relationships and the aggregation of dynamic models Journal of Econometrics 14 (1980) 227-238. © North-Holland Publishing Company
- [2] C. W. J. Granger and R.Joyeux, , An Introduction to Long- Memory Time Series Models and Fractional Differencing, Journal of Time Series Analysis, 1, (1980) 15-29.
- [3] Ding, Z., C. Granger and R. Engle (1993), "A Long Memory Property of Stock Market Returns and a New Model", Journal of Empirical Finance, 1, 83-106.
- [4] Ding, Z. and C. Granger (1996), "Modeling Volatility Persistence of Speculative Returns: A New approach", Journal of Econometrics, 73: 185-215.
- [5] R.T. Ballie. Long memory process and fractional integration in econometrics Journal of Econometrics 73, (1996), 5 -59

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Bibliometric Analysis of Ethnomathematics in Classroom

Communication Info

Authors:

Edi SUPRIYADI^{1,2}

TURMUDI²

Jarnawi Afgani DAHLAN¹

¹Department of Mathematics
Education, Universitas
Pendidikan Indonesia,
Bandung, Indonesia

² Department of Industrial
Engineering, Sekolah Tinggi
Teknologi Bandung, Bandung,
Indonesia

Keywords:

- (1) Bibliometric
- (2) Ethnomathematics
- (3) Mathematics
- (4) Mathematics Education

Abstract

There are several challenges to incorporating ethnomathematics into the curriculum. Peni and Baba [1] found that ethnomathematics is often only used as a superficial introduction to mathematical topics, while Sunzuma and Maharaj [2] identified teacher-related issues, such as a lack of knowledge about how to integrate ethnomathematics approaches into geometry teaching, as hindrances to its integration. However, Katz [3] argued that ethnomathematics can be an effective tool for motivating students to learn a range of mathematical concepts. This study employed a bibliometric analysis [4], [5] method using the Scopus database to examine keywords, authors, publications, and trends in ethnomathematics classroom papers. The focus on ethnomathematics in the classroom is a relevant and timely topic for exploring new ways to advance the field. The keywords used in this study were "ethnomathematics" and "classroom." There have been 41 documents produced on the topic of ethnomathematics, with an average of 7,537 citations each. The source with the highest number of articles on ethnomathematics is "Journal of Physics: Conference Series," with 8 articles. The first-ranked author, Oliveras ML, has published 3 articles on the topic. The most cited paper in this study is [6].

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] N. R. N. Peni and T. Baba, "Consideration of curriculum approaches of employing ethnomathematics in mathematics classroom," in *Journal of Physics: Conference Series*, 2019, vol. 1321, no. 3, p. 32125.
- [2] G. Sunzuma and A. Maharaj, "Teacher-related challenges affecting the integration of ethnomathematics approaches into the teaching of geometry," *Eurasia J. Math. Sci. Technol. Educ.*, vol. 15, no. 9, 2019, doi: 10.29333/ejmste/108457.
- [3] V. J. Katz, "Ethnomathematics in the Classroom.," *Learn. Math.*, vol. 14, pp. 26–30, 1994.
- [4] M. Aria and C. Cuccurullo, "bibliometrix: An R-tool for comprehensive science mapping analysis," *J. Informetr.*, 2017, [Online]. Available: <https://www.sciencedirect.com/science/article/pii/S1751157717300500>
- [5] E. Supriyadi, "a Bibliometrics Analysis on Mathematical Thinking in Indonesia From Scopus Online Database With Affiliation From Indonesia," *Alifmatika J. Pendidik. Dan Pembelajaran Mat.*, vol. 4, no. 1, pp. 82–98, 2022, doi: 10.35316/alifmatika.2022.v4i1.82-98.
- [6] R. Eglash, A. Bennett, C. O'Donnell, S. Jennings, and M. Cintorino, "Culturally situated design tools: Ethnocomputing from field site to classroom," *Am. Anthropol.*, vol. 108, no. 2, pp. 347–362, 2006, doi: 10.1525/aa.2006.108.2.347.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



The homogeneous spectrum of a G-graded commutative ring

Communication Info

Authors:

Yassir MATA¹

Mohamed AQALMOUN¹

¹LMMPA, ENS, DEPARTMENT
OF MATHEMATICS, SIDI
MOHAMED BEN ABDELLAH
UNIVERSITY, FEZ, MOROCCO.

Keywords:

(1) G-graded ring

(2) G-graded prime ideal

(3) G-graded maximal ideal

Abstract

Let G be a torsion group. In this article, we focus only on G -graded commutative ring i.e commutative ring R such that $R = \bigoplus_{g \in G} R_g$ where R_g as Abelian group and $R_g R_{g'} \subseteq R_{gg'}$ for all, $g' \in G$. Our main goal is to establish a strong relation between G -graded prime (maximal) ideals of R and prime (maximal) ideals of R_e , for instance, it is showed that, the G -graded spectrum of R is homeomorphic to the spectrum of R_e with respect to the Zariski topologies.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] W. Heinzer and M. Roitman. The homogeneous spectrum of a graded commutative ring. Proc. Amer. Math. Soc 130 (2002), 1573-1580.
- [2] H. A. Khashan. Graded rings in which every graded ideal is a product of Gr-primary ideals. Int. J. Algebra. 2(13-16) (2005), 779-788.
- [3] J. Ohm and R. Pendleton. Rings with Noetherian spectrum. Duke Math. J.35:631-639, (1968).
- [4] A. Seidenberg. A note on the dimension theory of rings, Pac. J. Math., 3(1953), 505-512.
- [5] A. Yousefian Darani and S. Motmaen. Zariski topology on the spectrum of graded classical prime submodules. Appl. Gen. Topol. 14, no. 2(2013), 159-169.



Tikhonov regularization of heavy ball method driven by a hessian term. New results of convergence

Communication Info

Authors:

Akram Chahid BAGY¹
Zaki CHBANI²
Hassan RIAHI³

¹LM DP, Cadi Ayad University,
Marrakech, Morocco

²LM DP, Cadi Ayad University,
Marrakech, Morocco

³LM DP, Cadi Ayad University,
Marrakech, Morocco

Keywords:

- (1) Convex optimization
- (2) Heavy-ball method
- (3) Tikhonov approximation
- (4) Hessian-driven damping

Abstract

Let H be a real Hilbert space, and $f : H \rightarrow \mathbb{R}$ be a convex twice differentiable function whose solution set $\operatorname{argmin}_H f$ is nonempty. We investigate the long-time behavior of the trajectories of the vanishing damped dynamical system with Tikhonov regularizing term and Hessian-driven damping

$$\ddot{x}(t) + \alpha \dot{x}(t) + \delta \nabla^2 f(x(t)) \dot{x}(t) + \beta(t) \nabla f(x(t)) + cx(t) = 0$$

where α, c, δ are three positive constants, and the time scale parameter β is a positive nondecreasing function such that $\lim_{t \rightarrow +\infty} \beta(t) = +\infty$, and the Hessian driven damping significantly

reduces the oscillatory aspects. Under some assumptions on the parameter β , we will show rapid convergence of values, strong convergence towards the minimum norm element of $\operatorname{argmin}_H f$ and rapid convergence of the gradients towards zero. Note that the time scale parameter β improves the rate of convergences mentioned above. As particular cases of β , we set $\beta(t) = t^r \ln^q(t)$, for $(r, q) \in \mathbb{R}_+^2$ and $\beta(t) = e^{\gamma t^p}$, for $p \in]0; 1[$ and $\gamma > 0$.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] H. Attouch, Variational Convergence for Functions and Operators, Appl. Math. Ser., Pitman Advanced Publishing Program, Boston, 1984.
- [2] H. Attouch, A. Balhag, Z. Chbani, H. Riahi, Damped inertial dynamics with vanishing Tikhonov regularization: Strong asymptotic convergence towards the minimum norm solution. J. Differential Equations 311 (2022) 29{58. <https://doi.org/10.1016/j.jde.2021.12.005>
- [3] H. Attouch, A. Balhag, Z. Chbani, H. Riahi, Fast convex optimization via inertial dynamics combining viscous and Hessian-driven damping with time rescaling, Evol. Equ. Control Theory 11 (2) (2022) 487-514.
- [4] H. Attouch, A. Balhag, Z. Chbani, H. Riahi, Accelerated gradient methods combining Tikhonov regularization with geometric damping driven by the Hessian, arXiv.2203.05457 (2022).
- [5] H. Attouch, Z. Chbani, H. Riahi, Fast proximal methods via time scaling of damped inertial dynamics, SIAM J. Optim., 29 (3) (2019) 2227{2256. <https://doi.org/10.1137/18M1230207>
- [6] A.C. Bagy, Z. Chbani, H. Riahi, The Heavy ball method regularized by Tikhonov term. Simultaneous convergence of values and trajectories, Evol. Equ. Control Theory 12 (2) (2023) 687-702. <https://doi.org/10.3934/eect.2022046>
- [7] B. Polyak, Some methods of speeding up the convergence of iteration methods, USSR Comput. Math. Math. Phys. 4 (1964) 1{17. Sci., 4 (2010) 3289-3306.
- [8] W. Siegel, Accelerated first-order methods: Differential equations and Lyapunov functions, <https://doi.org/arXiv:1903.05671v1> [math.OC] (2019).

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



RECONSTRUCTING A FUNCTION FROM ITS CONICAL RADON TRANSFORM

Communication Info

Authors:

Rim GOUIA ZARRAD¹

¹South Mediterranean
University, 1053 Les Berges du
Lac II Walkway, Tunis 1053
TUNISIA

Keywords:

- (1) Inverse Problem
- (2) Conical Radon Transform

Abstract

In recent years, Radon type transforms that integrate functions along families of curves or surfaces, have been intensively studied due to their applications to inverse scattering, synthetic aperture radar, imaging science, nuclear industry, etc.

In this presentation, we consider the transform that integrates a function f over a family of cones invariant to translation. A new exact inversion formula is presented in the case of fixed opening angle and vertical central axis. In addition, the results of numerical simulations are presented to demonstrate the efficiency of the suggested algorithm in 2D[1-3].

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] R. Gouia-Zarrad, G. Ambartsoumian, Exact inversion of the conical Radon transform with a fixed opening angle, *Inverse Problems* 30, (2014).
- [2] R. Gouia-Zarrad, Analytical reconstruction formula for n-dimensional conical Radon transform, *Computers and Mathematics with Applications*, Vol. 68, Issue 9, (2014).
- [3] Gouia-Zarrad, Rim, Souvik Roy, Sunghwan Moon, Numerical inversion and uniqueness of a spherical radon transform restricted with a fixed angular span, *Applied Mathematics and Computation* 408 (2021): 126338.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Algebraic points of degree at most 14 on the Fermat septic

Communication Info

Authors:

Moussa FALL¹
Moustapha Camra²
Oumar SALL³

^{1,2,3} *Laboratoire de
Mathématiques et
Applications, Université
Assane Seck de Ziguinchor,
Sénégal.*

Keywords:

- (1) Algebraic points
- (2) Divisors
- (3) Linear systems
- (4) Theorem of Abel Jacobi

Abstract

In this paper, we study the algebraic points of degree at most 14 over \mathbb{Q} on the Fermat septic curve F_7 of projective equation $x^7 + y^7 + z^7 = 0$. Klassen and Tzermias gave in [5] a geometric description of algebraic points of degree at most 5 over \mathbb{Q} on F_7 and Sall improved the results of Klassen and Tzermias by determining in [6] the algebraic points of degree at most 10 over \mathbb{Q} . Using their results and Abel Jacobi's theorem, we extend their work by giving a geometric description of algebraic points of degree at most 14 over \mathbb{Q} on F_7 .

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] B. Gross and D. Rohrlich, Some results on the Mordell-Weil group of the jacobian of the Fermat curve, *Invent. Math.* 4 (1978), 201-224.
- [2] D. K. Faddeev, On the divisor class groups of some algebraic curves, *Dokl. Tom 136 pp. 296-298 Sov. Math. Vol. 2 (1961) pp. 67-69*
- [3] D. K. Faddeev, Invariants of divisor classes for the curves $x^k(1-x)^l = y^l$ in l -adic cyclotomic fields, *Trudy Math. Inst. Steklov* 64 (1961) pp. 284-293.
- [4] M. Hindry and J. H. Silverman, *Diophantine geometry, an introduction*, volume 201 of Graduate Texts in Mathematics. Springer-Verlag, New York, \$2000\$.
- [5] O. Debarre and M. Klassen, Points of low degree on smooth plane curves, *J. Reine Angew. Math.* 446, 81-87 (1994)
- [6] O. Sall, Points algébriques de petits degrés sur les courbes de Fermat, *C. R. Acad. Sci. Paris*, t. 330, série I, p 67-70, 2000.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Points algébriques de degré donné quelconque sur la courbe d'équation affine: $y^2 = 6x(x^4 + 3)$

Communication Info

Authors:

Mohamadou Mor Diogou
DIALLO¹
Chérif Mamina COLY²
Oumar SALL³

¹LMA, Assane Seck University of
Ziguinchor, Senegal

²LMA, Assane Seck University
of Ziguinchor, Senegal

³LMA, Assane Seck University
of Ziguinchor, Senegal

Keywords:

- (1) Mordell-weil group
- (2) Jacobian
- (3) Linear system

Abstract

We determine explicitly the set of algebraic points of given degree on \mathbb{Q} over the affine equation curve $y^2 = 6x(x^4 + 3)$.

This curve is described by Nils BRUIN in [1], who saw that the Mordell-Weil group is finite and explained the generators of the torsion group for this curve. In this note a necessary and sufficient condition is the finiteness of the Mordell-Weil group of rational points of the Jacobian J .

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] N. BRUIN : On powers as sums of two cubes, Algorithmic Number Theory, Tome 21, 4th International Symposium, ANTS-IV Leiden, The Netherlands, July 2-7, (2000), p. 169–184.
- [2] P.A Griffiths: Introduction to algebraic curves, Translation mathematical monographs volume 76. (1989). American Mathematical Society, Providence (1989).
- [3] E.F. Schaefer, Rational points on algebraic curves, lecture II, February 5, 1999, Santa Clara University.



A Sequential Upper Parametric Approximation Method for Generalized Fractional Programs

Communication Info

Authors:

Karima BOUFI¹

Abdessamad FADIL¹

Ahmed ROUBI¹

¹*LMISI, Hassan I University of
Settat, Settat, Morocco*

Keywords:

- (1) Generalized fractional programming
- (2) Nonconvex optimization
- (3) Successive majorizations methods

Abstract

The majorization approximation procedure consists in replacing the resolution of a nonlinear optimization problem by solving a sequence of simpler ones, whose objective and constraint functions upper estimate those of the original problem. For generalized fractional programming, i.e., constrained minimization programs whose objective functions are maximums of finite ratios of functions, we propose an adapted scheme that simultaneously upper approximates parametric functions formed by the objective and constraint functions. This notion is defined for continuously differentiable functions. For directionally convex functions, that is, functions whose directional derivatives are convex with respect to directions, we will establish that every cluster point of the generated sequence satisfies Karush-Kuhn-Tucker type conditions expressed in terms of directional derivatives. By specifying the generic algorithm to particular problems we obtain new methods. In particular, for generalized fractional programs with continuously differentiable functions that have Lipschitz gradients a new sequential quadratic method, and a new gradient type method are obtained.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] A. Beck, A. Ben-Tal, and L. Tetruashvili. A sequential parametric convex approximation method with applications to non-convex truss topology design problems. *J. Glob. Optim.*, 47(1) :29–51, 2010.
- [2] C.R. Bector, S. Chandra, and M.K. Bector. Generalized fractional programming duality : a parametric approach. *J. Optim. Theory Appl.*, 60(2) :243–260, 1989.
- [3] J-P. Crouzeix, J.A. Ferland, and S. Schaible. An algorithm for generalized fractional programs. *J. Optim. Theory Appl.*, 47 :35–49, 1985.
- [4] K. Boufi and A. Roubi. Prox-regularization of the dual method of centers for generalized fractional programs. *Optim Methods Softw.*, 34(3) :515–545, 2019.



Mathematical modeling of a fractal contact law in granular materials

Communication Info

Authors:

Younes ABOUELHANOUNE

EMAO, ENSA Al-Hoceima.
Abdelmalek Essaadi University
Tetouan, Morocco

Keywords:

- (1) Elastic material
- (2) boundary layers
- (3) Γ -convergence
- (4) fractal interface

Abstract

In this paper, we study a dense elastic network generated by an Apollonian loading of granular material in \mathbb{R}^2 [1]. We suppose the discs are compressed together to generate tiny straight contact regions with perfect attachment on thinner sections [2]. The goal is to use Γ -convergence methods to investigate the structure's asymptotic behavior in respect to a parameter characterizing the thickness of the perfect contact lines between the materials [3, 4]. On the resultant residual fractal interface, we get an effective limit condition that represents the potential elastic energy of this balancing network under external stresses.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Y. Abouelhanoune and M. El Jarroudi, Analysis of interfacial fractal contact in 3-dimensional packing, International Journal of Applied Mathematics, Volume 35 No. 2 (2022), 317-329.
- [2] Y. Abouelhanoune and M. El Jarroudi, Interfacial contact model in a dense network of elastic materials, Functional Analysis and Its Applications, 2021, Vol. 55, No. 1, pp. 1-14.
- [3] Vojislav V. Mitic, and al., Fractal frontiers in microelectronic ceramic materials. Ceramics International, V 45, Issue 7, Part B, 2019, 9679-9685.
- [4] Mingchun Lin, and al., A topological view on microscopic structural evolution for granular material under loading and unloading path. Computers and Geotechnics 141, 2022, 104530.
- [5] Sergey Korchagin and al., Mathematical Modeling of Layered Nanocomposite of Fractal Structure. Mathematics 2021, 9(13), 1541.
- [6] R. Lakes, Materials with structural hierarchy, Nature 365 (1993), 511-515.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Existence results of hybrid fractional differential equation with generalized ω -Caputo Fractional derivative

Communication Info

Authors:

Najat CHEFNAJ¹
Khalid HILAL¹
Ahmed KAJOUNI¹

¹LMACS, Sultan Moulay Slimane
University, Faculty of Sciences
and Technics, Beni Mellal,
Morocco

Keywords:

- (1) Hybrid systems of ordinary differential equations
- (2) fractional derivatives and integrals
- (3) fixed-point theorems.

Abstract

Fractional calculus refers to integration or differentiation of any order. The field has a history as old as calculus itself, which did not attract enough attention for a long time. In the past decades, the theory of fractional differential equations has become an important area of investigation because of its wide applicability in many branches of physics, economics and technical sciences. Impulsive effects are common phenomena due to short-term perturbations whose duration is negligible in comparison with the total duration of the original process [5]. Such perturbations can be reasonably well approximated as being instantaneous changes of state, or in the form of impulses. The governing equations of such phenomena may be modeled as impulsive differential equations. In this paper, we establish sufficient conditions for the existence and uniqueness of solution of impulsive hybrid fractional differential equations with initial and boundary hybrid conditions. The proof of the main result is based on the classical fixed point theorems such as Banach fixed point theorem and Leray-Schauder alternative fixed point theorem. Two examples are included to show the applicability of our results.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] B. C. Dhage, and V. Lakshmikantham, *Basic results on hybrid differential equations*, Nonlinear Analysis: Hybrid Systems, **4** (2010).
- [2] K. Hilal and A. Kajouni, *Boundary value problems for hybrid differential equations with fractional order*, Advances in Difference Equations **2015** (2015).
- [3] L.Zhang and G.Wang, *Existence of solutions for nonlinear fractional differential equations with impulses and anti-periodic boundary conditions*, Electronic Journal of Qualitative Theory of Differential Equations **7** (2011), 1–11.
- [4] Y. Zhao, S. Sun, Z. Han and Q. Li, *Theory of fractional hybrid differential equations*, Computers and Mathematics with Application **62** (2011) 1312–1324.
- [5] G. Zhenghui, L. Yang and G. Liu, *Existence and uniqueness of solutions to impulsive fractional integro-differential equations with nonlocal*, Applied Mathematics **4** (2013), 859–863..

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



A survey on derivations of a Sullivan model

Communication Info

Authors:

Saloua CHOUINGOU¹

¹Department of Mathematics
and Computer Sciences;
Faculty
of Sciences Ain Chock;
University Hassan II;
Casablanca, Morocco

Keywords:

- (1) Sullivan Model
- (2) Algebra of derivations
- (3) Rational Homotopy Theory

Abstract

Rational homotopy associates to any rational simply connected space, a commutative differential graded algebra. If we restrict to almost free commutative differential graded algebras, that is "Sullivan models", this association is unique.

In this note, we shall define and study the evaluation subgroups, $G_n(X)$, of a topological space X . Finally, we record the relationship between the evaluation subgroups and the homotopy exact sequence of a fibration.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Y. Félix, S. Halperin, and J. C. Tomas, *Rational Homotopy Theory*, Springer, New York, NY, USA, 2001.
- [2] D. H. Gottlieb, "Evaluation subgroups of homotopy groups," *American Journal of Mathematics*, vol. 91, no. 3, pp. 729–756, 1969.
- [3] G. Lupton and S. B. Smith, "Rationalized evaluation subgroups of a map I: Sullivan models, derivations and G-sequences," *Journal of Pure and Applied Algebra*, vol. 209, no. 1, pp. 159–171, 2007. [2] K.G. Murty, *Linear Complementarity, Linear and Nonlinear Programming*, Helderman-Verlag, 1988.
- [4] O. Maphane, Derivations of a Sullivan model and the rationalized G- sequence. *Int. J. Math. Math. Sci.*, (2021), Art. ID 6687527, 5 pp.
- [5] D. Sullivan, Infinitesimal computations in topology. *Publ. Math. IHES.*, 47 (1977), pp. 269–331.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Weak limited sets and operators on Banach lattices

Communication Info

Authors:

Farid AFKIR¹
Aziz ELBOUR¹

¹Departement of Mathematics,
Faculty of Sciences and
Technologies, Moulay Ismail
University, P.O Box , Errachidia
52000, Morocco

Keywords:

- (1) Banach lattices
- (2) Positive operators
- (3) Dunford-Pettis operators
- (4) The order continuity of norm

Abstract

I. Ghencui recently introduced and studied the classes of weak limited sets and operators on Banach spaces [5]. A subset A of a Banach space X is said to be weak limited if $T(A)$ is relatively compact for every Dunford-Pettis operator $T: X \rightarrow c_0$, and an operator $S: X \rightarrow Y$, between two Banach spaces, is called weak limited if S maps the closed unit ball of X into a weak limited subset of Y . The aim of this communication is to study these classes of sets and operators on Banach lattices. Precisely, we prove that an operator $T: E \rightarrow F$, between two Banach lattices, maps order intervals onto weak limited sets if and only if the modulus $|TS|$ exists and is Dunford-Pettis for every Dunford-Pettis operator $S: F \rightarrow c_0$. Next, we establish that a Banach lattice E does not contain any isomorphic copy of ℓ^1 if and only if the order intervals of E are weak limited and the norm of E' is order continuous.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] C.D. Aliprantis and O. Burkinshaw, Positive operators, Reprint of the 1985 original, Springer, Dordrecht, 2006.
- [2] B. Aqzzouz and K. Bouras, (L) sets and almost (L) sets in Banach lattices, Quaest. Math. 36(1) (2013) 107–118.
- [3] E.M. Bator and P.W. Lewis, Operators having weakly precompact adjoints, Math. Nachr. 157(1) (1992) 99–103.
- [4] Bourgain and J. Diestel, Limited operators and strict cosingularity, Math. Nachr. 119(1) (1984) 55–58.
- [5] I. Ghencui, A note on weak reciprocal Dunford-Pettis sets, Acta Math. Hung. 152(2) (2017) 453–463.
- [6] P. Meyer-Nieberg, Banach lattices, Universitext, Springer-Verlag, Berlin, 1991.
- [7] A.C. Zaanen, Riesz spaces II, North Holland Publishing Company, Amsterdam, 1983.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Some Results About Operator Perturbation of Fusion Frame

Communication Info

Authors:

Nadia Assila¹
Samir Kabbaj¹

¹LEDP&AGS, Ibn Tofail
University, Kenitra, Morocco

Keywords:

- (1) Fusion frame
- (2) K-fusion frame
- (3) Controlled Fusion Frame

Abstract

Fusion frames or frames of subspaces are an extension of frames in Hilbert spaces, which were introduced recently by P.G Casazza, G. Kutyniok and S. Li in connection with distributed processing.

In this talk, we introduce the notion of controlled K-frame of subspaces (K-fusion frame) which is a generalization of fusion frame in Hilbert space H where K is an adjointable operator on H . We give several characterizations in terms of bounded operators and some of their properties are obtained. Then we obtain some new results about the operator perturbation of controlled K-fusion frames and we present some sufficient conditions under which a controlled sequence of subspaces remains a standard controlled K-frame of subspaces after perturbation the sequence by a bounded operator. Further, we analyze stability conditions of controlled K-fusion frames under perturbation.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] O. Christensen, An introduction to frames and Riesz bases, Birkhauser, Boston (2016).
- [2] O. Christensen, C. Heil, Perturbations of Banach frames and atomic decomposition, Math. Nachr. 185(1997), 33-47.
- [3] P. Balaz, J. P. Antoine and A. Grybos, Wighted and controlled frames, Int. J. Wavelets Multi. Infor. Process. (2010), no. 10, 109--132.
- [4] N. Assila, S. Kabbaj, B. Moalige, Controlled K-fusion frame for Hilbert spaces, Moroccan J. Pure Appl. Anal. 7 (2020), no.1, 116--133. <https://doi.org/10.2478/mjpaa-2021-0011>
- [5] J. J. Benedetto, O. Yilmaz, A. M. Powell, Sigma-delta quantization and finite frames, 2004 IEEE International Conference on Acoustics, Speech, and Signal Processing, 2004, [https://doi: 10.1109/ICASSP.2004.1326700](https://doi:10.1109/ICASSP.2004.1326700)
- [6] P. G. Casazza, The art of frame theory, Taiwanese J. Math. 4 (2000), 129--201.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Douglas' factorization theorem and atomic system in Hilbert pro- C^* -module

Communication Info

Authors:

Roumaissae EL JAZZAR¹
Mohamed ROSSAFI²

¹ *Laboratory of Partial Differential Equations, Spectral Algebra and Geometry, University Ibn Tofail, Kenitra, Morocco*

² *LASMA, University Sidi Mohamed Ben Abdellah, Fes, Morocco*

Keywords:

- (1) Douglas majorization,
- (2) atomic system
- (3) Hilbert pro- C^* -modules

Abstract

We introduce the generalized inverse operators which have an interesting role in operator theory. We establish Douglas' factorization theorem type for Hilbert pro- C^* -module. We also introduce the notion of atomic system and of K-frame in Hilbert pro- C^* -module and we study the relationship between them. We demonstrate some properties of K-frame by using Douglas' factorization theorem. Finally, we demonstrate that the sum of two K-frames in a Hilbert pro- C^* -module with certain conditions is once again a K-frame.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] M. Fragoulopoulou, An introduction to the representation theory of topological $*$ -algebras, *Schriftenreihe, Univ. Münster*, **48** (1988), 1-81
- [2] M. Joita, Hilbert modules over locally C^* -algebras, *Editura Universitătii din Bucuresti*, 2006.
- [3] M. Rossafi, S. Kabbaj, Operator Frame for $\text{End}^*(H)$, *Journal of Linear and Topological Algebra*, Vol. 08, No. 02, 2019, 85-95.
- [4] E. C. Lance, Hilbert C -modules, *London Math. Soc.*, **210**. Univ. Press, Cambridge, 1995.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Fixed point theorem for (φ, F) contraction on C^* -algebra valued partial metric spaces

Communication Info

Authors:

Hafida Massit¹
Mohamed Rossaf²

¹Laboratory of partial differential Equations spectral Algebra and Geometry, University Ibn Tofail, Kenitra, Morocco.

²LaSMA, University Sidi Mohamed Ben Abdellah, Fez, Morocco

Keywords:

- (1) Fixed point
- (2) C^* -algebra valued partial metric spaces
- (3) C^* -algebra valued partial (φ, F) -contraction

Abstract

In this talk, we extend the new notion in C^* -algebra valued partial metric spaces and establishing the existence and uniqueness of fixed point for them. Non-trivial examples are further provided to support the hypotheses of our results.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] A. Amini-Harandi, A. P. Farajzadeh, D. O'Regan, R. P. Agarwal, Best Proximity Pairs for Upper Semi continuous Set-Valued Maps in Hyperconvex Metric Spaces. *Fixed Point Theory Appl* 2008, 648985 (2008)
- [2] S. Banach, Sur les opérations dans les ensembles abstraits et leur application aux équations intégrales, *Fund. Math.*, 3 (1922), 133–181.
- [3] A. Branciari, A fixed point theorem of Banach-Caccioppoli type on a class of generalized metric spaces, *Publ. Math. Debrecen*, 57 (2000), 31–37.
- [4] J. Collins, J. Zimmer, An asymmetric Arzel`a-Ascoli theorem, *Topology Appl.* 154 (2007), no. 11, 2312–2322.
- [5] A. Farajzadeh, P. Chuadchawna, A. Kaewcharoen, Fixed point theorems for $(\alpha, \eta, \psi, \xi)$ -contractive multi-valued mappings on α - η -complete partial metric spaces, *J. Nonlinear Sci. Appl.* 9 (2016), 1977-1990.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



A Study on uaw-DUNFORD-PETTIS OPERATORS

Communication Info

Authors:

Otman Aboutafail,¹
Sanaa BOUMNIDEL²
A. EL KADDOURI,³

¹ ENSAK, National School of
Applied Sciences, Ibn Tofail
Uni-

versity, Kenitra, Morocco

² Faculty Polydisciplinary of
Larache, Morocco

³ ENSATé, National School of
Applied Sciences, Tetouan,
Morocco

Keywords:

- (1) Linear operator
- (2) Banach Lattice
- (3) Dunford-Pettis operators

Abstract

Dunford-Pettis operators are linear operators on Banach spaces that satisfy a certain property, namely that they map weakly convergent sequences to norm convergent sequences. The concept of Dunford-Pettis operators is important in the theory of Banach spaces and functional analysis.

Many new operators were defined on the basis of this famous operator in functional analysis field, the uaw-Dunford-Pettis is one of the most important ones.

In the article we study relationship between this operator and others, and we conclude some new results.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Aliprantis C.D. and Burkinshaw O., Positive operators. Reprint of the 1985 original. Springer, Dordrecht, 2006.
- [2] P.G. Dodds, and D.H. Fremlin, Compact operators on Banach lattices, Israel J. Math. 34 (1979), 287–320.
- [3] J. Borwein, M. Fabian, and J. Vanderwerff, Some Characterizations of Banach spaces via convex and other locally Lipschitz functions, Acta MathematicaVietnamica, vol. 22, no. 1, pp. 53–69, 1997. Point Method for Linear Complementarity Problem, Appl. Math. Sci., 4 (2010) 3289-3306.
- [7] Meyer-Nieberg P., Banach lattices. Universitext. Springer-Verlag, Berlin, 1991.
- [8] Y.Deng, M.O'Brien, and V.G.Troitsky: Unbounded norme convergence in Banach lattices 2010 Mathematics Subject Classification. Septembre 19,2016

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



On Local Topological Algebras

Communication Info

Author:

Ali OUKHOUYA

University of Cadi Ayyad, ENSA,
Marrakech, Morocco

Keywords:

- (1) Topological algebra
- (2) Spectrum
- (3) Gel'fand map
- (4) Local algebras
- (5) Partitions of unity

Abstract

The notion of the so-called "locality" of a given Banach algebra, is a classical subject, was treated by M. Gel'fand, D. Raikov and G. Silov (1964) [2]. Then A. Mallios continued (1993) [5], for suitable classes of topological algebra, in general, followed (2001), by A. Oukhouya in the case of uniform (locally m-convex) algebras [7]. Nowadays, it is well-know that "information" whatsoever, is, in point of fact, always of a "local" character. In other words, what actually amounts to the same thing, "... *the centrale message of quantum Field Theory [is] that all information characterizing the theory is strictly local ...* " Haag [3]. R.M. Brooks considers a "partition of unity" on the spectrum of locally m-convex algebra, proving its existence in the case of an unital commutative regular Fréchet algebra, as before, thus obtaining his "local theorem" [1]. Now, our aim is to treat "Partion of unity" of a suitable unital commutative locally m-convex algebra, without assuming any regularity. As a byproduct, we also extend the local theorem in the previous framework.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] R.M. Brooks, Partitions of unity in F-algebras. Math Ann. 77(1968), 265-272.
- [2]. I. Gel'fand, D. Raikov and G. Silov, Commutative Normed Rings. Chelsey, New York, 1964.
- [3] R. Haag Local Quantum Physics. Fields, Particles, Algebras (2nd Ed.). Springer, Berlin, 1996.
- [4] A. Mallios, Topological algebras. Selected Topics. North-Holland, Amsterdam, 1986.
- [5] A. Mallios, On geometric topological algebras. J. Math. Anal. Appl. 172 (1993), 301-322.
- [6] A. Mallios et A. Oukhouya, k-algèbres topologiques. Scient. Math. Japon, 61 (2005), 385-390.
- [7] A. Oukhouya, on local topological algebras. Scient. Math. Japon. 57 (2003), 493-497.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Contribution on L-weakly compact sets and operators

Communication Info

Authors:

Hassan Khabaoui¹
Jawad H'michane²
Kamal El fahri³

¹ Moulay Ismail University of
Meknès, M, Morocco

² Moulay Ismail University of
Meknès, Meknès, Morocco

³ Ibn Zohr University, Agadir,
Morocco

Keywords:

- (1) L-weakly compact set
- (2) L-weakly compact operator
- (3) order continuous Banach lattice
- (4) o-weakly compact operator
- (5) M-weakly compact operator
- (6) b-weakly compact operator

Abstract

In this paper we introduce and study a new class of operators related to L-weakly compact sets on Banach Lattice and which brings together several classical classes of operators (as o-weakly compact operators, b-weakly compact operators, M-weakly compact operators, L-weakly compact operators, almost Dunford Pettis operators). As consequences, we give some new lattice approximation properties of these classes of operators.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] C.D. Aliprantis and O. Burkinshaw, Positive operators. Reprint of the 1985 original. Springer, Dordrecht, 2006.
- [2] B. Aqzzouz and K. Bouras, Weak and almost Dunford-Pettis operators on Banach lattices. *Demonstratio Mathematica*, vol. 46, no. 1, 2013, pp. 165-179. <https://doi.org/10.1515/dema-2013-0431>.
- [3] B. Aqzzouz, A.Elbour, Some characterizations of almost Dunford-Pettis operators and applications. *Positivity* 15, 369-380 (2011). <https://doi.org/10.1007/s11117-010-0083-7>.
- [4] K. El Fahri, H. Khabaoui and J. H'michane, Some characterizations of L-weakly compact sets using the unbounded absolute weak convergence and applications. *Positivity* 26, 42 (2022). <https://doi.org/10.1007/s11117-022-00912-2>.
- [5] N. Machrafi, K. El Fahri and M. Moussa, A note on b-semi-compact sets and operators. *Rend. Circ. Mat. Palermo* 65, 47-53 (2016). <https://doi.org/10.1007/s12215-015-0217-7>
- [6] P. Meyer-Nieberg, *Banach Lattices*, Universitext, Springer-Verlag, Berlin, 1991.
- [7] O.Zabeti, Unbounded absolute weak convergence in Banach lattices. *Positivity* 22, 501-505 (2018). <https://doi.org/10.1007/s11117-017-0524-7>

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



The Perturbation Classes Problem of Left (resp. Right) g -Drazin Invertible Operators

Communication Info

Author:

Djalal OUNADJELA¹

¹LMFAO, Ahmed Benbella
University of Oran 1, Oran,
Algeria

Keywords:

- (1) Generalized inverses
- (2) Invariant Subspaces
- (3) Perturbation

Abstract

Since Mbekhta has introduced in [1] the notions of the analytic core and the quasi-nilpotent part of an operator, research in local spectral theory has found new powerful tools at its disposal. Concretely, this means that successfully characterizing an operator type by means of these two notions is a great step toward a complete study of its properties. Therefore, since left (resp. right) g -Drazin invertible operators are characterized according to their analytic core and quasi-nilpotent part we can push their perturbation study more deeply than before.

For details on local spectral theory and left (resp. right) g -Drazin invertible operators, see the books and papers of Aina [2-3], Laursen and Neuman [4], Hocine et. al [5] and Cvetković [6]. In this communication, positive answers to commuting quasi-nilpotent, finite rank and Riesz perturbations of left (resp. right) g -Drazin invertible operators.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] M. Mbekhta, Généralisation De La Décomposition De Kato Aux Operateurs Paranormaux Et Spectraux, Glasgow Math. J. 29 (1987), 159-175. MR 88i:47010
- [2] P. Aiena, Fredholm and Local Spectral Theory with Applications to Multipliers. Kluwer Academic Publishers, New York (2004)
- [3] P. Aiena and S. Triolo, Local spectral theory for Drazin invertible operators, Journal of mathematical analysis and applications, vol. 435, no. 1, pp. 414–424, Mar. 2016.
- [4] K. B. Laursen, M. M. Neumann An introduction to local spectral theory. Clarendon Press, Oxford, 2000. MR 2001k:47002
- [5] K. Hocine, M. Benharrat, B. Messirdi, Left and right generalized Drazin invertible operators, Linear and Multilinear Algebra, 63 (2015) 1635–1648.
- [6] M. D. Cvetkovic, On upper and lower generalized Drazin invertible operators, Funct. Anal. Approx. Comput. 7 (3) (2015), 67-74.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



FIXED POINT THEOREM IN THE VARIABLE EXPONENT SEQUENCE SPACES WITH A GRAPH

Communication Info

Authors:

Kenza BENKIRANE¹
Abderrahim ELADRAOUI²
Samia BENNANI³

¹LAMS, Hassan II University of
Casablanca, Casablanca,
Morocco

²LAMS, Hassan II University of
Casablanca, Casablanca,
Morocco

³LAMS, Hassan II University of
Casablanca, Casablanca,
Morocco

Keywords:

- (1) The variable exponent sequence spaces $lp(\cdot)$.
- (2) Modular spaces.
- (3) Vector space.
- (4) Graph.
- (5) Fixed points theorems.

Abstract

The variable exponent sequence spaces $lp(\cdot)$ find their roots in the celebrated work by Orlicz [1]. They inspired the formal definition of a modular introduced by Nakano [2, 3]. This vector space is a special case of the variable exponent spaces $Lp(\cdot)$. Toward the second half of the twentieth century, it was realized that these variable exponent spaces constituted the right framework for the mathematical formulation of a number of problems for which the classical Lebesgue spaces were inadequate. We open, this communication, by presenting some definitions and basic facts about the space $lp(\cdot)$. And, by combining the fixed point theory and the graph theory, we present Kannan fixed point theorem in the variable exponent sequence spaces $lp(\cdot)$ with a graph and Chatterjea fixed point theorem in the variable exponent sequence spaces $lp(\cdot)$. Inspired by the ideas given in [4, 5, 6, 7, 8], we investigate the existence of the fixed point for mappings satisfying a G-monotone G-Kannan mapping and G-monotone G-Chatterjea mapping in the variable exponent sequence spaces $lp(\cdot)$ endowed with graph.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Orlicz, W. Über konjugierte exponentenfolgen. Stud. Math. 1931, vol. 3, no. 1, pp. 200-211.
- [2] Nakano, H. Modulated sequence spaces. Proceedings of the Japan Academy. 1951, vol. 27, no 9, pp. 508-512.
- [3] Nakano, H. Modulated semi-ordered linear spaces. Maruzen Company, 1950.
- [4] Sundaresan, K. Uniform convexity of Banach spaces $l(p)$. Studia Mathematica, 1971, vol. 3, no 39, p. 227-231.
- [5] Afrah, A. N. and Khamsi, M. A. Fixed Points of Kannan Maps in the Variable Exponent Sequence Spaces $lp(\cdot)$. Mathematics. 2020, vol. 8, no 1, p. 76.
- [6] Khamsi, M. A. et Kozłowski, W. K. Fixed point theory in modular function spaces. Birkhäuser, 2015.
- [7] Musielak, J. Orlicz spaces and modular spaces. 2006, vol. 1034. Springer.
- [8] Chaira, K. Eladraoui, A. Kabil, M. and al. Kannan fixed point theorem on generalized metric space with a graph. Applied Mathematical Sciences. 2019, vol. 13, no 6, p. 263-274.
- [9] Khamsi, M. A. Kozłowski, W. M. Fixed point theory in modular function spaces. Birkhäuser. 2015

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



A generalized fixed point theorem in modular b-metric spaces and application

Communication Info

Authors:

Abdelhak EL HADDOUCHI¹
Mustapha ESSAADAoui²
Brahim MARZOUKI³

¹Faculty of Science and
Technology, Errachidia,
Moulay Ismail University,
Meknes Morocco

^{2,3}Faculty of Science, Oujda,
Mohammed First University,
Oujda Morocco

Keywords:

- (1) Modular b-metric space
- (2) Point fixe
- (3) Relation implicite

Abstract

In this work, we are interested to prove a general fixed point theorem in modular b-metric spaces. The results in this paper give us particular results and illustrated by examples. To show the significance of our result an application is presented to establish the existence of a solution of integral equation.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] V.V. Chistyakov, Modular metric spaces, I: Basic concepts, *Nonlinear Anal.*, 72, 2010, 1-14.
- [2] M.E. Ege, C. Alaca, Some Results for Modular b-Metric Spaces and an Application to System of Linear Equations, *Azerbaijan Journal of Mathematics*, V. 8, No 1, 2018, January, ISSN 2218-6816.
- [3] N. Makran, A. El Haddouchi, B. Marzouki, A common fixed point of multi-valued maps in b-Metric space. *U.P.B. Sci. Bull., Series A*, Vol. 82, Iss. 1, 2020 ISSN 1223-7027.



Random Fixed Point Theorems for Monotone Random Operator with Application to Random Differential Equations in Ordered Banach Spaces

Communication Info

Authors:

A. El-Ghabi (1)

A. Khchine (2)

M.A. Taoudi (3)

^{1,2,3} Cadi Ayyad University,
National School of Applied
Sciences, 575, Marrakesh,
Morocco

Keywords:

(1) Random (deterministic)
fixed point,
(2) random operator,
(3) monotone operator,
(4) random differential
equation.

Abstract

In this talk, we present several random fixed point theorems for monotone (countably) convex-power condensing random operators in ordered Banach spaces. As an application, we discuss the solvability of a broad class of random first-order vector-valued ordinary differential equations.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] A. Alahmari, M. Mabrouk, M.A. Taoudi, Fixed point theorems for monotone mappings in ordered Banach spaces under weak topology features. *J. Math. Appl.* 42 (2019), 5-19.
- [2] A. T. Bharucha-Reid, Random integral equations. *Mathematics in Science and Engineering*, Vol. 96. Academic Press, New York-London, 1972.
- [3] A. Chlebowicz, M.A. Taoudi, Measures of weak noncompactness and fixed points. *Advances in nonlinear analysis via the concept of measure of noncompactness*, 247-296, Springer, Singapore, 2017.
- [4] A. El-Ghabi, M.A. Taoudi, Random fixed point theorems under weak topology features and application to random integral equations with lack of compactness. *J. Fixed Point Theory Appl.* 22 (2020), no. 4, 85.
- [5] A. El-Ghabi, A. Khchine and M.A Taoudi, Random fixed point theorems and applications to random first-order vector-valued differential equations, *J. Funct. Spaces* 2021, Art. ID 6648938, 16 pp.
- [6] S. Itoh, Random fixed-point theorems with an application to random differential equations in Banach spaces. *J. Math. Anal. Appl.* 67 (1979), no. 2, 261-273.

ICRAMCS 2023

The FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



On representation and convergence in Mosco sense of set-valued Aumann-Pettis integrable martingales

Communication Info

Authors:

Nordine LATIFI¹
Mohamed EL HARAMI²

¹, Moulay Ismail
University, EST, Menes,
Morocco

² Moulay Ismail
University, EST, Menes, Morocco

Keywords:

- (1) Set-valued martingale,
- (2) Pettis integration,
- (3) random sets,
- (4) Pettis conditional expectation,
- (5) Mosco convergence

Abstract

The set-valued Aumann-Pettis integrable martingales has a major role giving advances in probability theory. Using classical results on the projective limit of a sequence of subsets as mentioned by BOURBAKI [1]. First we show the existence of martingale selection for a set-valued Aumann-Pettis integrable martingale see HESS [2]. Then we prove two type of representation theorem. At last, we apply the Mosco convergence of set-valued Aumann-Pettis integrable regular martingales, EL HARAMI et al. [3], and we present a convergence in Mosco sense and regularity theorem of the general (not necessary regular) set-valued Aumann-Pettis integrable martingale Ezzaki et al. [4].

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Bourbaki, N.: *Eléments de Mathématiques, Topologie Générale*, Chaps. 1 a 4. Hermann, Paris (1971).
- [2] Hess, C.: On multivalued martingales whose values may be unbounded: martingale selectors and Mosco convergence, *J. Multivariate Anal.* 39, 175-201 (1991).
- [3] Akhiat, F., El Harami, M., Ezzaki, F.: Pettis conditional expectation of closed convex random sets in a Banach space without RNP. *J. Korean Math. Soc.* 55, 833-848 (2018).
- [4] Akhiat, F., Castaing, C and Ezzaki, F.: Some various convergence results for multivalued martingales, *Adv. Maths. Ec.* 13, 1-33 (2010).

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Statistical inference for a new inhomogeneous Gompertz diffusion process

Communication Info

Authors:

Nadia MAKHLOUKI¹
Ahmed NAFIDI²

¹LAMSAD, Hassan I University
of Settat, Settat, Morocco

²LAMSAD, Hassan I University
of Settat, Settat, Morocco

Keywords:

- (1) Gompertz diffusion process
- (2) Statistical inference
- (3) Application

Abstract

The goal of this work is to investigate a novel non-homogeneous extension of the Gompertz diffusion process (cf.[1],[2]), based on the fact that both the deceleration factor (cf. [4]) and the intrinsic growth rate (cf. [3]) in the drift are affected by time function. By using the corresponding Itô stochastic differential equation, We achieve the probabilistic characteristics of the model as the transition probability density function and the mean functions (conditional and non-conditional). Then, the statistical inference of the parameter is attained, the maximum likelihood approach which uses discrete sampling, is used to estimate the parameters and getting the confidence bounds for the parameters as well as the distributions of the generated estimators. Finally, we apply this stochastic process to model the evolution of the electric power consumption in Morocco.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] FERRANTE, L., BOMPADE, S., POSSATI, L., AND LEONE, L. Parameter estimation in a Gompertzian stochastic-model for tumor growth. *Biometrics* 56 (2000), 107681.
- [2] R. Gutiérrez, R. Gutiérrez-Sánchez and A. Nafidi Modelling and forecasting vehicle stocks using the trends of stochastic Gompertz diffusion models. The case of Spain. *Appl. stochastic models Bus. Ind.* 25(2009) 385-405.
- [3] R. Gutiérrez, R Gutiérrez-Sánchez, A Nafidi, P Román, F Torres. Inference in Gompertz-type nonhomogeneous stochastic systems by means of discrete sampling. *Cybernetics and Systems* 36 (2005) 203-216.
- [4] R. Gutiérrez, R. Gutiérrez-Sánchez and A. Nafidi. Trend analysis using non-homogeneous stochastic diffusion processes. Emission of CO₂; Kyoto protocol in Spain. *Stoch Environ Res Risk Assess.* 22 (2008) 57-66.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



A link between the Gompertz and Vasicek Interest Rate Diffusion Models

Communication Info

Authors:

Abdenbi EL AZRI¹
Ahmed NAFIDI¹

¹Hassan First University of
Settat, National School of
Applied Science, Department of
Mathematics and Informatics,
Laboratory of Systems
Modelization and Analysis for
Decision Support, B.P. 218,
26103, Berrechid, Morocco

Keywords:

Keywords:

- (1) Vasicek interest rate
- (2) Gompertz diffusion process
- (3) Stochastic diffusion process
- (4) Stochastic differential equation

Abstract

The main goal of this paper is to establish new links between the Gompertz diffusion model [1-3] and the Vasicek Interest Rate model [4]. These links focus on elementary stochastic calculus and Itô's calculus [5]. Firstly, we prove that the exponential of the Vasicek Interest Rate model is a Gompertz diffusion process. Secondly, we prove that the logarithm of the Gompertz diffusion process is a Vasicek Interest Rate model. New computations of the probability transition density function and the mean functions of the processes have quite simple formulations.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] R. Gutiérrez, R. Gutiérrez-Sánchez, A. Nafidi, A Modelling and forecasting vehicle stocks using the trends of stochastic Gompertz diffusion models: The case of Spain, *Appl. Stochastic Models Bus. Ind.*, 25 (2009) 385-405.
- [2] R. Gutiérrez, A. Nafidi, R. Gutiérrez-Sánchez, Forecasting total natural-gas consumption in Spain by using the stochastic Gompertz innovation diffusion model, *Applied Energy*, 80 (2005) 115-124.
- [3] R. Gutiérrez, R. Gutiérrez-Sánchez, A. Nafidi, Electricity consumption in Morocco: Stochastic Gompertz diffusion analysis with exogenous factors, *Applied Energy*, 83 (2006) 1139-1151.
- [4] W. Xiao, W. Zhang, X. Zhang, X. Chen, The valuation of equity warrants under the fractional Vasicek process of the short-term interest rate, *Physica A.*, 394 (2014) 320-337.
- [5] L. Arnold, *Stochastic Differential Equations*, John Wiley and Sons, NY, 1973.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



A comparative analysis of SEM software and packages: An evaluation of Amos, SmartPLS, Semopy, Mplus, and R packages Sem and Lavaan

Communication Info

Authors:

Driss El Amalki¹
Abdelilah Kaddar²
Nadia Beniich¹

¹ Faculty of Sciences, Chouaib
Doukkali University

² National school of applied
sciences of El Jadida, Chouaib
Doukkali University
(Morocco)

Keywords:

- (1) Structural Equation modeling
- (2) SEM software comparison
- (3) Goodness-of-fit indexes
- (4) AMOS
- (5) SmartPLS
- (6) SEM packages

Abstract

This paper presents a comprehensive comparison of various software programs and packages that are widely used for conducting Structural Equation Modeling (SEM) analysis. SEM is a collection of statistical methods that enable researchers to examine the relationships between one or more independent variables and one or more dependent variables [1], [2]. The software programs evaluated in this paper include Amos [3], SmartPLS [4], Python package Semopy [5], R packages Sem [6] and Lavaan [7], and Mplus [8]. The comparison is based on input and output formats, technical options, and estimation methods. The study aims to provide researchers with a better understanding of the strengths and limitations of each software program, as well as to assist them in choosing the most appropriate software for their research needs. The results of this study indicate that all the programs are reliable and effective for developing and analyzing structural relationships, and while the results are equivalent, the differences lie mostly on the basis of the model approach and the quality of the data.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] R. E. Hair, J. F., Black, W. C., Babin, B. J. and Anderson, "Multivariate Data Analysis," p. 785, 2010.
- [2] K R. B. Kline, "Principles and Practice of Structural Equation Modeling, Fourth Edition - Rex B. Kline, p. 9, 2011.
- [3] B. M. Byrne, "Structural Equation Modeling with Amos: Basic Concepts, Applications, and Programming, Third edition," *Structural Equation Modeling with Amos: Basic Concepts, Applications, and Programming, Third edition*, pp. 1-438, Jan. 2016.
- [4] C. M. Ringle, S. Wende, and J.-M. Becker, "SmartPLS 3." Boenningstedt, 2015.
- [5] A. A. Igolkina and G. Meshcheryakov, "semopy: A Python Package for Structural Equation Modeling," *Structural Equation Modeling*, vol. 27, no. 6, pp. 952-963, 2020.
- [6] J. Fox, "Structural equation modeling with the sem package in R," *Structural Equation Modeling*, vol. 13, no. 3, pp. 465-486, 2006.
- [7] Y. Rosseel, "lavaan: An R Package for Structural Equation Modeling," *J Stat Softw*, vol. 48, pp. 1-36, May 2012.
- [8] L. K. Muthen and B. Muthen, "Mplus user's guide : statistical analysis with latent variables," p. 944.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



STATIS Method: application to different types of data

Communication Info

Authors:

Cristina Dias^{1,5}
Carla Santos^{2,5}
Isabel Borges³
João Tiago MEXIA^{4,5}

¹*Polytechnic Institute of
Portalegre, Portalegre*

²*Polytechnic Institute of Beja,
Beja, Portugal Portalegre*

³*Department of Technologies
and Valoriza, Polytechnic
Institute of Portalegre,
Portalegre*

⁴*Department of Mathematics –
NOVA SST, Lisbon, Portugal*

⁵*Center for Mathematics and
Applications (NOVAMath) NOVA
SST, Lisbon, Portugal*

Keywords:

- (1) Principal components
- (2) Exploratory analysis
- (3) Objects
- (4) Studies

Abstract

The aim of this paper is to present a method, called STATIS, which can be applied for exploratory analysis of different types of data sets, and to compare its performance with other methods for the analysis of environmental and health data. It was found that STATIS and Tucker model lead to the same results, but Tucker model requires a higher complexity to explain the same amount of variance. This study showed that STATIS is an exploratory tool with robust properties, besides this, the STATIS method is very efficient since it is a noniterative algorithm.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] M Areia, A., Oliveira, M. M & Mexia, J. T., 2011, *Modelling the Compromise Matrix in STATIS*, *Methodology*, 5, 277-288.
- [2] Escoufier, Y., 1973, *Le Traitement des Variables Vectorielles*, *Biometrics*, 29(4), 751-760.
- [3] Escoufier, Y. & L'Hermier H., 1978, *A Propos de la Comparaison Graphique des Matrices de Variance*, *Biom. J.*, 20(5), 477-483.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Application of AHP Procedure for measuring the Security of Energy Supply - case of Morocco

Communication Info

Authors:

Zakariya TAJANI¹
Mohamed SABBANE¹
Chakir TAJANI²

¹Faculty of sciences, Moulay
Ismail University, Meknes,
Morocco

²SMAD, Polydisciplinary
Faculty of Larache, Abdelmalek
Essaadi University, Morocco

Keywords:

- (1) Security of Energy Supply
- (2) Analytical Hierarchy
Process
- (3) Moroccan Energy Situation

Abstract

Energy is considered as a fundamental pillar not only for the economic development of countries, but also for their social and political stability, security and sovereignty. In this paper, we analyze the Moroccan energy supply security based on three parameters. Namely; the Energy Mix Concentration Index, the Energy Origin Diversification and the electricity production Dependency on primary energy imports. Given that each parameter can't give a clear idea about the energy supply risks, we have proposed, based on Analytical Hierarchy Process "AHP", the DCETO index which is a new composed indicator that measures energy supply security taking into consideration the above-mentioned parameters. Numerical simulations for five energy supply situations to verify the representativeness of this index and its sensitivity to each component

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] S.C. Bhattacharyya, Energy economics: concepts, issues, markets and governance. Springer Science and Business Media, 2011.
- [2] International Energy Agency <https://www.iea.org/countries/morocco>.
- [3] B. Kruyt, D.P. van Vuuren, H.J.M. de Vries a,c, H. Groenenberg, Indicators for energy security, Energy Policy, 37 (2009) 2166–2181.
- [4] I. Canco, D. Kruja, T. Iancu, AHP, a Reliable Method for Quality Decision Making: A Case Study in Business, Sustainability, 13 (2021) 13932.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Inférence statistique en des processus stochastiques markoviens de diffusion

Communication Info

Auteurs:

Mariam AARRAS¹
Mohamed EL MEROUANI¹

¹LaR2A, Université Abdelmalek
Essaâdi, Tétouan, Maroc

Mots clés:

- (1) Processus stochastique de diffusion
- (2) Processus markoviens
- (3) Estimations

Résumé

L'objectif de notre recherche et le développement de l'inférence statistique (estimation du maximum de vraisemblance multivariée, les tests statistiques des rapports de maximum de vraisemblance et leur comportement asymptotique [2]) pour des processus stochastiques Markoviens de diffusion [1],[4].

Cette inférence sur les paramètres de la diffusion peut se faire par voie d'échantillonnage discret, malgré que le processus soit d'espace continu et de temps continu, cela grâce à la propriété de Markov. Le processus de diffusion sera défini ici à partir des équations aux dérivées partielles avancées et retardées de Kolmogorov ou de Fokker-Planck [7]. On envisagera des applications dans des domaines pratiques comme la physique l'économie [3] la finance la biologie où la médecine.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

Référence

- [1] Basawa, I.V. and Prakasa Rao, B.L.S. Statistical Inference for stochastic Processes, Academic Press. (1980).
- [2] Brown, B.M and Hewitt, J.I. Asymptotic likelihood theory for diffusion process, Theory Probab. Its Appl. 2, 373-377. (1975).
- [3] El Merouani, M., "Difusiones con factores Exógenos. Aspectos Computacionales y Aplicaciones Económicas", Thèse de Doctorat, Université de Grenade, Espagne, 1995.
- [4] Prakasa Rao BSL Statistical inference for diffusion type process, Ed. Arnold (1999).
- [5] Karlin, S. et Taylor, H. M., « A Second Course in Stochastic Processes., »Academic Press, New York, (1981).
- [6] Anderson, T.W An introduction to multivariate statistical analysis, John Wiley and sons. (1984).
- [7] H. Risken, "The Fokker-Planck Equation: Methods of Solutions and Applications", 2nd edition, Springer Series in Synergetics, Springer, (1996).

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Machine Learning for forecasting some stock market index

Communication Info

Authors:

Mohammed BENMOUMEN¹

¹*LaMSD, Department of Mathematics, Faculty of Sciences, Mohammed The First University;*

Keywords:

- (1) Maching Learning
- (2) GARCH model
- (3) Kalman Filter
- (4) Stock market index

Abstract

In this paper we evaluate our algorithm for estimating the parameters of GARCH models (see M. Benmoumen, 2022) by transposing it to real data and then we present our Maching learning for forecasting the returns of some stock market index.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] A. C. Harvey, Forecasting, structural time series models and the Kalman _lter, Cambridge university press, 1990.
- [2] C. Francq, and J.M. and Zakoian, GARCH models : structure, statistical inference and _nancial applications, John Wiley and Sons, 2010.
- [3] M. Benmoumen, Numerical optimization of the likelihood function based on Kalman Filter in the GARCH models, Mathematical Modeling and Computing, 9, 3, (2022), 599-606.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Existence Results for Infinite Delay Neutral Stochastic Integro-differential System with Poisson Jumps

Communication Info

Authors:

Marie Reine A. KAKPO¹
Mamadou Abdoul DIOP^{2,3}
Mariam B TRAORE⁴
Carlos OGOUYANDJOU¹

¹IMSP, Université d'Abomey-Calavi, Abomey-Calavi, Bénin

²UFR SAT, Université Gaston Berger de Saint-Louis, Saint-Louis, Sénégal

³UMMISCO, IRD, France

⁴EDSTM, Université des Sciences, des Techniques des Technologies de Bamako, Bamako, Mali

Keywords:

- (1) Mild solution
- (2) Stochastic
- (3) Integro-differential
- (4) Poisson Jump
- (5) Fixed point theorem

Abstract

Research on solving integrodifferential equations theory has recently become increasingly important. Thanks to the approach on the phase space developed by Hal and Kato [1], the integrodifferential equations with infinite delay have experienced considerable progress, whether deterministic or stochastic [2]. All these theories have been developed either by the semigroup approach [3,4] or by the operator approach [5] based on an adapted fixed-point theorem. In the present work, we present the study of a mild solution of an infinite delay neutral stochastic integrodifferential system with Poisson Jump in a Hilbert space by the resolvent operator approach. After obtaining the mild solution, we studied some properties, such as uniqueness and continuous dependence. The existence result is obtained thanks to the Banach fixed point theorem, while the Schaefer fixed point theorem made it possible to get at least one solution for our system. An example has been given to illustrate our obtained results.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Hale and J. Kato, Phase space for retarded equations with infinite delay, Funkcial Ekwac, 21, (1978), 11-41.
- [2] M. R. A. KAKPO, C. OGOUYANDJOU, and M. A. DIOP, Existence Results for Stochastic Integrodifferential Equations With Nonlocal Conditions 75-91, 2021.
- [3] A. Pazy, Semi groups of Linear Operators and Applications to Partial Differential Equations, Springer-Verlag, New York 1983.
- [4] G. Da Prato and J. Zabczyk, Stochastic Equations in Infinite Dimensions, Cambridge University Press, Cambridge, 1992.
- [5] R. C. Grimmer, Resolvent operators for integral equations in a Banach space, Transactions of the American Mathematical Society, 273 (1), (1982).

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Investigation of COVID-19 Dynamics in Turkey with Real Data and Stochastic Simulations

Communication Info

Authors:

Zafer BEKIRYAZICI¹

¹Department of Mathematics,
Recep Tayyip Erdogan
University, Rize, Turkey

Keywords:

- (1) Stochastic Differential Equation
- (2) COVID-19
- (3) Simulation
- (4) Stochastic Noise

Abstract

In this study, a recent deterministic ordinary differential equation system modeling the spread of the coronavirus (SARS-CoV-2) pandemic is used to analyze the course of the disease. Stochastic noise is added to the deterministic system to obtain a stochastic model and comment on the stochastic dynamics of disease transmission. The stochastic model is simulated and COVID-19 data for Turkey between March 2020 and October 2022 are used to compare and validate the results of the model and make estimations for the course of the pandemic in the upcoming period. Data from the first thousand days of the pandemic in Turkey are used to interpret the stochastic behavior of COVID-19 transmission and forecast the possible expectations for the number of total infections in the future.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Kucharski, A. J., Russell, T. W., Diamond, C., Liu, Y., Edmunds, J., Funk, S., ... Flasche, S. (2020). Early dynamics of transmission and control of COVID-19: a mathematical modelling study. *The lancet infectious diseases*, 20(5), 553-558.
- [2] Haq, I. U., Ullah, N., Ali, N., & Nisar, K. S. (2022). A New Mathematical Model of COVID-19 with Quarantine and Vaccination. *Mathematics*, 11(1), 142.
- [3] Paul, J. N., Mbalawata, I. S., Mirau, S. S., & Masandawa, L. (2023). Mathematical modeling of vaccination as a control measure of stress to fight COVID-19 infections. *Chaos, Solitons & Fractals*, 166, 112920.
- [4] Turkish Ministry of Health, COVID-19 Information Platform. <https://covid19.saglik.gov.tr/>, Access Date 27/01/2023.
- [5] Kloeden, P.E.; Platen E. Numerical Solution of Stochastic Differential Equations; Springer: United States of America, 1992.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



A Stochastic Rayleigh diffusion process: Parameters estimation and simulation.

Communication Info

Authors:

Yassine CHAKROUNE
Ahmed NAFIDI

Hassan First University of Settat,
National School of Applied
Sciences, LAMSAD, B.P. 280,
26100 Berrechid, Morocco.

Keywords:

- (1) Rayleigh distribution,
- (2) Diffusion process,
- (3)
- (4) MEAN FUNCION Rayleigh distribution, Diffusion process estimation, Mean function. Diffusion process estimation, Mean function.

Abstract

In this work we proposed a new diffusion process based on the Rayleigh density function curve. First we determined the explicit form of the process by solving the stochastic differential equation by applying the Ito method, then we proposed the probabilistic characteristics such as the density function, the mean and the conditional mean function. Unlike other processes in the same context, this one allowed us to end the explicit form of the estimators of these parameters by solving the maximum likelihood equation system. Finally a simulation study was proposed to see the behavior of our process and the efficiency of the estimators.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] R. Gutiérrez, A. Nafidi, R.G. Sánchez, Forecasting total natural-gas consumption in Spain by using the stochastic Gompertz innovation diffusion model, Appl. Energy 80 (2) (2005) 115–124.
- [2] R. Gutiérrez, R. Gutiérrez-Sánchez, A. Nafidi .The Stochastic Rayleigh diffusion model : Statistical inference and computational aspects. Applications to modelling of real cases. Applied Mathematics and Computation 175 (2006) 628–644.
- [3] A. Nafidi, M. Bahij, B. Achchab, R. Gutiérrez-Sánchez, The stochastic Weibull diffusion process : Computational aspects and simulation, Applied Mathematics and Computation 348 (2019) 575–587.
- [4] R. Gutiérrez, R. Gutiérrez-Sánchez, A. Nafidi, The trend of the total stock of the private car-petrol in Spain : Stochastic modelling using a new gamma diffusion process, Appl. Energy 86 (1) (2009) 18–24.
- [5] Ramon Gutiérrez A new Gompertz-type diffusion process with application to random growth 208 (2007) 147-165.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



The Recursive Conditional Hazard Function Estimator for Censored Functional Ergodic data

Communication Info

Authors:

Hadjer Kebir¹

¹*LSPS, Djillali Liabes University
, Sidi Bel Abbes, Algeria.*

Keywords:

- (1) Conditional hazard function
- (2) Censored data
- (3) Functional ergodic data
- (4) Recursive kernel estimate

Abstract

The functional estimate has attracted a lot of attention in the statistical literature. For an overview of the present state on non-parametrical functional data, we refer to the works of Ferraty and Vieu. [1] and Ramsay and Silverman. [2], and the references therein. The conditional hazard function rate plays an important role in the statistics. One of the important work about the conditional hazard rate in infinite dimensional space for functional covariates is of Ferraty, Rabhi and Vieu 2008. [3]. In this paper, we propose a recursive kernel estimator of the conditional hazard function in the case of censored response given a functional explanatory. The functional estimation combining censored data and ergodic theory has been studied by Chaouch and Khardani. [4]. Under ergodicity condition, we establish the almost surely convergence rate of the proposed estimator.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] F. Ferraty, P. Vieu, Nonparametric functional data analysis, 2006.
- [2] J.O Ramsay, B.W. Silverman, Applied functional data analysis, 2002.
- [3] F. Ferraty, A.Rabhi, P.Vieu, Estimation non-paramétrique de la fonction de hasard avec variable explicative fonctionnelle, 53 (2008) 1-18.
- [4] M.Chaouch, S.Khardani, Randomly censored quantile regression estimation using functional stationary ergodic data, 27 (2002) 65-87.



Functional regression and their estimation with missing data at random

Communication Info

Authors:

Abbassia BENCHIHA¹

¹Laboratory of Statistics and Stochastic Processes, University of Djillali Liabes, Sidi Bel Abbès Algeria

Keywords:

- (1) Local linear method
- (2) Missing data
- (3) Regression operator

Abstract

In this paper, we are mainly interested in the non-parametric estimator of the functional regression operator, we consider the problem of the co-variability analysis between a functional variable X and scalar response Y presents some missing observations. We use the local linear approach to model this relationship by constructing a local linear estimator of the regression operator when missing data appears in the response variable.

The main aim of the present work is to construct an alternative nonparametric estimation of the functional regression when there are missing responses. More precisely, we construct a new estimate of the functional nonparametric regression by the local linear smoothing method and we show its asymptotic properties. Specifically, under some general conditions, we prove the pointwise almost complete consistency of this.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Baillo, A. and Granè, A., Local linear regression for functional predictor and scalar response, *J. Multivariate Analysis*, 100(2009) 102-111.
- [2] Barrientos-Marin, J., Ferraty, F. and Vieu, P., Locally Modelled Regression and Functional Data. *J. Nonparametric Statistics*, 5 (2010) 617-632.
- [3] Benhenni, K., Ferraty, F., Rachdi, M. and Vieu, P., Local Smoothing with functional data. *J. Computational Statistics*. 3 (2007) 353-369.
- [4] Dabo-Niang, S., Laksaci, A., Estimation non paramétrique du mode conditionnel pour variable explicative fonctionnelle. *Pun. Inst. Stat. Univ. Paris*, 3 (2007) 27-42.

ICRAMCS 2023

FOURTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



A Simulation based Empirical Bayesian Approach for Breast Cancer Patients

Communication Info

Authors:

Aditya Chakraborty¹

¹Assistant Professor of Applied
Data Science, Master of Public
Health (MPH) Program
Eastern Virginia Medical
School, Virginia, USA

Keywords:

- (1) Hamiltonian Monte Carlo (HMC)
- (2) Empirical Bayes
- (3) Resampling Techniques
- (4) SEER Breast Cancer Data
- (5) Bayesian Survival Analysis
- (6) Simulation Studies

Abstract

The study focuses on a new analytical method of obtaining survival probability estimates with the application of Empirical Bayesian analysis (EBA). The study group consists of the patients diagnosed and died of Breast Cancer, who have undergone both chemotherapy, and radiation at the fourth stage of cancer. The data was collected from the Surveillance, Epidemiology, and End Results (SEER), a big database for cancer. First, we identify parametrically the most suitable probabilistic behavior of the survival times of patients by the goodness of fit (GOF) tests, which was found to be two-parameter log-normal. Then we perform Empirical Bayesian analysis by assuming the shape parameter as random. Our main goal of the study is to select the appropriate prior for the shape parameter via different resampling techniques (Jackknife & Bootstrap) [1] and obtain the posterior distribution of the shape parameter. We call the Bayesian estimate of the posterior distribution of the shape parameter the empirical Bayesian estimate. We used the Hamiltonian Monte Carlo [2] method to obtain the posterior distribution and performed a sensitivity analysis with simulation studies to validate the method. Finally, we compared the empirical Bayesian survival probability estimates with parametric, and non-parametric survival methods, and obtained very consistent results. The empirical Bayesian estimates [3] were found to be more precise compared to the parametric, and non-parametric methods. This analytical methodology can be implemented for any time-to-event data, where Bayesian analysis is needed.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] hao, Jun, and Dongsheng Tu. The jackknife and bootstrap. Springer Science & Business Media, 2012
- [2] Nishio, M., Arakawa, A. Performance of Hamiltonian Monte Carlo and No-U-Turn Sampler for estimating genetic parameters and breeding values. *Genet Sel Evol* 51, 73 (2019). <https://doi.org/10.1186/s12711-019-0515-1>.
- [3] Casella, George. "An introduction to empirical Bayes data analysis." *The American Statistician* 39.2 (1985): 83-87

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Sentiment Analysis from texts written in standard Arabic and Moroccan dialect

Communication Info

Authors:

ABDELLAH AIT ELOULI¹
HASSAN OUAHI¹
El Mehdi CHARRAT¹

¹Department of Computer
Sciences, University IBN
ZOHR AGADIR, faculty FSA
AITMELLOUL, Morocco

Keywords:

- (1) sentiment analysis
- (2) machine learning
- (3) Deep learning
- (4) natural language
processing

Abstract

Sentiment analysis, also known as opinion mining, is the use of natural language processing, text analysis, and computational linguistics to identify and extract subjective information from source materials [1]. This process can be used to determine the attitudes, opinions, and emotions of a speaker or writer with respect to some topic or the overall contextual polarity of a document. The goal of sentiment analysis is to determine the attitudes, opinions, and emotions of a speaker or writer with respect to some topic or the overall contextual polarity of a document. Sentiment analysis is widely used in social media analysis, customer service, and market research.[2][3] Our task is to apply a set of machine learning algorithms and others of deep learning on comments written in Arabic with the Arabic letters, trying to highlight the strengths of each algorithm. In this work, we define and describe the process and important steps of each tested approach. And so, we look for the method that effectively classifies comments into positive and negative categories.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] B. Pang and L. Lee, "Opinion mining and sentiment analysis," *Inf. Retr. Boston.*, vol. 2, no. 1, 2008.
- [2] P. Routray, C. K. Swain, and S. P. Mishra, "A Survey on Sentiment Analysis," *Int. J. Comput. Appl.*, vol. 76, no. 10, p. 18, 2013.
- [3] B. Liu, "Sentiment analysis and subjectivity," *Handb. Nat. Lang. Process.*, vol. 2, pp. 627–666, 2010.



Improving Breast Cancer Diagnosis with a Light-Weighted Deep Learning Approach

Communication Info

Authors:

Jaafar JAAFARI¹
Samira DOUZI²
Khadija Douzi¹

¹ FSTM, University Hassan II,
Casablanca, Morocco

² FMPR, University Mohammed
V, Rabat, Morocco

Keywords:

- (1) Breast Cancer
- (2) Convolutional Neural Networks
- (3) Computer vision
- (4) Edge detectors
- (5) Thermographic images

Abstract

The issue of breast cancer is a significant health concern for women around the world, with more than 40,000 deaths each year [1]. The early detection of breast cancer can lead to a decrease in both the severity of the disease and the risk of death, and in some cases, may allow for alternative treatment options that do not involve surgery [2]. The main objective of this study is to propose a new approach for detecting breast cancer using thermographic images, with a specific focus on accessibility for women in resource-limited settings. By utilizing mobile technology, the proposed approach aims to empower women in these communities to perform self-diagnosis via their mobile devices. The proposed approach is based on the use of MobileNet v2 and the attention mechanism. This approach is lightweight, which has the potential to be more accessible and cost-effective, especially in resource-limited settings. Furthermore, multiple edge detection algorithms were tested to evaluate their performance with the proposed model. The results of this study demonstrate that the proposed model outperforms state-of-the-art approaches in terms of performance and accuracy.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] National Breast Cancer Foundation. Breast Cancer Facts; National Breast Cancer Foundation: Sydney, Australia, 2016.
- [2] Sathish, D., Kamath, D., Rajagopal, K. V., and Prasad, K., Medical imaging techniques and computer aided diagnostic approaches for the detection of breast cancer with an emphasis on thermography - a review. Int. J. Med. Eng. Inform. 8:275-99. <https://doi.org/10.1504/IJMEI.2016.077446>, 2016.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



A New Model Based on Genetic Algorithms for Multilayer Perceptron Neural Network Hyper-parameters Optimization

Communication Info

Authors:

Fatima Zahrae El-HASSANI¹
Khalid HADDOUCH¹

¹ENSA, Sidi mohammed Ben
Abdelleh University Fez, Fez,
Morocco

Keywords:

- (1) Multi-layer perceptron (MLP)
- (2) Genetic algorithm (GA)
- (3) Hyper-parameters Optimization
- (1) Machine learning (ML)
- (1) Non-Linear Optimization

Abstract

Multi-layer perceptron (MLP) have been widely used in a variety of applications and domains. The hyper-parameters of these machine learning (ML) models must be tuned to fit different problems. The choice of the best hyper-parameters configuration has a direct impact on the performance of the model. This work proposes a new optimization model to find the optimal neural architecture solved by the genetic algorithm method. We use a real chromosome representing the architecture that can express both the number of layers and the number of nodes in each layer. This new proposed approach models the neural architecture optimization challenge as nonlinear constraint programming with mixed variables. The generalizability of MLP was evaluated and the risk of over fitting was avoided by using a cross-validation technique. Our model was tested using a hypothyroidism dataset recovered from the Gravel Institute in Sydney, Australia, and submitted to the UC-Knowledge Irvine Discovery in Databases program. Compared to previous studies, the results show an improvement in categorization performance. The stability of the technique is also demonstrated by the fact that the suggested approach has the lowest standard deviation of the average accuracy rate.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] L. Yang, A. Shami, On hyperparameter optimization of machine learning algorithms: Theory and practice, vol. 44, no 8, p. 295-316, 2020.
- [2] H. Ramchoun, M. Idrissi, Y. Ghanou, M. Etaouil, Multilayer Perceptron: Architecture Optimization and Training. Int J Interact Multimed Artif Intell 4:26. doi: 10.9781/ijimai.2016.415
- [3] M. Ettaouil, Y. Ghanou, Neural architectures optimization and Genetic algorithms. 8:13, 2009.
- [4] Y. El foutayeni, M. Khaladi, General Characterization of a Linear Complementarity Problem, Amer. J. Model. Optim., 1 (2013) 1-5.
- [5] S. Sun, Z. Cao, H. Zhu, J. Zhao (2019) A Survey of Optimization Methods from a Machine Learning Perspective.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Educational Data Mining and Learning Analytics: Literature review

Communication Info

Authors:

Meryam BENLAHLAL¹
Karima AISSAOUI¹
Mohammed
BERRADA¹

¹LIASSE, Sidi Mohammed Ben
Abdellah University, Fez,
Morocco

Keywords:

- (1) Educational data mining
- (2) Learning analytics
- (3) Big data

Abstract

During the pandemic period, distance learning is the method used to continue learning and teaching by universities and schools using a range of learning environments such as learning management system(LMS), massive open online courses(MOOCs), open educational resources (OER), OpenCourseWare(OCW) and social media sites[1][2][3][4]. The use of these environments has produced massive data, and the collection and analysis of this data requires the use of the fields of educational data mining (EDM) and learning analytics (LA) which have the common goal of improving learning and teaching at the student level (improving their performance and skills), or at the teacher level (making courseware more effective), as well as learning environments, ...[4][5][6]. The purpose of this review is to examine research between 2019 and 2022 that uses the concepts of EDM and LA in order to provide a comprehensive view of these two areas. This paper provides an in-depth explanation of the two concepts, their goals, differences, learning environments, data, methods and techniques used, and thus tools found in the EDM and LA fields.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] T. L. De Andrade, S. J. Rigo, J. Luis, and V. Barbosa, "Active Methodology , Educational Data Mining and Learning Analytics : A Systematic Mapping Study," vol. 20, no. 2, 2021.
- [2] M. Yağcı, "Educational data mining : prediction of students ' academic performance using machine learning algorithms," 2022.
- [3] K. L. M. Ang, F. L. Ge, and K. P. Seng, "Big Educational Data Analytics: Survey, Architecture and Challenges," *IEEE Access*, vol. 8, pp. 116392–116414, 2020.
- [4] C. Romero and S. Ventura, "Educational data mining and learning analytics : An updated survey," no. September 2019, pp. 1–21, 2020.
- [5] A. Charitopoulos, M. Rangoussi, and D. Koulouriotis, "On the Use of Soft Computing Methods in Educational Data Mining and Learning Analytics Research : a Review of Years 2010 – 2018," no. iii, 2020.
- [6] H. Aldowah, H. Al-samarraie, and W. Mohamad, "Telematics and Informatics Educational data mining and learning analytics for 21st century higher education : A review and synthesis," *Telemat. Informatics*, vol. 37, no. January, pp. 13–49, 2019.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



COVID-19 in Morocco: an epidemiological case study

Communication Info

Authors:

El Mehdi CHOUIT¹
Mohamed RACHDI²
Mostafa BELLAFKIH¹
Brahim RAOUYANE³

¹RAISS Laboratory,
Department of Mathematics
and Computer Science,
National Institute of Posts and
Telecommunications (INPT),
Rabat, Morocco.

²TIM Laboratory, Faculty of
sciences Ben M'sik, ENSAD,
Hassan II University

³Department of Mathematics
and Computer Science, Faculty
of Sciences Ain Chock,
University Hassan II

Keywords:

- (1) Covid-19
- (2) Linear Regression
- (3) SVM
- (4) Machine Learning
- (5) Time Series

Abstract

All industries employ machine learning extensively [1]. Machine learning (ML)-based forecasting systems have proven their efficacy in evaluating perioperative effects, which can help hasten decision-making on the most likely course of action. ML models have been used for some time to identify and classify hazardous threat factors in several technical fields. Several distinct predictions [2] methodologies are frequently utilized to address forecasting issues. The research demonstrates how machine learning (ML) models can predict the frequency of COVID-19 incidents in the future, which is now seen to pose a severe threat to civilization. In this work, we compared and analyzed Linear Regression and Support Vector Machine (SVM), two popular machine learning methods. Each model projects three variables: the total number of confirmed cases, the total number of fatalities, and the total number of recoveries over the subsequent 30 days. The study's findings show that it is a viable option to use these strategies under the present COVID-19 pandemic scenario. Two ML models were utilized to increase accuracy. According to the experiment's findings, SVM produces the lowest results when it comes to COVID-19 prediction, whereas Linear Regression produces the best.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Aggarwal, K., Mijwil, M. M., Al-Mistarehi, A. H., Alomari, S., Gök, M., Alaabdin, A. M. Z., & Abdurhman, S. H. (2022). Has the future started? The current growth of artificial intelligence, machine learning, and deep learning. *Iraqi Journal for Computer Science and Mathematics*, 3(1), 115-123.
- [2] Chouit, E. M., RACHDI, M. ., BELLAFKIH, M., & RAOUYANE, B. . (2022). Forecasting of the epidemiological situation: Case of COVID-19 in Morocco. *Journal of the Nigerian Society of Physical Sciences*, 4(4), 843. <https://doi.org/10.46481/jnsps.2022.843>

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



An improved ACO algorithm for multi-dialectal sentiment analysis

Communication Info

Authors:

Soukaina MIHI¹
Brahim AIT BEN ALI²
Nabil LAACHFOUBI³

^{1,2,3}IR2M, Faculty Of Science and
Techniques, University Hassan
first of Settat

Keywords:

- (1) sentiment analysis
- (2) Arabic dialects
- (3) Ant Colony Optimization
- (4) Naïve Bayes

Abstract

In this study, we present a novel method based on a probabilistic model and improved Ant Colony Optimization (ACO) to predict the sentiment of different datasets representing the most common dialects in the Arab world. The aim is to demonstrate the effectiveness of evolutionary algorithms in sentiment analysis tasks and their ability to compete with deep learning approaches. The correlation between features is used to calculate the relationship between nodes, which are treated like ants that are rewarded with increased pheromone in the link. The chosen features are then fed into a Naive Bayes classifier to determine the probability of the predicted classes. The results demonstrate that this system is comparable to the baseline and even outperforms it for some datasets, showing its potential for sentiment analysis of dialect Arabic, one of the most difficult tasks in NLP. To validate the proposed system, we conducted experiments for four datasets representing multiple dialects including Moroccan, Egyptian, Levantine and Gulf and considered F1-score and accuracy as evaluation measures.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Ahmad, S.R., Bakar, A.A., & Yaakub, M.R. (2019). Ant colony optimization for text feature selection in sentiment analysis. *Intell. Data Anal.*, 23, 133-158.
- [2] Yadav, A., Vishwakarma, D.K. A comparative study on bio-inspired algorithms for sentiment analysis. *Cluster Comput* 23, 2969–2989 (2020). <https://doi.org/10.1007/s10586-020-03062-w>
- [3] Christian Blum, Ant colony optimization: Introduction and recent trends, *Physics of Life Reviews*, Volume 2, Issue 4, 2005, Pages 353-373, ISSN 1571-0645, <https://doi.org/10.1016/j.plrev.2005.10.001>.
- [4] T. Parlar, E. Saraç and S. A. Özel, "Comparison of feature selection methods for sentiment analysis on Turkish Twitter data," 2017 25th Signal Processing and Communications Applications Conference (SIU), Antalya, Turkey, 2017, pp. 1-4, doi: 10.1109/SIU.2017.7960388.
- [5] Md. Monirul Kabir, Md. Shahjahan, Kazuyuki Murase, A new hybrid ant colony optimization algorithm for feature selection, *Expert Systems with Applications*, Volume 39, Issue 3, 2012, Pages 3747-3763, ISSN 0957-4174, <https://doi.org/10.1016/j.eswa.2011.09.073>.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Etude De La Vulnérabilité Sismique Des Bâtiments Dans La Zone D'Al Hoceima

Communication Info

Authors:

Soumaya EL JANOUS¹
Abdelouafi El GHOULBZOURI¹

¹Equipe de Recherche MODSGC,
ENSA-H, université Abdelmalek
Essaadi, Hoceima, Morocco

Keywords:

- (1) Performance
- (2) Interaction sol-structure
- (3) Courbe de fragilité

Abstract

Dans le cadre du calcul sismique basé sur la notion de performance, les ingénieurs se trouvent confrontés à une tâche difficile pour estimer la performance et évaluer les risques des systèmes sol-structure en interaction [1].

L'objectif de cette contribution est d'étudier le comportement sismique des structures en béton armé en interaction avec le sol [2] dans la ville d'AL HOCEIMA qui se trouve dans le nord du Maroc.

La problématique s'inscrit dans le cadre de proposition de modèles simplifiés afin d'aborder un problème compliqué tel que l'interaction sol-structure (ISS). Le comportement non linéaire de la structure [3] est déterminé par une approche capacitive basée sur la performance sismique telle que la méthode N2 proposée par P. Fajfar [4].

Les courbes de fragilité [5] sont établies en tenant compte des effets de l'ISS et des incertitudes associées au chargement (mouvement du sol), aux propriétés de la structure, du sol, et de la fondation (impédances,) [6].

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Avilés, J. & Pérez-Rocha, L. (2003). Soil-structure interaction in yielding systems. *Earthquake Engineering and Structural Dynamics*, 32, 1749-1771.
- [2] Gazetas, G., & Mylonakis, G. (1998). Seismic soil-structure interaction: new evidence and emerging issues," *Geotechnical Earthquake Engineering and Soil Dynamics III ASCE*, eds. P. Dakoulas, E. K. Yegian, and R. D. Holtz, Vol. 11, pp. 111..
- [3] Fajfar, P., & Gaspersic P. (1996). The N2 method for the seismic damage analysis of RC buildings. *Earthquake Engineering and Structural Dynamics*, 25, 31-46
- [4] Fajfar, P. & Fischinger, M. (1987). Non-linear seismic analysis of RC building : Implications of a case study. *European Earthquake Engineering*, 1, 31-43.
- [5] Dumova-Jovanoska, E, (2004). Fragility curves for RC structures in Skopje region. *Proceedings of the Thirteenth World Conference on Earthquake Engineering, Vancouver, Canada*.
- [6] Peláez, J.A., Hamdache, M., & Casado, C.L. (2005). Updating the Probabilistic Seismic Hazard Values of Algeria with the 21 May 2003

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Medical Images Segmentation

Communication Info

Authors :

Meryem AMEUR¹
Cherki DAOUI²
Najlae IDRISSE³

^{1,2,3}*LTIAD, Sultan Moulay
Slimane University of Beni
Mellal, Morocco*

Keywords:

(1) HMC
(2) TMC
(3) unsupervised
segmentation
(4) stationary process
(5) non stationary process
(5) Auxiliary process
(6) Medical Image
segmentation

Abstract

Our work presents some applications of grey level medical images segmentation. Our study focuses on unsupervised segmentation using the classical and the recently hidden Markov model; Hidden Markov chain and Triplet Markov chain. These models are different in term of process modeling. Where, the classical model considers that the hidden process X is stationary and the recently model assumes that the hidden process X is non stationary then to model that it introduce an auxiliary process U . The role of U is to represent this non-stationary of X process. Here we compare these models HMC and TMC in term of quality using some types of medical images. The results demonstrate that TMC is performant than HMC.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] P. Lanchatin, Chaines de Markov triplet et segmentation non supervisée de signaux, PhD thesis of national institute of telecommunications, 2006.
[2] S. Rafi, Chaines de Markov cachées et séparation non supervisée de sources, PhD thesis of national institute of telecommunications and management Sud Paris, 2012

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Detect Plant Diseases in Smart Farms Using the Deep Learning Tool

Communication Info

Authors:

Hammou Djilal Rafik¹
Akram Rais¹
Sanaa Chabane¹

¹EEDIS, Djillali Liabes
Department of computer
sciences
University of Sidi Bel Abbas,
Algeria

Keywords:

- (1) Plant disease
- (2) Deep Learning
- (3) Agriculture
- (4) Accuracy
- (5) Concatenation
- (6) CNN
- (7) PlantVilage
- (8) Architectures

Abstract

Agriculture is the future of global human nutrition. This field is faced with an infinitude of obstacles, such as plant diseases [1], in addition to the growth of the world population, which constantly requires an increase in agricultural production. Early detection of plant diseases is an efficient tool and plays a primary role in improving yields in agricultural production. The techniques and methods used render an enormous service to agriculture by avoiding crop losses and making it possible to combat plant diseases as soon as they appear. The arrival of deep learning [2] upset the world of computing and the entire field of agriculture by bringing new ideas and generating applications related to agriculture and its exactitude. In this project, we plan to use deep learning [3] with this convolutional neural network (CNN) architecture to detect plant diseases and classify them [4][5]. Then we will use the concatenation between the CNN architectures to improve the accuracy and reduce the error as much as possible [6][7]. Our approach will be tested on a corpus of images named PlantVilage [8], and we will validate our results with the rate of accuracy, loss, execution time, precision, and recall.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Pelczar, Rita M. , Pelczar, Michael J. , Shurtleff, Malcolm C. and Kelman, Arthur. "plant disease". *Encyclopedia Britannica*, 31 Aug. 2021, <https://www.britannica.com/science/plant-disease>. Accessed 31 January 2023.
- [2] I. Goodfellow, Y. Bengio, and A. Courville, Deep Learning. MIT Press, 2016. <http://www.deeplearningbook.org>.
- [3] Hammou, D.R., Boubaker, M. (2022). Tomato Plant Disease Detection and Classification Using Convolutional Neural Network Architectures Technologies. In: Ben Ahmed, M., Teodorescu, HN.L., Mazri, T., Subashini, P., Boudhir, A.A. (eds) Networking, Intelligent Systems and Security. Smart Innovation, Systems and Technologies, vol 237. Springer, Singapore. https://doi.org/10.1007/978-981-16-3637-0_3.
- [4] B. Tugrul, E. Elfatimi, and R. Eryigit, "Convolutional Neural Networks in Detection of Plant Leaf Diseases: A Review," *Agriculture*, vol. 12, no. 8, p. 1192, Aug. 2022, doi: 10.3390/agriculture12081192.
- [5] S. M. Hassan and A. K. Maji, "Plant Disease Identification Using a Novel Convolutional Neural Network," in *IEEE Access*, vol. 10, pp. 5390-5401, 2022, doi: 10.1109/ACCESS.2022.3141371.
- [6] J. Lu, L. Tan, and H. Jiang, "Review on Convolutional Neural Network (CNN) Applied to Plant Leaf Disease Classification," *Agriculture*, vol. 11, no. 8, p. 707, Aug. 2021, doi: 10.3390/agriculture11080707.
- [7] P. Kaur et al., "Recognition of Leaf Disease Using Hybrid Convolutional Neural Network by Applying Feature Reduction," *Sensors*, vol. 22, no. 2, p. 575, Jan. 2022, doi: 10.3390/s22020575.
- [8] Hughes, D., Salathé, M.: An open access repository of images on plant health to enable the development of mobile disease diagnostics through machine learning and crowdsourcing. ArXiv preprint arXiv:1511.08060 (2015).

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Analyse prédictive du risque d'apparition de troubles psychiatriques chez les chauffeurs de poids lourds à l'aide d'une approche bayésienne floue

Communication Info

Authors:

Imane BENALLOU
Abdellah AZMANI
Monir AZMANI

Laboratoire d'Informatique,
systèmes et
télécommunications (LIST)

Faculté des Sciences et
Techniques de Tanger

Université Abdelmalek Essaadi
Tétouan- Maroc

Keywords:

- (1) Troubles psychiatriques
- (2) Chauffeurs de poids lourds
- (3) Réseaux bayésiens
- (4) Logique floue

Abstract

Les chauffeurs routiers professionnels travaillent dans des conditions exigeantes, les horaires de travail sont souvent irréguliers [1]. La plupart du temps, ils se trouvent dans l'obligation de passer de longues périodes loin de chez eux et de leur famille, la qualité et la durée du sommeil étant fréquemment réduite [2], sans oublier le stress permanent de livrer la commande à temps [3]. Toutes ces contraintes mettent en danger la sécurité des conducteurs sur la route et affectent négativement leur santé en général et en particulier leur bien-être mental [4]. Dans cet article, on vise à développer une approche bayésienne floue qui anticipe, par une analyse prédictive combinant les réseaux bayésiens [5] et la logique floue [6], l'apparition de troubles psychiatriques chez les chauffeurs de poids lourds.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] C. S. Sartori, P. Smet, et G. Vanden Berghe, « Truck driver scheduling with interdependent routes and working time constraints », *EURO Journal on Transportation and Logistics*, vol. 11, p. 100092, 2022, doi: 10.1016/j.ejtl.2022.100092.
- [2] E. Giroto *et al.*, « Working conditions and sleepiness while driving among truck drivers », *Traffic Injury Prevention*, vol. 20, n° 5, p. 504-509, juill. 2019, doi: 10.1080/15389588.2019.1609670.
- [3] P. Delhomme et A. Gheorghiu, « Perceived stress, mental health, organizational factors, and self-reported risky driving behaviors among truck drivers circulating in France », *Journal of Safety Research*, vol. 79, p. 341-351, déc. 2021, doi: 10.1016/j.jsr.2021.10.001.
- [4] A. M. Crizzle, P. Bigelow, D. Adams, S. Gooderham, A. M. Myers, et P. Thiffault, « Health and wellness of long-haul truck and bus drivers: A systematic literature review and directions for future research », *Journal of Transport & Health*, vol. 7, p. 90-109, déc. 2017, doi: 10.1016/j.jth.2017.05.359.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Multi users pairing based cryptography with diffie-Hellman key exchange

Communication Info

Authors:

ISMAIL ASSOJAA¹
SIHAM EZZOUAK²
HAKIMA MOUANIS³

^{1,2,3}USMBA, SIDI MOHAMMED
BEN ABDELLAH UNIVERSITY,
FACULTY OF SCIENCE DHAR EL
MAHREZ, DEPARTMENT OF
MATHEMATICS, LABORATORY
LASMA, FEZ, MOROCCO.

Keywords:

- (1) Pairing
- (2) DIFFIE-HELLMAN protocol
- (3) Random point

Abstract

Cryptography is the study and practice of techniques for secure communication between two peoples (Alice & Bob), in the presence of a third partie called adversaries (Eve). But in many cases, communications are not limited to just two peoples but extended to more users. Diffie-Hellman (D.H) is one among the earliest practical example of public key exchange implemented within the field of cryptography and secure communication. The Diffie-Hellman key exchange method allows two parties that haven't any prior knowledge of any other to jointly establish a shared secret key over an insecure channel. In this work we will extend the D.H key exchange, for multi users and we will give some way to random the input of points used for the pairing application with D.H key exchange.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Victor S. Miller. Use of elliptic curves in cryptography. *Crypto 1985*, LNCS 218, pp. 417-426, 1985.
- [2] N Koblitz. Elliptic curve cryptosystems. *Mathematics of Computation*, V48(177), pp. 203-209, 1987.
- [3] R.L. Rivest, A. Shamir, and L.M. Adleman. A method for obtaining digital signatures and publickey cryptosystems. *Commun. ACM*, Vol. 21, No. 2, pp. 120-126, 1978.
- [4] Whelan, C., Scott, M.: The Importance of the Final Exponentiation in Pairings When Considering Fault Attacks. In: Takagi, T., Okamoto, T., Okamoto, E., Okamoto, T. (eds.) *Pairing 2007*. LNCS, vol. 4575, pp. 225-246. Springer, Heidelberg (2007).
- [5] Nadia El Mrabet.: What about Vulnerability to a Fault Attack of the Miller's Algorithm During an Identity Based Protocol. J.H. Park et al. (Eds.): *ISA 2009*, LNCS 5576, pp. 122-134, 2009.
- [6] Damien Jauvart, Nadia El Mrabet, Jacques J. A. Fournier, and Louis Goubin. Resistance of the Point Randomisation Countermeasure for Pairings Against Side-Channel Attack. Springer Nature Switzerland AG 2019 M. S. Obaidat and E. Cabello (Eds.): *ICETE 2017*, CCIS 990, pp. 150-172, 2019.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Exploring new strategies to improve data centers efficiency: A survey

Communication Info

Authors:

Hassan BENNANI¹

Aziz SAOULI²

¹ENSIAS, Mohammed V

University in Rabat,

Morocco

²LARIT Laboratory, team

Network, Telecommunication

and intelligence, University

Ibn Tofail, Faculty of Science,

BP 242, Kenitra,

Morocco

Keywords:

(1) Datacenter

(2) Power Usage Effectiveness

(3) Facility Power

(4) Efficiency

Abstract

Digital technologies are everywhere and affecting our life directly. According to the International Energy Agency, data centers and data transmission are responsible for nearly 1% of energy related greenhouse gas emissions. The efficient energy utilization in a must in data centers. Since 2010 and thanks to energy efficiency improvements data centers use (excluding crypto) has grown moderately despite the strong growth in demand for data center services. In this paper, we survey the state of art techniques for energy consumption and strategies to improve datacenters efficiency.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Nadjahi, C., Louahlia, H., & Lemasson, S. (2018). A review of thermal management and innovative cooling strategies for data center. *Sustainable Computing: Informatics and Systems*, 19, 14-28.
- [2] Li, Y., Wen, Y., Tao, D., & Guan, K. (2019). Transforming cooling optimization for green data center via deep reinforcement learning. *IEEE transactions on cybernetics*, 50(5), 2002-2013.
- [3] Deymi-Dashtebayaz, M., & Valipour-Namanlo, S. (2019). Thermo-economic and environmental feasibility of waste heat recovery of a data center using air source heat pump. *Journal of Cleaner Production*, 219, 117-126.
- [4] Tang, X., Liao, X., Zheng, J., & Yang, X. (2018). Energy efficient job scheduling with workload prediction on cloud data center. *Cluster Computing*, 21(3), 1581-1593.
- [5] Cho, J., Lim, T., & Kim, B. S. (2012). Viability of datacenter cooling systems for energy efficiency in temperate or subtropical regions: Case study. *Energy and buildings*, 55, 189-197.
- [6] Yadav, R., Zhang, W., Li, K., Liu, C., Shafiq, M., & Karn, N. K. (2020). An adaptive heuristic for managing energy consumption and overloaded hosts in a cloud data center. *Wireless Networks*, 26(3), 1905-1919.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Efficient and Effective Intrusion Detection in IoT Networks: Transformer-based Approach

Communication Info

Authors:

FatimaEzzahra LAGHRISSI¹
Samira DOUZI²
Khadija DOUZI¹

¹ *FSTM, University Hassan II of Casablanca, Morocco*

² *FMPR, University Mohammed V of Rabat, Morocco*

Keywords:

- (1) Internet of Things (IoT)
- (2) Intrusion Detection Systems
- (3) Transformers
- (4) Principal Components Analysis
- (5) Shap Values

Abstract

The Internet of Things (IoT) has brought about a significant increase in the number of connected devices in recent years, leading to the development of new and diverse applications. However, this increased connectivity brings various security risks[1]. Intrusion detection systems (IDS) play a crucial role in mitigating these risks by detecting and responding to malicious activity within a network. This paper presents an analysis of the impact of using transformers on IDS in IoT networks. Transformers are a type of machine learning model that have been shown to have superior performance in natural language processing tasks [2]. However, they have not been extensively studied in the context of IDS. The objective of this research is to evaluate the effectiveness of transformer-based models in detecting intrusions in IoT networks and to compare their performance with traditional ML algorithms. Multiple feature engineering techniques were used in the analysis, such as PCA and Shap values. These techniques were employed to reduce the dimensionality of the data and to identify the most important features in detecting intrusions. The results demonstrate that transformer-based models are a promising approach for intrusion detection in IoT networks. The use of these models, in conjunction with feature engineering techniques such as PCA and Shap values, can significantly improve the accuracy and efficiency of the IDS. This is particularly relevant for real-time monitoring systems where the cost and processing time are an important factor.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Williams, Phillip & Dutta, Indira & Daoud, Hisham & Bayoumi, Magdy. (2022). A Survey on Security in Internet of Things with a Focus on the Impact of Emerging Technologies. *Internet of Things*. 19. 100564. 10.1016/j.iot.2022.100564.
- [2] Wolf, Thomas & Debut, Lysandre & Sanh, Victor & Chaumond, Julien & Delangue, Clement & Moi, Anthony & Cistac, Pierric & Rault, Tim & al.(2020). Transformers: State-of-the-Art Natural Language Processing. 38-45. 10.18653/v1/2020.emnlp-demos.6.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Low-cost air pollution monitoring IoT platform: A Case Study of Inezgane-Ait Melloul (Southwestern Morocco)

Communication Info

Authors:

Abdellatif BEKKAR¹
Badr HSSINA¹
Samira DOUZI²
Khadija DOUZI¹

¹Department of Computer
Sciences
FSTM, University Hassan II
Casablanca, Morocco

²Department of Drug Science
FMPR, University Mohammed V
Rabat, Morocco

Keywords:

- (1) Artificial intelligence of things
- (2) Low-cost sensors
- (3) Smart cities
- (4) Air pollution

Abstract

Air pollution awareness is one of the key aspects of modern smart cities. Decision makers and other key stakeholders are often unaware of the air contamination in their immediate environment and its relationship to the local surroundings and microclimate when making short- or long-term decisions. The Internet of Things (IoT) paradigm provides a suitable general framework for monitoring air pollution as it incorporates a sensor network containing static and/or mobile sensors to measure different pollutants. In this context, this work presents an AIoT (artificial intelligence of things) platform designed for air pollution monitoring using low-cost sensors in the city of Ait Melloul, Morocco. The main features of this AIoT system are to simplify the monitoring process, provide real-time information to citizens, involve citizens in the process, detect high pollution areas, and use machine learning for forecasting. Decision-makers can use this information to take appropriate actions to improve air quality. Preliminary results show that this system effectively monitors air quality.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

- [1] Bekkar, A., Hssina, B., Douzi, S. *et al.* Air-pollution prediction in smart city, deep learning approach. *J Big Data* **8**, 161 (2021). <https://doi.org/10.1186/s40537-021-00548-1>
- [2] Gryech I, Ben-Aboud Y, Guermah B, Sbihi N, Ghogho M, Kobbane A. MoreAir: A Low-Cost Urban Air Pollution Monitoring System. *Sensors*. 2020; 20(4):998. <https://doi.org/10.3390/s20040998>
- [3] Bekkar, Abdellatif, et al. "Spatiotemporal Prediction of PM 2.5 Concentrations Based on IoT Sensors." *AI and IoT for Sustainable Development in Emerging Countries: Challenges and Opportunities*. Cham: Springer International Publishing, 2022. 199-215.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Using NLP for the design of a legal contract processing model

Communication Info

Authors:

Youssra AMAZOU¹
Abdellah AZMANI¹
Monir AZMANI¹

¹LIST, Faculty of Science and
Technology of Tanger,
University Abdelmalek Essaadi,
Tetouan, Morocco

Keywords:

- (1) AI in law
- (2) Natural language processing in law
- (3) Legal domain
- (4) Legal contract

Abstract

Contracts are an essential element in the professional and social spheres. Understanding these documents is indispensable to ensure that all critical clauses are adequately understood and managed. Contracts may contain requirements and other incidental details, such as guidelines and supporting statements. Therefore, professionals in this field must read and identify the text that establishes the requirements, conflicts, and compliance of the contract content with the law. The traditional manual practice of this scope processing requires significant time and effort and can involve human error.

Natural language processing (NLP) based solutions have been particularly sought after for the legal systems of several countries [1][2]. However, many countries are still behind in exploring advanced AI technologies in their legal framework. Hence, our paper explores how the use of NLP can enhance the legal framework contracting process [3][4], [5], Special attention will be accorded to the Moroccan legal system. Firstly, we present the state of the art of NLP in law [3], [4]. Secondly, we examine the experience of other countries that have applied this approach to their national systems, as well as the possibility of adapting this one to the Moroccan legal system. We conclude by presenting our conceptual model that attempts to fill a gap in the Moroccan Legal Contracting literature [5], [6].

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] E. Mumcuoğlu, C. E. Öztürk, H. M. Ozaktas, and A. Koç, "Natural language processing in law: Prediction of outcomes in the higher courts of Turkey," *Inf Process Manag*, vol. 58, no. 5, Sep. 2021, doi: 10.1016/j.ipm.2021.102684.
- [2] D. Hendrycks, C. Burns, A. Chen, and S. Ball, "CUAD: An Expert-Annotated NLP Dataset for Legal Contract Review," Mar. 2021, [Online]. Available: <http://arxiv.org/abs/2103.06268>
- [3] H. Zhong, C. Xiao, C. Tu, T. Zhang, Z. Liu, and M. Sun, "How Does NLP Benefit Legal System: A Summary of Legal Artificial Intelligence," Apr. 2020, [Online]. Available: <http://arxiv.org/abs/2004.12158>
- [4] B. S. Haney, "APPLIED NATURAL LANGUAGE PROCESSING FOR LAW PRACTICE," 2020. [Online]. Available: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1971953.
- [5] R. Funaki, Y. Nagata, K. Suenaga, and S. Mori, "A Contract Corpus for Recognizing Rights and Obligations," 2020.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Toward smart irrigation systems using IoT and AI

Communication Info

Authors:

Mohamed-Akram LAMHOUR¹

Mohamed MSALEK²

Soufiane ARDCHIR³

Youssef Ouassit⁴

Mohamed AZZOUAZI⁵

^{1,2,4,5}LTIM, Hassan II University
of Casablanca, Casablanca,
Morocco

³ National School of Business
and Management, Casablanca,
Morocco

Keywords:

(1) Smart Irrigation

(2) IOT

(3) AI

(4) Machine Learning

(5) Deep Learning

Abstract

Smart Irrigation is an innovative approach that integrates IoT and Deep Learning technologies to create an autonomous irrigation system capable of monitoring soil moisture levels using a soil moisture sensor and irrigating crops accordingly [1]. The system offers numerous benefits, including increased crop yields [2], reduced human involvement, and lower equipment costs [3]. Smart Irrigation is an environmentally friendly solution that helps conserve water by ensuring that only the required amount is used for irrigation [4]. This paper provides a comprehensive overview of the current state-of-the-art Smart Irrigation systems, exploring their design and operation, as well as their potential benefits and limitations. Moreover, the paper highlights areas for future research and development, which can contribute to the advancement of Smart Irrigation systems.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

[1] Y. Ahansal, M. Bouziani, R. Yaagoubi, I. Sebari, K. Sebari, and L. Kenny, "Towards Smart Irrigation: A Literature Review on the Use of Geospatial Technologies and Machine Learning in the Management of Water Resources in Arboriculture," *Agronomy*, vol. 12, no. 2, Art. no. 2, Feb. 2022, doi: 10.3390/agronomy12020297.

[2] O. Elijah, T. A. Rahman, I. Orikumhi, C. Y. Leow, and M. N. Hindia, "An Overview of Internet of Things (IoT) and Data Analytics in Agriculture: Benefits and Challenges," *IEEE Internet Things J.*, vol. 5, no. 5, pp. 3758–3773, Oct. 2018, doi: 10.1109/JIOT.2018.2844296.

[3] K. Obaideen *et al.*, "An overview of smart irrigation systems using IoT," *Energy Nexus*, vol. 7, p. 100124, Sep. 2022, doi: 10.1016/j.nexus.2022.100124.

[4] M. S. Munir, I. S. Bajwa, and S. M. Cheema, "An intelligent and secure smart watering system using fuzzy

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Association Rules for Understanding Consumer Behavior: A Comparative Analysis

Communication Info

Authors:

Mohamed MEFTAH¹
Soumaya OUNACER¹
Mohamed AZZOUAZI¹

¹Laboratory of Information
Technology and Modeling,
Hassan II University, Faculty of
sciences Ben M'sik, Casablanca,
Morocco

Keywords:

- (1) Association Rules
- (2) Data Mining
- (3) Consumer Behavior
- (4) Merchandising

Abstract

Association rules methodology, introduced by Agrawal and Srikant [1], is a powerful tool for identifying hidden associations between multiple variables stored in large databases. Han et al. [2] have also contributed significantly to the development of this approach. In recent years, association rule mining has gained considerable attention in the field of data mining, particularly in understanding consumer behavior [3-4]. Several studies have been conducted to compare various algorithms and determine the most effective approach for extracting valuable insights from these datasets [4-5]. Researchers and practitioners can benefit from these studies to drive effective decision-making using association rules. The analysis aims to contribute to a better understanding of the role that association rules can play in data mining and to offer insights that can guide future research endeavors.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Agrawal, R., & Srikant, R. Fast algorithms for mining association rules in large databases. In Proceedings of the 20th International Conference on Very Large Data Bases, pp. (1994) 487-499.
- [2] Cho, Y. S., & Kim, H. J. Analyzing the relationship between brand awareness and consumer decision-making using association rule mining. *Journal of Open Innovation: Technology, Market, and Complexity*, 4(4), (2018) 56.
- [3] Liu, B. Sentiment analysis and opinion mining. *Synthesis Lectures on Human Language Technologies*, 5(1), (2012) 1-167.
- [4] Cheung, W. K., Kwok, J. T., & Law, M. H. A comparative study of the Apriori and FP-growth algorithms. In Proceedings of the Sixth ACM SIGKDD International Conference on Knowledge Discovery and Data Mining, pp. (2000) 59-68.
- [5] Wang, J., & Yang, J. A comparative study of data mining algorithms for consumer credit risk assessment. *Journal of Systems Science and Information*, 5(2), (2017) 178-187.

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Detection and Diagnosis of Leaf Diseases in Plants

Communication Info

Authors:

¹FANDI Fatima Zahra
²GHAZOUANI Mohamed
³AZZOUAZI Mohamed

¹FSBM, Hassan II University of
Casablanca, Casablanca,
Morocco

²FSBM, Hassan II University of
Casablanca, Casablanca,
Morocco

³FSBM, Hassan II University of
Casablanca, Casablanca,
Morocco

Keywords:

- (1) IOT
- (2) Agriculture
- (3) CNN
- (5) Semantic segmentation.

Abstract

The world population is anticipated to increase to 9 billion people by 2050. Because it achieves two key goals—increasing crop yields and lowering the use of pesticides—plant disease identification has recently gained a lot of interest in smart agriculture. To prevent the development of illnesses in plantations, which can have extremely high costs in terms of time and money, it is essential to identify questionable plants as soon as possible. The majority of plant diseases have observable symptoms, and it is now generally believed that an expert plant pathologist can identify a disease by visually inspecting affected plants.

This subject is an appropriate area application for computer-assisted research because 1) the process of disease diagnosis is slow to complete manually, 2) some plant diseases have no apparent symptoms, 3) and the effectiveness of the diagnosis is proportional to the ability of the pathologist. Advanced analytical techniques will be used in diagnostic systems for various disorders. Artificial intelligence (AI) is a key role in this situation since it makes it possible to realize new kinds of systems and adds intelligence to the identification of plant illnesses. SLR discusses the current state of the art and suggests exciting new directions for identifying plant diseases and classifying species from photos. For use in computing and agriculture, image identification and classification of damaged leaf species.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] Abbas, Amreen, Sweta Jain, Mahesh Gour, and Swetha Vankudothu. "Tomato Plant Disease Detection Using Transfer Learning with C-GAN Synthetic Images." *Computers and Electronics in Agriculture* 187 (August 2021).
- Ashwinkumar, S., S. Rajagopal, V. Manimaran, and B. Jegajothi. "Automated Plant Leaf Disease Detection and Classification Using Optimal MobileNet Based Convolutional Neural Networks." *Materials Today: Proceedings* 51 (2022).
- [2] Bedi, Punam, and Pushkar Gole. "Plant Disease Detection Using Hybrid Model Based on Convolutional Autoencoder and Convolutional Neural Network." *Artificial Intelligence in Agriculture* 5 (2021).
- Shravan, Vemishetti, K. Swaraj, K. Meenakshi, and Padmavathi Kora. "A Deep Learning Based Crop Disease Classification Using Transfer Learning." *Materials Today: Proceedings*, February 2021.
- Sharma, Parul, Yash Paul Singh Berwal, and Wiqas Ghai. "Performance Analysis of Deep Learning CNN Models for Disease Detection in Plants Using Image Segmentation." *Information Processing in Agriculture* 7, no. 4 (December 2020).

ICRAMCS 2023

THE FIFTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
March 16-17-18, 2023 | Casablanca, Morocco



Big Data : Graphes, Web et Sécurité des données

Communication Info

Authors:

Khalil NAMIR¹
El Habib BENLAHMAR²

¹LTIM, University of Hassan II-
FSBM, Casablanca, MAROC

²LTIM, University of Hassan II-
FSBM, Casablanca, MAROC

Keywords :

- (1) Algorithme
- (2) Big Data
- (3) Données
- (4) Fraude
- (5) Graphe
- (6) Neo4j
- (7) Sécurité
- (8) Volume
- (9) Temps réel
- (10) PHP5

Abstract

Face à l'explosion du volume des données, il est devenu primordial pour les entreprises de mettre en place de nouveaux outils pour permettre de détecter en temps réel les changements afin de prendre les meilleures décisions possibles. L'objectif principal de ce travail est de proposer un algorithme ainsi qu'une application web basée sur les graphes dont le but ultime est de sécuriser les données et de détecter les fraudes au sein de l'entreprise.

C'est dans cet esprit où se situe ce travail qui consiste à donner une vision claire et nette sur l'utilité du Big Data, et son apport avec la sécurité des données en proposant un algorithme ainsi qu'une application web permettant de détecter les fraudes et permettre au décideur de réagir. On va utiliser les nouveaux outils informatiques tels que ; la base de données orientée graphe Neo4j et le langage de scripting PHP et JavaScript.

© ICRAMCS 2023 Proceedings ISSN: 2605-7700

References

- [1] David Floyer « Enterprise Big-data »
- [2] « Big Data : Opportunités et problèmes de sécurité » - études Forrester
- [3] « Les 3 V du Big Data : Volume, Vitesse et Variété » - Gérard Clech
- [4] « Hadoop : une histoire vieille de dix ans » - Vincent Berdot
- [5] « NoSQL : un mouvement qui prend de l'ampleur » - Nicolas Martignole
- [6] Les graphes Alchemy: <https://github.com/GraphAlchemist>
- [7] Théorie des graphes : http://blog.christophelebot.fr/wp-content/uploads/2007/03/theorie_graphes.pdf
- [8] <http://graphalchemist.github.io/Alchemy/#/examples>
- [9] « Présentation sur les Big Data » - Xavier Dalloz
- [10] « Le phénomène des big data touche toutes les entreprises » - Claude Bernard