BİRUNİ UNIVERSITY

12th INTERNATIONAL CONFERENCE ON APPLIED ANALYSIS AND MATHEMATICAL MODELING (ICAAMM24)

Abstract Book

July 19-23, 2024,

Istanbul-Turkey

Abstracts Book

Editors
Mustafa Bayram
Aydın Seçer

12th INTERNATIONAL CONFERENCE ON APPLIED ANALYSIS AND MATHEMATICAL MODELING (ICAAMM24) Abstract Book, July 19-23, 2024, Istanbul-Turkey

Abstracts Book

Prof. Dr. Mustafa Bayram
Prof. Dr. Aydın Seçer

.

Participant Statistics

230 participants from 29 different countries attended the conference, 28 of them from Turkey and the others from abroad, so 88% participants are foreigners and 12% participants are Turkish.

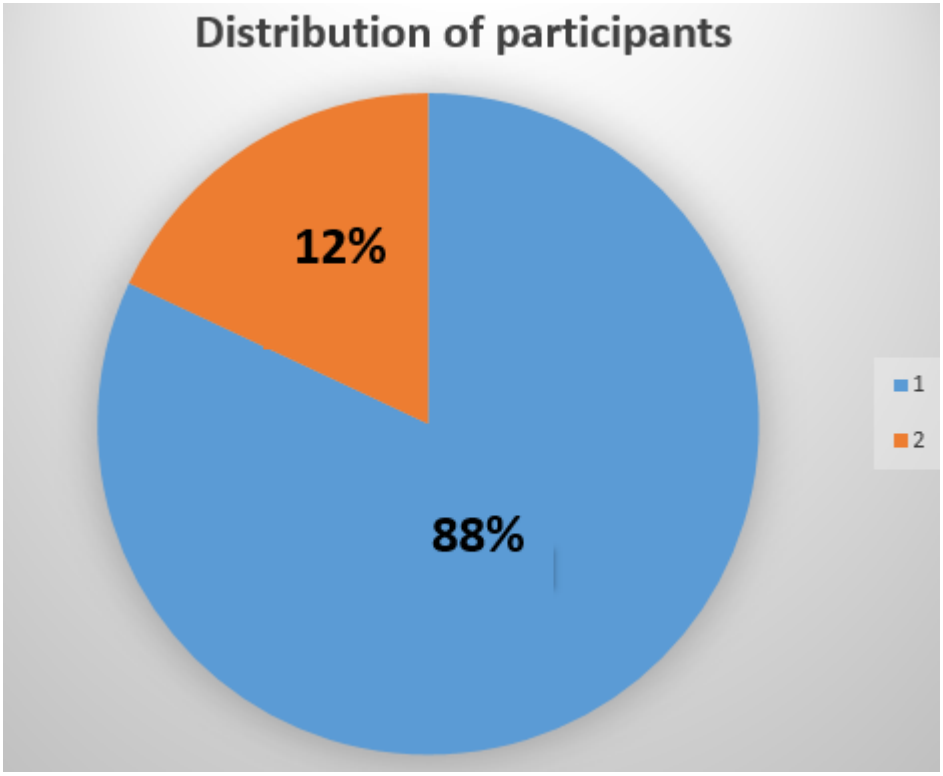

Figure 1: 1. Foreign participants, 2. Turkish participants

Contents

Analysis of Fractal, Fractional and Conformable Derivatives and Integral Transforms **22**
Ali Akgul 22

Possible breakthrough in fractional order modeling of epidemiological systems **23**
Carla Pinto 23

Parametrized Trigonometric derived Lp degree of approximation by various smooth singular integral operators **24**
George A. Anastassiou 24

Investigating the dynamical behavior of systems with a positive maximal Lyapunov Characteristic Exponent near zero **25**
Maaita Jamal Odysseas 25

Cardinal basis functions for fractional problems involving the Hadamard derivative **26**
Mohammad Hossein Heydari 26

Mathematical Modeling, Stochastic Processes and Computational Complexity in Precision Medicine: Medical and Clinical-related Applications with Fractional Calculus Operators, Bloch Torrey Partial Differential Equation, Hidden Markov and Artificial Intelligence **27**
Yeliz Karaca 27

Iterative processes for nonlinear problems: from Newton to nowadays **29**
Alicia Cordero[1] and Juan R. Torregrosa[2] 29

Stability analysis and optimal control of variable-order fractional covid-19 dynamic discrete model **30**
Amar Debbouche 30

What is a generalized fractional operator? **31**
Dumitru Baleanu 31

Some Basic Properties of Harmonic Functions Defined by the Salagean Operator **32**
Serkan Çakmak 32

Image denoising by anistropic nonlinear model and deep neural network architecture **33**
Khadija Bouzaachane[1] and El mahdi EL Guarmah[2] 33

Transformers for aircraft emergency landing sites semantic segmentation **34**
Adil Illi [1], Khadija Bouzaachane [1], Salah El Hadaj [1], El Mahdi El Guarmah [2] 34

Optimization of Path Loss Models in Urban Areas Using 4G-LTE Networks **36**
A. Khiredine[1*], S. Zitouni[2**] 36

Finite difference implicit scheme for diagonal non-conservative hyperbolic systems **37**
Rachida Boudjerada 37

Existence results for p(t)-Laplacian fractional differential equations **38**
Assia Guezane Lakoud and Rabah Khaldi 38

Fractional neutral differential equations involving $(k,\psi)-$Hilfer fractional derivative and control: Complete controllability exploration **39**
Kerboua Mourad 39

Packing chromatic number for certain classes of graphs **40**
Rachid Lemdani 40

Numerical development for an integro-diffirential equation depending in acceleration trem **41**
Segni Sami 41

An intelligent conditional integrator sliding mode controller for a two-degree-of-freedom robotic arm **42**
Abdelkader Kerraci, Mohamed Fayçal Khelfi and Ahmed-Foitih Zoubir 42

Enhanced Restarting PINN with Functional Link Artificial Neural Network on the Solution of Thermal Partial Differential Equation **43**
Maharani A. Bakar and Danang A. Pratama 43

Some new results on the coalition number **44**
Noureddine Ikhlef Eschouf 44

On independent [1,k]-set in graphs **45**
Ahmed Bouchou 45

Analytical and Computational aspects on an Unreliable Retrial Queue with Two Distinct Customer Types **46**
Mohamed Boualem, Nasreddine Dehamnia, and Djamil Aïssani 46

Combination of approximation and statistical methods for the ruin probability assessment in risk models **47**
Aicha Bareche and Zineb Harfouche 47

Solvability of a fractional boundary value problem involving Riesz fractional derivative **48**
Rabah Khaldi and Assia Guezane-Lakoud 48

Optimizing a linear Fractional function over an integer efficient set of a Multi-Objective Linear Program **49**
Younsi Née Abbaci Leila 49

Optimal Embedding of some new classes of Balanced Binary Trees in Hypercube **50**
Kamal Kabyl 50

Modeling and fuzzy logic based nonlinear control of three-level grid-connected PV system with active filter functionality **51**
Gouraya Benadjaoud, Kassa Idjdarene[1], Hocine Amimeur, Farid Hamoudi, Brahim Deffaf[2] 51

Using least-squares adjustments to analyse nuclear data from AME2020 **52**
Djelloul Benzaid, Salaheddine Bentridi, Abdelkader Kerraci, Naima Amrani 52

Enhancing the Remaining Useful Life Prediction of Lithium-Ion Batteries Using Deep Learning Approaches **53**
Tahar Boukra and bilel Ayachi 53

Existence results for a strongly nonlinear elliptic system in Sobolev spaces with variable exponent **54**
Samira Lecheheb 54

A Method for Solving a Multicriteria Bilinear Game **55**
Noureddine Khimoum 55

An Efficient Simplex Algorithm for Training SVM Classification Problems **56**
Belkacem Brahmi 56

An inverse problem of determining a time-dependent coefficient in a time-fractional reaction-diffusion equation with involution and periodic boundary conditions **57**
Brahim Nouiri, Salaheddine Lamine 57

On the existence of the Berge equilibrium in the non-cooperative Bayesian game **58**
Karima Bouibed and Aicha Anzi 58

A New Complex Number Definition: Distinct Imaginary Numbers **59**
Mehmet Pakdemirli 59

Estimation of the regression function using the asymmetric kernel method **60**
Lamia Djerroud 60

Augmented truncation approximations of discrete-time Markov chains **61**
Badredine Issaadi 61

Econometric modeling of olive oil production in Bejaia from 2000 to 2021 **62**
Kheira Mecheri[1*], Djamila Zirem [2**] 62

Reliability analysis of the unreliable server and impatient customers **63**
Djamila Zirem[1], Kheira Mecheri[2] 63

Boundary control of a viscoelastic flexible marine riser with nonlinear Terms **64**
L. Seghour, N.-e. Tatar and A. Berkani 64

Mann's stochastic approach for estimating parameters of the Black-Scholes model **66**
Baya Takhedmit[1*], Massissa Soufit[2**] 66

A Parametric Uncertainty Analysis Based on Bayesian Approach **67**
Katia Bachi and Karim Abbas 67

Bimodal Biometric Identification Based on the Fusion of Finger Veins and Finger Knuckle Print **68**
Youcef Brik [1*], Bilal Attallah[2**] 68

Stochastic analysis of GI/M/s queue with negative arrivals **69**
Louiza Berdjoudj 69

Stability and Almost-Periodic Solutions Of Beams Networks with Structural Damping **70**
Ahmed Bchatnia[1],Amina Boukhatem[2] 70

Investigating the Dynamics of Positive Solutions of a Three-Dimensional System of Difference Equations with rational terms **71**
Zabat Hiba[(1,a)], Dekkar Imane [(1,b)], Touafek Nouressadat[(1,c)], Durhasan Turgut Tollu [(2,d)] 71

Preservation of homoclinic orbits after discretization in a degenerate system **72**
Nadia Mohdeb 72

The boundary value problem concerns a weighted fractional derivative involving a function of variable order **73**
Ridha Dida . . . 73

Sensitivity analysis in genetic network models **74**
Massinissa Soufit, Baya Takhedmit and Karim Abbas . . . 74

The Autohomeomorphism Groups of Some Digital Lines **75**
Othman Echi . . . 75

Finite Rings and Error Correcting Codes **77**
Aicha Batoul . . . 77

On the multiplicity of non radial solutions for fractional p-Laplacian problems **78**
Noria Bekkouche [1*], Fatima Dib[2**] ,Daoudi-Merzagui [3***] . . . 78

A multi-server queue in a multi-phase random environment with waiting servers and customers' impatience under synchronous working vacation policy **79**
Houalef Meriem[*] . . . 79
Amina Angelika Bouchentouf . . . 79

A second order BVP with time depending operator on the whole-line **80**
Samira Zahar . . . 80

Euler Bernoulli beam equation with two boundary fractional fedbacks **81**
Fatiha Chouaou and Hamra Mohammed Amin . . . 81

Euler Bernoulli beam equation with two boundary fractional fedbacks **82**
Fatiha Chouaou and Hamra Mohammed Amin . . . 82

Strategic Pricing for Hazelnut Producers: MN-Method and Linear Programming Approaches **83**
Melike Muntaş [1*], Burhaneddin İzgi [2**] . . . 83

Average Solutions of Differential Equations Containing Fractional Derivatives of Orders Governed by Probability Distributions with Bounded Support **84**
Zafer Bekiryazici . . . 84

Soliton Dynamics in the Perturbed Dispersive Nonlinear Schrödinger Equation with Multiplicative White Noise by the F–Expansion Method **85**
Yakup Yıldırım [1,2,3] . . . 85

Dark and Singular Soliton Solutions in Perturbed Fokas–Lenells Equation with Nonlinear Chromatic Dispersion and Quadratic Self-Phase Modulation **86**
Şebnem Gökdeniz Sıvakcı [1,*], Yakup Yıldırım [2], Aydin Seçer [1] . . . 86

Qualitative Analysis for Nonlinear Fractional Difference Equations **87**
Hakan Adiguzel . . . 87

Application of Wavelet-Galerkin Approximation Techniques on the Partial Differential Equations via Maple **88**
Tugcem Partal and Mustafa Bayram . . . 88

Derivation of optical solitons of dimensionless resonant nonlinear Schrödinger equation with the Kudryashov's law **89**
Selvi Altun Durmus, Aydin Secer, Muslum Ozisik, Mustafa Bayram 89

Revealing optical soliton solutions of the perturbed Schrödinger-Hirota equation with generalized anti-cubic law of nonlinearity **90**
Ismail Onder[1], Aydin Secer[1,2], Muslum Ozisik[1] and Mustafa Bayram[2,*] 90

Producing soliton solutions for the nonlinear complex Ginzburg-Landau model including generalized quadratic-cubic law nonlinearity and chromatic dispersion **91**
Handenur Esen[1], Aydin Secer[1,2], Muslum Ozisik[1], Mustafa Bayram[2] 91

Introduction of a model describing two zones with an interface **92**
Nabahats DIB and Tewfik Mahdjoub 92

Solving the Generalized Chavy-Waddy–Kolokolnikov Model: Analytical Approaches to Bacterial Colonies **93**
Melih Cinar[a,] 93

How to Treat Gene Expression Data for Mathematical Modelling in Dynamical Sense **94**
Ozlem Defterli 94

Travelling Wave Solutions of the Benney-Roskes/Zakharov-Rubenchik System **95**
Mehmet Fatih Ucar 95

Stochastic Analysis with Zili's Generalized fractional Brownian motion **96**
Mounir Zili 96

The Qualitative Properties of Integro-Delay Differential Equations **97**
Osman Tunç 97

Flood Modeling Using Spatial Pair-Copula Construction **98**
[a,*]Izzat Fakhruddin Kamaruzaman , Wan Zawiah Wan Zin [b] and Noratiqah Mohd Ariff [b] 98

Fractional order of differential inclusions with lipschitz perturbations of an inverse strongly monotone and maximal monotone operators **100**
[1] Aicha Ouali, Abdallah Beddani and [2] Yamina Miloudi 100

Advanced Control Strategies and Energy Optimization for Hybrid Energy Storage in Electrified Vehicles **101**
Zahra Mokrani, Djamila Rekioua, Adel Oubelaid, Khoudir Kakouche , Toufik Rekioua, Chafiaa Serir, Talit Belhoul and Radia Abdelli 101

Mathematical Methods Safety Barrier Performance Assessment **102**
Hamaidi Brahim [1] and Taibi Hicham[2] 102
Sara Hassoul and Salah Menouar 103

Parallel Active Filter Analysis, Control, and Diagnosis **104**
Benyettou Loutfi, Rahali Hilal and Zeghlache Samir 104

Comparative Analysis between Adaptive type-1 Fuzzy Field-Oriented Control and hybrid Sliding Mode-Backstepping Control of a Double Star Induction Machine (DSIM) **105**
Rahali Hilal, Bilal Djamal Eddine Cherif, Zeghlache Samir and Benyettou Loutfi 105

Artificial Intelligence-Based Mathematical Analysis for Coupled Differential System Subject to Circular Obstacle in Corrugated Backward Facing Step **106**
Khalil Ur Rehman [1,*] and Wasfi Shatanawi [1] 106

Mathematical modeling of organism swimming through rough inclined passage **107**
Zeeshan Asghar and Wasfi Shatanawi 107

Biological effects and chemical characterization of Ilex aquifolium L. extracts: A new source of bioactive constituents **108**
A ldjia Hadroug[1,*] and Rachid Belhattab[2] 108

Fractional Order Moment Parameter Estimator of Compound-Gaussian Clutter with Nakagami-Distributed Textures **109**
Izzeddine Chalabi and Maroua Louglaib 109

Structural, elastic, vibrational and thermal properties of quaternary Lithium based Alloys **110**
Badis Bennecer*, Nassima Guechi and Saliha Karfaf 110

Study of the influence of cutting parameters on technological parameters in the turning process of titanium alloy **111**
Nabil Kribes1, Younes Belbellaa1 , Khaoula Abbed, Smail Boutabba1 111

Fractional Order Moment Parameter Estimator of Compound-Gaussian Clutter with Nakagami-Distributed Textures **112**
Izzeddine Chalabi and Maroua Louglaib 112

Correlations between the Nusslet and the Reynolds Numbers: a Statistical Approach Ahsene Lanani and Rahima Benchabi **113**
Ahsene Lanani[1] and Rahima Benchabi [2] 113

Long-Term Dynamics of the Wave Equation under Mixed Boundary Conditions **114**
Karima Laoubi 114

DFT calculations of two azo-palladium (II) complexes **115**
Meriem Lmmouchi[1] and Souheyla Chetioui[2,3] 115

Some particular nonlinear partial differential equations solution by the Adomian and modified decompositions methods **116**
Naima Meskine 116

Physical Properties of Mg-doped Co_3O_4 Nanocrystalline Thin Films Elaborated Using Spray Pyrolysis **117**
Warda Darenfad[1], Noubeil Guermat[2,3], Kamel Mirouh[1], Younes Nezzari[1] and Rayene Merah[1] 117

Impact of Fluorine Doping on the Structural, Optical and Electrical Characteristics of Spray Deposited SnO2 Thin Films **118**
Noubeil Guermat[1,2],Warda Darenfad [3], Kamel Mirouh [3] and Azzedine Bellel[2] 118

Study of the behaviour of a hydrodynamic contact using the homogenization method **119**
Mouassa Ahcène, Lahmar Mustapha, Boucherit Hamid and Ellagoune Salah 119

An Efficient Numerical Solution for Nonlinear Poro-Elasto-Hydrodynamic (PEHD) Lubrication Problem in Dynamically Loaded Journal Bearings Lubricated with Nanofluids **120**
Mustapha Lahmar[1], Reda Hamel[1], Hamid Boucherit[1], Ahcene Mouassa[1], and Benyebka Bou-Saïd[2] and [2] 120

Periodic-Soliton Solutions by a New Perspective **121**
Ömer Ünsal 121

Explicit Formulas for Algebraic and Non-Algebraic Limit Cycles of a Family of Planar Differential Systems **122**
Rachid Boukoucha 122

Application of Response Surface Methodology for Parametric Optimization of Natural Convection in Trapezoidal Cavity containing Hybrid Nanofluid **123**
Norihan Md Arifin[1], Mohd. Shafie Mustafa[1], Muhamad Hasif Mohd Hashim[1], Aniza Ab Ghani[1] and Ahmad Nazri Mohamad Som[2] 123

Effect of natural and artificial aging on the mechanical properties of high density polyethylene HDPE 100 **124**
Ahmed Belbah[1], Naouri Ladaci[1], Ouarda Kirati[2] 124

First Principales Calculations of the Electronic, Magnetic, and Elastic Properties of FeVYSb (Y= Sc, Y) Heusler Alloys **125**
I. Bensehil[1,2*],H. Baaziz[3,4],A. Kolli[2], T. Ghellab[3,4],Z. Charifi[3,4] 125

Enhancement Multi-interest U-Net for Medical Image Segmentation **126**
Lahouaoui Lalaoui and Zohra Zerdoumi 126

Refined descriptive sampling with dependent variables **127**
Kebaili Siham 127

Soliton Solutions and modulation instability analysis of the Lakshmanan–Porsezian–Daniel equation in the presence of parabolic law **128**
Neslihan Ozdemir and Sinan Perktas 128

DFT calculations of two azo-palladium (II) complexes **129**
Meriem Lmmouchi[1] and Souheyla Chetioui[2,3] 129

Analysis of the structure and behaviour of odonate populations in a number of wetlands likely to be impacted by thermal springs in the Bejaia region (north-central Algeria). **130**
Abdelmadjid Chelli and Salhi Kelthoum 130

Study of Spatial Conformation of Anomeric Xylose Esters by Density Functional Theory **131**
Chahra Bidjou-Haiour* 131

Thermal performance enhancement of LHTES using enhanced PCMs with fins **132**
Ghulam Rasool 132

Application of the Maud program to monitor the microstructural evolution of nanosized Cr50Ni50 alloy **133**
L. Dekhil[1] , N. Hanneche[2], M. Fellah[3], M. Bououdina [4] 133

Modeling of discharge currents and dielectric losses in electrically aged cable insulation by filamentary trees **134**
Nacéra Rouha and Aissa Saiche 134

Statistical analysis of COVID-19 Monthly Pandemic Evolution in Algeria **135**
Zohra Chekroud∗, Salim Heddam, Nadjah Khannat and Bouchra Khalfaoui 135

Dynamic insights into vitamin E and cholesterol encapsulation for enhanced ovine sperm cryopreservation: A semi-empirical modelization approach **136**
Sofiane Fatmi[*,1,2,3], Lamia Taouzinet[1,2,4], Zahra Toutou[1,2], Mohamed Skiba[3] and Mokrane Iguerouada[1,2] 136

Statistical Analysis of Wear in Contaminated Dry Rolling Contacts **138**
Abdelhakim Djalab, Mohamed Rafik Sari 138

Oscillatory Solutions of a new Class of Fredhom Type Integrodifferential Equations **139**
Farouk Chérif and Salsabil Hajjaj 139

High Gain Reconfigurable Trapezoidal Patch Antenna On Thick YIG Substrate **140**
Linda Djouablia, and Aziza Zermane 140

Mathematical Modeling and an Adaptive PID Control of Quadrotor **141**
Abderrahmen Bouguerra[1], Keltoum Loukal[1], Samir Zeghlache[2] 141

Modeling and interval type 2 fuzzy logic controller of manipulator robot **142**
Keltoum Loukal[1] , Abderrahmen Bouguerra[1] and Samir Zeghlache[2] 142

Approximation method for performance analysis of a retrial queuing system with collisions and transmission errors for wireless networks **143**
Lamia Lakaour[1], Karima Adel-Aissanou[1], Djamil Aïssani[1], Amel Boulahouad[1], Nadia Hani[1] 143

Stochastic Modelling of Rumour Spreading with the Adjusting Control Mechanism Attitude in Homogeneous Network **144**
Norhayati Rosli[1], Muhammad Fahmi Ahmad Zuber[1], Hamdi Agustin[2], Lo Hai Hiung[3], Imelda Atastina[4] 144

Statistical Optimization of Culture Media of Lipolytic Enzyme from a Thermophilic Actinomycete Isolated from Local Poultry Compost **145**
Fatiha Benamia[1,*], Noura Semache[1], Selma Bounour, Mohammed Lotfi Souici[1], and Ali Ladjama[2] . . . 145

Predicting Stock Volatility: Machine Learning versus Classical Approaches **146**
Nassim Touche and Aicha Anzi 146

Thermal properties of $Fe_{0.6}Al_{1-x}Co_x$ alloys in Magnetic Induction Melted **147**
Abdelhak Fekrache[1], Mohamed Yacine Debili[2], and Salim boulkhessaim[3] 147

Investigating an algorithmic solution for a two person game problem **148**
Aicha Anzi and Karima Bouibed 148

Abamectin induced renal injuries and the protective effect of Ajuga iva in domestic pigeon (Columba livia domestica) **149**
Souheila Slimani 149

Application of Artificial Neural Networks (ANN) and Response Surface Method (RSM) for enhancing the Immobilization Conditions for Lipase on Ion-Exchange Resin **150**
Fatiha Benamia[1,*], Samah Bouchagra[1,2], Noura Semache[1], Selma Bounour[1] 150

Crystal Structure and Hirshfeld Surface Analysis of E-1-(3-nitrophenylazo)-2-naphtol **151**
Mohamed Amine Benaouida[1,2] and Ali Benosmane[2,3] 151

Analysis of Sub-Synchronous Resonance in a wind farm with Thyristor-controlled series capacitor **152**
Rayane Leulmi and Salima Lekhchine and Ammar Medoued 152

Maximizing Efficiency: Simulation-Based Modeling of Hybrid Power Systems with MPPT Technology 153
Manal Toumi and Omar Boudebbouz 153

Sub-synchronous oscillation in a wind park with series compensation 154
[1]Lekhchine Salima and Bahi Tahar[2] , Leulmi Rayane[3] 154

Nonlinear Wavelet Estimators of Spatially varying coefficients 155
Karima Kimouche 155

The role of modeling with statistical structural equations in psychology 156
Awatif Bouguerra [1] and Halima Bouguerra [2] 156

A Numerical Study of Mixed Convection Ternary Hybrid Nanofluid Flow in a Duct Subjected to a Fluctuating Temperature 157
Aicha Bouhezza[1] and Ammar Laichi[2] 157

Modeling of fatigue crack growth by special mathematical function: Exponential function 158
Mustapha Benachour, Nadjia Benachour, F.Z. Seriari 158

Maintenance efficiency assessment in virtual age reduction models 159
Radouane Laggoune and El Hassene Ait Mokhtar and Farid Zeffane 159

Study of The Impact of Lubricating Oil Additives on The Reduction The Effects of Solid Pollution on The Stability of The Rotor-Bearing System 160
Hamid Boucherit, Mustapha Lahmar, Mouassa Ahcene 160

Application of Three Exact Solution Methods on the (3+1)-dimensional Boiti-Leon-Manna-Pempinelli Equation 161
Tugba Aydemir 161

A Review of Stochastic Population Dynamics Models 162
Lallouche Abdallah 162

Access to valuable building blocks by the regio-and enantioselective ring opening of itaconic anhydride by lipase catalysis 163
Nabila Braia, F.Z. Smaine and M. Merabet-Khelassi 163

Study and tribological analysis of the mechanical behavior of a hydrodynamic bearing 164
Soumia Teyar, Hassina Gheribi 164

Study of the tribological behavior of a plain bearing 165
Gheribi Hassina, Teyar Soumia 165

Study and analysis of diesel engine performance 166
C. Boubechou1, A. Bouchoucha2, H. Zaidi3 166

Data analysis of the contribution of the spark plasma sintering (SPS) technique into the optimization of the mechanical properties of certain titanium alloys 167
Settouti Nadera and Liani Bachir 167

Modeling Wheat Evapotranspiration in Semi-Arid Regions Using Satellite Remote Sensing 168
Tarek Bouregaa 168

On the solutions of an abstract system of difference equations **169**
Imane Dekkar 169

Influence of glass addition on the crystallization kinetics of spinel in porcelain insulators prepared from economic raw materials **170**
Hocine Belhouchet 170

Synthesis and characterization of GNP/Fe3O4 catalyst: Application for the removal of Crystal Violet dye **171**
Hassan Ayadia[1,2], Mohamed Amine Benaouida[1,2], Issam Boudraa[2,3], and Sabrina Halladja[1,4] 171

Some classical theorems of factorizations in the sublinear case **172**
Tiaiba Abdelmoumen 172

Computational studies of Electronic, optical and elastic properties of half-Heusler SrMgA (A= Si, Sn) Compounds for optoelectronic applications **173**
S. Djellab[1,2], L. Tairi[1,3], S. Ghemid[1], H Meradji[1] 173

Smart control of photovoltaic system with batteries in a standalone area **174**
Djamila Rekioua[1], Saloua Belaid[1], Toufik Rekioua[1], Pierre Olivier Logerais[2], Zahra mokrani[1], Adel Oubelaid[1], and Khoudir Kakouche[1] 174

The effect of Covid-19 vaccination on case and mortality rates in Türkiye **175**
Perihan Oya Şengül and Derya Tan 175

Multi-criteria Decision Support for Intelligent Management of Traffic Lights in an Isolated Intersection **176**
F. Rahmoune, S. Larbi and M.S. Radjef 176

Comparison study of two FTCs strategies for double stator induction machines **177**
Toufik Roubache[1,2] 177

Diagnostic of Dual stator winding Induction machine (DSWIM) Based on Mechanical Signatures of Stray Magnetic Flux **178**
Assam Zorig[1], Noureddine. Hamouda[2] ,Khaled Belhouchet[1] Badreddine Babes[2] and Abdelhamid Rabhi[3] 178

Multi-coupled circuit modelling to study generator's defects impacts on the power quality in wind energy conversion systems connected to the grid **179**
Radia Abdelli, Ahcene Bouzida, Chafia Serir, Zahra Mokrani, Djamila Rekioua, Talit Belhoul 179

Mathematical model of a solar photovoltaic system optimized by artificial neural networks **180**
Chafiaa Serir[1], Samia Bensmail[2], Djamila Rekioua[1],Talit Belhoul[3], Zahra Mokrani[1] and Radia Abdelli[1] 180

Eco-friendly synthesis of bi-phase iron oxide nanoparticles: Effect of Geranium Rosat plant extract concentration and their antibacterial activity **181**
Smail Boudjadar[1,2], Leila Boumaza[1], Ouidad Abdelaziz[3] 181

Ecological synthesis of copper oxides nanoparticles using Geranium Rosat leaf extract and their antibacterial activity **182**
Leila Boumaza[1], Ouidad Abdelaziz [3], Smail Boudjadar[1], 2 182

Generalization of the Method Based on Parameterization Developed for Solving Integer Linear Programming Problems **183**
Kadriye Şimşek Alan 183

Some Notes on Oscillatory Solutions of Fractional Differential Equations **184**
Aydin Secer[1], Mustafa Bayram[2], Engin Can[3], Hakan Adiguzel[3] 184

A Novel and Efficient Method for Integer Linear Programming Problems **185**
Kadriye Şimşek Alan 185

Synthesis, structural analysis of new trans-Pd(O,N)2 complex derived from hydroxo-diazenyl-benzoate azo-ligand **186**
Souheyla Chetioui[1,2,*], Sihem Menassel[1,3], Ilhem Bensehil[1,4] 186

DFT study of (E)-1-(4-Fluorophenyl)-2-(2-oxidonaphthalen-1- yl) diazenium **187**
Nabila Benabila[1,*], Chetioui Souheyla[1,2], Hafida Merouani[3,4] 187

Gaussian-Hybrid Numbers Obtained from Jacobsthal and Jacobsthal-Lucas Numbers **188**
Merve Taştan Tekin 188

Biological effects and chemical characterization of Ilex aquifolium L. extracts: A new source of bioactive constituents **189**
A ldjia Hadroug[1,*] and Rachid Belhattab[2] 189

A Numerical Study of Forced Vibration Analysis of Sandwich Plates with Viscoelastic Core in the Thermal Environment Subjected to Moving Load **190**
Tekili Sabiha, Mokas Nacer, Karmi Yacine and Khadri Youcef 190

Nonlinear Dynamic Analysis of PCLD Sandwich Beams in the Thermal Environment with Frequency and Temperature Dependent Viscoelastic Cores **191**
Khadri Youcef, Tekili Sabiha, Karmi Yacine and Mokas Nacef 191

Application of 3D Decision Criteria for the Selection of an Ally **192**
Murat Özkaya[1,2*], Yücel Baştan[3**], Burhaneddin İzgi[1***] 192

A Matrix Norm-Based Solution for Zero Sum Fuzzy Matrix Games: Fuzzy Matrix Norm Method **193**
Burhaneddin İzgi[1*], Hale Gonce Köçken[2**], Murat Özkaya[1,3***], ... 193

Statistical modelling of the effect of cutting parameters on the roughness of the machined surface when drilling C22 steel in the annealed and hardened state **194**
Mokas Nacer, Abidi Youcef, Tekili Sabaha 194

Bending and free vibration analysis of functionally graded carbon nanotube-reinforced composite beams by finite element method (FEM) **195**
Sabiha Tekili, Nacer Mokas and Youcef Khadri 195

The importance of statistical tools for understanding the smoking behaviour of Algerian smokers: a decision-making aid for the effectiveness of tobacco control measures **196**
Nabila Kendi and Younes Hidra 196

Extraction Process of Algerian Rosmarinus Officinalis L. Essential Oil by Hydrodistillation-Statistical Approach **198**
Sarra Guilane, Ouarda Moumeni, Chaima Labadlia and Mohamed Hichem Ben Zaim 198

Contribution to the Application of Condition Maintenance for Followed and Diagnostic Of a Rotating Machine **199**
Tamaloussi Naima, Benzaid Lamia, Azzez Zina, Bouzaouit Azzedine 199

Using Calculus of Variations to Mathematically Model a Durable Tent Design **200**
Using Calculus of Variations to Mathematically Model a Durable Tent Design 200

Comparison of software tools for calculating maximum tsunami wave heights **202**
Mikhail Lavrentiev[1,2] and Andrey Marchuk[1,3] and Konstantin Oblaukhov[1] and Mikhail Shadrin[1] 202

Transoceanic tsunami modeling on a 1-minute grid **203**
Mikhail Lavrentiev[1,2] and Konstantin Lysakov[1,3] and Andrey Marchuk[1,4] and Konstantin Oblaukhov[1,3] 203

Realizing Multiple Optical Bifurcation using a Micoring Resonator with Triple-Coupler **204**
Mahdi Bahadoran[1*], Faezeh Pakfetrat[1], Ahmad Fakhrurrazi Ahmad Noorden[2] 204

Modelling and optimisation of the maximum power of a wind turbine using fuzzy logic **205**
Samia Bensmail[1] and Chafiaa Serir[2] and Djamila Rekioua[3] 205

Bound state solutions of the Dirac equation with the Eckart potential including Coulomb-like tensor potential by Feynman path integral **206**
Assia Amrouche[1], Ahmed Diaf[2] 206

On Generalized Metric Spaces and their Topological and Fixed Point Theoretic Applications **207**
Tadesse Bekeshie Gerbaba 207

Generation of Multiple Nonlinear Optical Bistability using GaAsInP Microring Resonator with Three Input Port **208**
Mahdi Bahadoran[1*], Faezeh Pakfetrat[1], Ahmad Fakhrurrazi Ahmad Noorden[2] Zahra Tohidinia[1] 208

Load and distance-based sink movement algorithm for network performance improvement in mobile wireless sensor networks with a mobile sink **209**
Louiza Belkhiri-Brahmi[1], Samira Yessad[1] and Fouzi Semchedine[1,2] 209

Solution of Markov Reward Games Using Convolutional Neural Networks **210**
Murat Özkaya[1,2*] , Burhaneddin İzgi[1**] 210

Statistical Proprieties and Modeling of Lifetime Data under Exponential Geometric Pareto Distribution **212**
Lallouche Abdallah 212

Nonlocal and Nonclassical Properties of a System of Four-Level Atom Interacting with Parity Deformed field **213**
Sayed Abdel-Khalek[1,2], M. Algarni [3], K. Berrada[4] 213

Using Machine Learning Intelligence for analyzing Insights in Blood diseases Medical Data **214**
Azhari Mohamed 214

MESSAGE FROM CHAIRMAN

It was with great pleasure that we welcomed you to the "12th International Conference On Applied Analysis And Mathematical Modeling. This conference, which took place in Istanbul, Turkey from July 19-23, 2024, was a hybrid event presented by Biruni University. With a significant turnout of scientists from 29 countries and a total of 230 papers presented, we gathered to discuss the most recent developments, discoveries, and progress in Applied Analysis.

We aimed to delve into the fundamental and frontier theories that act as the backbone of modern science and technology. We hoped to instigate further research interest and explorations into this exciting field. The conference placed a spotlight on the foundational theories and principles, analytical and symbolic approaches, and computational techniques in nonlinear physical science and mathematics. A diverse range of topics was addressed, from nonlinear dynamical systems, nonlinear electronic circuits, and classical and fractional differential equations to nonlinear dynamics in fields such as biology and engineering. We also explored complexity in areas like physics, chemistry, and biomedicine, neurodynamics, social dynamics, data-driven dynamical systems, and mathematical methods in artificial intelligence, among others.

As the number of applications from around the world increased, we faced the challenging task of selecting and categorizing abstracts from numerous participants. We did our utmost to accommodate a wide range of speakers, creating an environment conducive to rich, engaging interactions and exchanges.

We were also delighted to offer a range of social activities including an excursion boat trip and a city tour, providing an excellent opportunity for participants to engage in informal discussions and networking. We were particularly heartened by the robust participation from young researchers, whose presentations contributed significantly to the conference.

The talks covered a wide range of mathematics and its applications such as analysis, algebra, statistics, computer mathematics, discrete mathematics, geometry, and engineering, as well as their use in modeling. We believed that this richness provided the basis for interdisciplinary collaborations.

We want to express our sincere thanks to some key individuals who contributed significantly to the conference's success. Aydin Secer and Dumitru Baleanu, your participation and efforts were truly appreciated. The same goes for Ali Akgul, Yeliz Karaca, Tuğçem Partal, Neslihan Ozdemir, Melih Cinar, Handenur Esen, and Ismail Onder, along with all our colleagues who worked tirelessly for the organization of the conference. In addition, we acknowledged the support and guidance of the chairman of the board of trustees of Biruni University and Prof. Dr. Adnan Yüksel, the Rector of Biruni University, our host institution. We were also grateful to all the plenary speakers who kindly accepted our invitation and dedicated their time to sharing their ideas during the conference.

Our heartfelt appreciation extended to all members of the organizing committee. If any individual or contribution has been unintentionally overlooked or forgotten, we hope for their kind understanding. We sincerely thanked all who put their effort into making this occasion possible.

We were delighted to welcome each and every one of you to this conference. We hope it was an enjoyable and productive experience and look forward to meeting again on future occasions.

Sincerely Yours,
Prof. Dr. Mustafa Bayram,
Conference Chair

Honorary Chairs

Adnan Yüksel (Rector of Biruni University)

Chair

Mustafa Bayram, Biruni University, Turkey

Co-Chairs

Aydin Secer, Turkey
Juan Ramon, Spain
Amar Debbouche, Algeria

Local Organizing Committee

Chairs: Huseyin Aydın and Yakup Yildirim, Biruni University, Turkey
Furkan Yıldırım, Ataturk University, Turkey
Handenur Esen Yildiz Technical University, Turkey
Sertan Alkan, Iskenderun Technical University, Turkey
Handan Gursoy Demir, Iskenderun Technical University, Turkey
Ismal Onder, Yildiz Technical University, Turkey
Tugcem Partal, Recep Tayyip Erdogan University, Turkey
Melih Cinar, Yildiz TechnicalUniversity, Turkey
Neslihan Özdemir, Yildiz Technical University, Turkey
Hakan Adiguzel, Sakarya University of Applied Science, Turkey
Ibrahim Emiroglu, Yildiz Technical University, Turkey
Nuran Guzel, Yildiz Technical University, Turkey
Osman Özcan, Fırat University, Turkey
Sebahat Ebru Das, Yildiz Technical University, Turkey
Samet Kadıoğlu, Istanbul Technical University, Turkey
Gülsemay Yigit, Bahcesehir University, Turkey
Burhan Tiryakioğlu, Marmara University, Turkey

Scientific Committee

Chair: Dumitru Baleanu, American University of Beirut
Co-Chairs: A Cordero (Spain), and A. Akgül (Turkey)

Scientific Committee members

Abdelsalam Gomaa Abdelsalam, Qatar University, Qatar
Abdon Atangana, University of the Free State, South Africa
Ahmed Bokhari, Algeria
Jamal-Odysseas Maaita, Greece
Abdul Rouf Alghofari, University Brawijaya, Endonesia
Abdurrahim Yılmaz, Middle East Technical University, Turkey
Adem Kilicman, Putra University, Malaysia
Agnieszka B. Malinowska, Bialystok University of Technology, Poland
Alexey Lukashov, Saratov State University, Russia
Ali Akgül, Siirt University, Turkey
Aly R. Seadawy, Taibah University, Saudi Arabia
Andrei Shkalikov, Moscov State University, Russia
Behzad Ghanbari, Kermanshah University, Iran
Burhaneddin İzgi, Istanbul Technical University, Turkey
Carlo Cattani, University of Tuscia, Italy
Cemil Tunc, Van Yuzuncu Yil University, Turkey
Chaudry Masood Khalique, North-West University, South Africa
Devendra Kumar, University of Rajasthan, India
Dianchen Lu, Jiangsu University, China
Elçin Yusufoğlu, Uşak University, Turkey
Ercan Çelik, Atatürk University, Turkey
Ercan Tunç, Tokat Gaziosmanpaşa University, Turkey
Fairouz Tchier, King Saud University, Saudi Arabia
Faruk Ucar, Marmara University, Turkey
George A. Anastassiou, University of Memphis, USA
Hari M. Srivastava, University of Victoria, Canada
HongGuang Sun, Hohai University, China
Hossein Jafari, University of South Africa, South Africa
İdris Dağ, Eskişehir Osmangazi University, Turkey
Jagdev Singh, JECRC University, India
Jordan Hristov, University of Chemical Technology, Bulgaria
Jose Francisco Gomez Aguilar, CONACyT-Tecnológico Nacional de México , México
Juan J. Nieto, University of Santiago de Compostela, Spain
Juan J. Trujillo, University of La Laguna, Spain
Kamyar Hosseini, Islamic Azad University, Iran
Lamiche Chaabane, University of M'sila, Algeria
Luis Vazquez, Universidad Complutense de Madrid, Spain
Mahmoud Abdel-Aty, Sohag University, Egypt
Mustafa Bayram, Biruni University, Turkey
Michal Fečkan, Comenius University, Slovakia

Michele Caputo, Accademia Nazionale Lincei University, Italy
Mir Sajjad Hashemi, Bonab University, Iran
Muhammad Younis,University of Punjab, Pakistan
M. Zaeem-ul-Haq Bhatti, Punjab University, Pakistan
Naila Rozi, University Sindh Madrassatul Islam, Pakıstan
Nasser Sweilam, Cairo University, Egypt
Necati Özdemir, Balıkesir University, Turkey
Nor Haniza Sarmin, University Technology, Malaysıa
Norihan Binti Md Arifin, University Putra, Malaysıa
Praveen Agarwal, Anand International College of Engineering, India
Rekha Srivastava, University of Victoria, Canada
Raoul R. Nigmattulin, Kazan State University, Russia
Ratno Bagus Edy Wibowo, University Brawijaya, Endonesia
Ravi P. Agarwal, Texas A&M University, USA
Reyad El-Khazali, Khalifa University of Sicence, Technology and Research Sharjah, UAE
Sachin Kumar, Thapar University, India
Selçuk Kutluay, İnönü University, Turkey
Shaher Momani, Mutah University, Jordan
Shahram Rezapour, Azarbaijan Shahid Madani University, Iran
Sunil Dutt Purohit, Rajasthan Technical University, India
Sunil Kumar, National Institute Of Technology, India
Suzeini Abdul Halim, University Malaya, Malaysia
Tadeusz Kaczorek, Bialystok University of Technology, Poland
Tamaz Kaladze, Tbilis State University, Georgia
Tamer Ugur, Ataturk University Turkey
Tasawar Hayat, King Abdulaziz University, Saudi Arabia
Fatih Tasci, Yildiz Technical University, Turkey
Vishnu Narayan Mishra, Indira Gandhi National Tribal University, India
Wen-Xiu Ma, University of South Florida, USA
Xiao-Jun Yang, China University of Mining and Technology, China
Yeliz Karaca, University of Massachusetts (UMass) Chan Medical School, Worchester, USA
Yong Zhou, Xiangtan University, China
Yongguang Yu, Beijing Jiaotong University, China
Tamaz Kaladze, Tbilisi University , Georgia
Zakia Hammouch, Moulay Ismail University, Morocco
Zanariah Binti Abdul Majid, Putra University, Malaysia
Abdullahi Yusuf, Biruni University, Turkey
Tukur Abdulkadir Suleiman, Biruni university, Turkey
Ozlem Defterli, Cankaya University, Turkey

Pleneary Speakers

Ravi P. Agarwal, USA
George Anastassiou, USA
Dumitru Baleanu , Lebanon
Mahmoud Abdel-Aty, Egypt
Jamal-Odysseas Maaita, Greece
Juan R. Torregrosa, Spain

Hossein Jafari, South Africa
Ali Akgul, Turkey
A. Cordero, Spain

Invited Speakers

Jordan Hristov, Bulgaria
Luis Vazquez, Spain
Yeliz Karaca, USA
Carla Pinto, Potugal
Mir Sajjad Hashemi, Iran
Sunil Dutt Purohit, India
Abdelsalam Gomaa Abdelsalam, Qatar
Jose Francisco Gomez Aguilar, Mexico
Zakia Hammouch, Morocco
Amin Jajarmi, Iran
Carlo Cattani, Italy
Nauman Ahmed, Pakistan
Zaid Odibat, Jordan
Shahram Rezapour, Iran
Carlo Grebogi, UK
Raoul Nigmatullin, Russia
Amar Debbouche, Algeria
Babak Shiri, China
Irina Perfilieva, Czech Republic
Mohammad Hossein Heydari, Iran
Praveen Agarwal, India
Jan Awrejcewicz, Poland
Valentina Emilia Balas, Romania

.

ORAL and POSTER PRESENTATIONS

Analysis of Fractal, Fractional and Conformable Derivatives and Integral Transforms

Ali Akgul

Siirt University, Art and Science Faculty, Department of Mathematics, 56100 Siirt, Turkey
E-mail: aliakgul@siirt.edu.tr

Abstract: In this work, we have investigated the fractal, fractional and conformable derivatives. We have considered many mathematical models with these derivatives. We have applied many integral transforms to these models. We have considered many new numerical methods to get the approximate solutions of the models. We compare the exact solutions with the approximate solutions. We demonstrate our results by some tables and figures. We prove the efficiency of the proposed techniques.

Possible breakthrough in fractional order modeling of epidemiological systems

Carla Pinto

School of Engineering, Polytechnic University of Porto
E-mail: cap.isep@gmail.com

Abstract: In the last years a myriad of papers have been written in fractional epidemiological models. Most of them ae mere generalizations of integer-order models, without any relevant biological assumption, only based in the incorporation of a "memory effect". The ODes are replaced by fractional differential equations (DE). Unfortunately questions such as: What is the physical and biological interpretation of fractional models? are everywhere to be found. We will try to discuss this and other issues pertaining to the modeling of fractional order DE.

Keywords: Caputo derivative, epidemiology, breakthrough, modeling.

Parametrized Trigonometric derived Lp degree of approximation by various smooth singular integral operators

George A. Anastassiou

Department of Mathematical Sciences, University of Memphis,Memphis, TN 38152, U.S.A.
E-mail: ganastss@memphis.edu

Abstract: In this work we continue with the study of smooth Gauss-Weierstrass, Poisson-Cauchy and Trigonometric singular integral operators that started in 1997. This time the foundation of our research is a trigonometric Taylor's formula. We prove the parametrized univariate Lp convergence of our operators to the unit operator with rates via Jackson-type parametrized inequalities involving the first Lp modulus of continuity. Of interest here is a residual appearing term. Note that our operators are not in general positive.

Investigating the dynamical behavior of systems with a positive maximal Lyapunov Characteristic Exponent near zero

Maaita Jamal Odysseas

Aristotle University of Thessaloniki, Department of Physics Section of Astrophysics, Astronomy and Mechanics
E-mail: jmaay@physics.auth.gr

Abstract: In this talk, we will try to answer the question: " What is the dynamical behavior when the proposed system has a positive maximal Lyapunov Exponent" near to zero?". To do so, we investigate many dynamical systems with the help of several numerical tools, such as Poincare sections and the Smaller Alignment Index.

Keywords: maximal Lyapunov Characteristic Exponent, Chaotic motion, Smaller Alignment Index

Cardinal basis functions for fractional problems involving the Hadamard derivative

Mohammad Hossein Heydari

Department of Mathematics Shiraz University of Technology Shiraz, 7155713876, Iran
E-mail: Heydari@sutech.ac.ir

Abstract: The Hadamard type fractional derivatives are a generalization of the fractional operator $(t^d)^n dt$ (where $n \in Z^+$) with a logarithmic kernel function. Such derivatives play a vital role in physics and engineering problems. It is shown that the Hadamard fractional derivatives are more suitable for modeling very slow processes. Solving problems with the Hadamard's fractional derivatives is much more complicated, due to the logarithmic kernels of these derivatives. The structure of these fractional derivatives (due to logarithmic kernels) is such that many numerical methods used for problems with other fractional derivatives cannot be easily developed for fractional problems with the Hadamard's derivatives. in recent years, different numerical technique, such as the generalized Legendre functions method, finite difference technique, reduction method, generalized sine–cosine wavelets method, Galerkin finite element method, Legendre-spectral method, Krawtchouk wavelets method and Haar wavelets method have been developed to solve such problems. In this talk, we investigate the use of the cardinal basis functions to solve some classes of fractional problems involving the Hadamard's fraction derivatives. Some proper basis functions, such as the logarithmic Chebyshev cardinal functions, shifted Chebyshev polynomials and hat functions are employed to solve these problems. The methods established based on these functions turn solving the problem under consideration into solving an algebraic system of equations, which can be easily solved.

Keywords: Hadamard fractional derivative; Logarithmic Chebyshev cardinal functions; Coupled nonlinear Schrodinger-KdV equations; Coupled nonlinear Schrodinger-Hirota equations.

References

[1] A. A. Kilbas, "Hadamard-type fractional calculus", Journal of the Korean Mathematical Society, 38(6):1191-1204, 2001.

[2] M. H. Heydari, D. Baleanu, A new strategy based on the logarithmic Chebyshev cardinal functions for Hadamard time fractional coupled nonlinear Schrodinger-Hirota equations, Communications in Nonlinear Science and Numerical Simulation, 135, 108018, 2024.

[3] M. H. Heydari, M. Razzaghi, "A hybrid approach for the numerical solution of Hadamard time fractional coupled nonlinear Schrodinger-KdV equations", Chines Journal of Physics, Under review, 2024.

Mathematical Modeling, Stochastic Processes and Computational Complexity in Precision Medicine: Medical and Clinical-related Applications with Fractional Calculus Operators, Bloch Torrey Partial Differential Equation, Hidden Markov and Artificial Intelligence

Yeliz Karaca

University of Massachusetts (UMass) Chan Medical School, Worcester, USA
E-mail: yeliz.karaca@ieee.org

Abstract: Mathematical models for uncertain phenomena are applicable for the purposes of description as well as computation of complex dynamical behaviors, which ensure the applicable mathematical formulations of neural dynamics across the temporal and spatial scales. Thus, the form of equations subsequently facilitating the comprehension of the subtleties of the original problem also help with the discovering of the new attributes concerning complex problems. Human brain, as one of the most complex networks of nature, manifests chaotic, stochastic and dynamic aspects entailed in its analysis considering the neurological configuration. Besides these, with its fractal structure, human brain demonstrates complex dynamics with fractals in the brain being marked by irregularity, singularity as well as self-similarity in terms of forms at different observation levels, which may render detection difficult due to the fact that observations in real-time occurrences can prove to be time-variant, discrete, continuous or noisy. Stochastic models, on the other hand, are characterized in applications with observations being probabilistic functions of the state, encompassing doubly stochastic process that ensures the inferring of the underlying stochastic process. Congruently, stochastic processes are mathematical models that are constructed through a family of random variables, and by reducing the problem to its fundamental characteristics and addressing the relationship with the flow of interacting elements, mathematical models are known to provide abstractions accordingly. Across this line, Hidden Markov Model (HMM), as a stochastic process, elicits that implicit or latent stochastic processes can be inferred indirectly through a sequence of observed states considering that observations are probabilistic functions of the state, and hence, HMM is proven to be beneficial for purposes of modeling, simulations and applications across a multitude of scientific disciplines. The computational complexity of all the models are calculated so that the complexity of equations can be measured based on the degrees to reduce computational time (time parameter) and make the most use of data storage (space parameter) to ultimately enhance compatibility with models. Apart from these points, advanced mathematical models are known to be employing multifaceted methods for extracting information from the images. Accordingly, Diffusion Magnetic Resonance Imaging (DMRI), as a noninvasive and experimental imaging technique, provides clinical and research applications, lending a measure concerned with the diffusion characteristics of water in biological tissues, particularly in the brain tissues. While delving into neuronal dynamics, the aforementioned techniques provide a reliable way to detect and generate accurate quantitative parametric instruments while reflecting the subtle properties of brain tissues, focusing on the precise connections between tissue microstructure and signals. For the evaluation of computational complexity pertaining to the finite difference method, Bloch–Torrey partial differential equation and fractional methods demonstrate the significance of applicable mathematical models to achieve an optimal level of accuracy to identify the total simulation time as well as the diffusion coefficient of the simulated tissue. Consequently, the critical manifolds of multifaceted mathematical modeling in conjunction with Artificial Intelligence (AI) as well as machine learning contribute to robust scientific understanding by validating the relevant multidisciplinary aspects to substantially enhance hyperparameter optimization based on complex data-based problems from the lens of solution-oriented schemes and systems.

Keywords: Mathematical Neuroscience; Stochastic Processes; Hidden Markov Model (HMM); Markovian processes; Bloch Torrey Partial Differential Equation; Fractional Calculus; Medical Imaging; Diffusion Magnetic Resonance Imaging (DMRI); Artificial Intelligence (AI); Computational Complexity; Neural Dynamics, Accurate Neuron Geometry Models; Optimal Predictive Dimension of Changes; Hyperparameter Optimization; Precision Medicine.

References

[1] Karaca, Y., Baleanu, D., & Karabudak, R. (2022). Hidden markov model and multifractal method-based predictive quantization complexity models vis-á-vis the differential prognosis and differentiation of multiple sclerosis' subgroups. Knowledge-Based Systems, 246, 108694.

[2] Karaca, Y. (2023). Fractional Calculus Operators–Bloch–Torrey Partial Differential Equation–Artificial Neural Networks–Computational Complexity Modeling of The Micro–Macrostructural Brain Tissues with Diffusion MRI Signal Processing and Neuronal Multi-Components. Fractals, 2340204.

Iterative processes for nonlinear problems: from Newton to nowadays

Alicia Cordero[1] and Juan R. Torregrosa[2]

[1]*Institute for Universitat Politècnica de València, València, Spain*
[2]*Universitat Politècnica de València, València, Spain*
E-mail: acordero@mat.upv.es, jrtorre@mat.upv.es

Abstract: Solving nonlinear problems modeled by the expression $F(x) = 0$, where F is a nonlinear function between two Banach spaces, is both a classical and topical problem that numerous researchers have worked on throughout history and in recent years is being very prolific, in part thanks to the computational tools that are being developed.
In general, there are no analytical methods to solve these problems, so we must use iterative schemes that approximate the solution by starting from an initial estimate. Among these procedures, possibly the best known and most widely used is Newton's method, whose iterative expression is

$$x_{k+1} = x_k - [F'(x_k)]^{-1} F(x_k),\ k = 0, 1, \ldots,$$

where $F'(x_k)$ is the "derivative" of function F evaluated in the iterate x_k. This scheme has quadratic convergence under some conditions.
Throughout history, and especially in recent years, numerous new iterative methods have been designed trying to improve the convergence speed, without increasing too much the computational cost and smoothing the convergence conditions. In this paper we will present an overview of this development from different points of view.
One of these approaches is the use of complex dynamics or multidimensional real dynamics tools to analyze the stability of the different methods, selecting those with good properties and rejecting those with chaotic behavior.

Stability analysis and optimal control of variable-order fractional covid-19 dynamic discrete model

Amar Debbouche

Department of Mathematics, Guelma University, Guelma, 24000 Algeria
E-mail: amar_debbouche@yahoo.fr

Abstract: In this work, we introduce an improved class of covid-19 dynamics involving a discrete-time and fractional variable order. We investigate the well-posedness results under appropriate set of sufficient conditions. Then, we find the disease-free equilibrium point and endemic equilibrium point. Next, we investigate the local asymptotic stability of the considered model. Further, we formulate a new discrete fractional optimal control problem for covid-19 using a discrete mathematical model with a variable order fractional derivative. Finally, we give numerical simulations to clarify and confirm the obtained theory.

Keywords: Variable-order derivative; fractional discrete calculus; covid-19 model; optimal control; stability; numerical simulation.

References

[1] Xu, C.; Yu, Y.; Ren, G.; Sun, Y.; Si, X. Stability analysis and optimal control of a fractional-order generalized SEIR model for the COVID-19 pandemic, Applied Mathematics and Computation, **2023**, 457, 128210.

[2] Ming, W.K.; Huang, J.; Zhang, C.J.P. Breaking down of healthcare system: Mathematical modelling for controlling the novel coronavirus (2019-nCoV) outbreak in Wuhan, China, BioRxiv, **2020**.

What is a generalized fractional operator?

Dumitru Baleanu

Lebanese American University, Department of Computer Sciences and Mathematics,Beirut, Lebanon and Institute of Space Sciences, Magurele-Bucharest,Romania
E-mail: dumitru.baleanu@lau.edu.lb

Abstract: Fractional calculus is an interdisciplinary field, and it is deeply connected with complicated processes appearing in various areas of research. Recently the generalized fractional operators and the modified versions of non-singular fractional operators are considered some of the hot topics within fractional calculus area.In my talk I will concentrate on the basic definition of the generalized fractional operator and modification of fractional operators with Mittag-Leffler.

References

[1] A. Ahmad, D. Baleanu, AIMS Math. 8(1), 887-904, 2023

[2] M. Al-Refai and D. Baleanu,Fractals, 30(51), Article number 2240129, 2022

[3] H. Khan, J. Alzabut, D. Baleanu, G. Alobaidi, M. U. Rehman, AIMS Math. 8(3), 6609-6625,2023

[4] R. Chawla, K. Deswal, D. Kumar, D. Baleanu, AIMS Math. 7(9), 17252-17268, 2022

[5] P.Q. Mohammed, H.M. Srivastava, D. Baleanu, K.M. Abualnaja, Symmetry 14(8),1519, 2022

[6] R. W. Ibrahim, D. Baleanu, Proceedings of the Institute of Mathematics and Mechanics, 48(Special Issue), 56-67 , 2022

Some Basic Properties of Harmonic Functions Defined by the Salagean Operator

Serkan Çakmak

Management Information Systems Department, Faculty of Economics, Administrative and Social Science, Istanbul Gelisim University, Turkey
E-mail: secakmak@gelisim.edu.tr

Abstract: The paper introduces a new subclass of harmonic functions within the unit disk, defined by the Salagean differential operator. It explores various properties, including close-to-convexity, coefficient bounds, and growth estimates. Furthermore, the study investigates convolution and convex combination properties for this specific class.

Keywords: Harmonic functions, Salagean derivative, close-to-convex functions, convolution.

Mathematics Subject Classification: 30C45, 30C50.

References

[1] Clunie, J., Sheil-Small, T. (1984). Harmonic univalent functions. *Ann. Acad. Sci. Fenn. Ser. A. I.*, 9, 3-25.

[2] Chichra, P. N. (1976). New subclasses of the class of close-to-convex functions. *Proc. Amer. Math. Soc.*, **62**(1), 37-43.

[3] Dorff, M. (2001). Convolutions of planar harmonic convex mappings. *Complex Variables Theory and Applications*, 45(3), 263-271.

[4] Duren, P. (2004). Harmonic mappings in the plane. *Cambridge Tracts in Mathematics, 156*. Cambridge Univ. Press, Cambridge..

[5] Jahangiri, J. M., Murugusundaramoorthy, G., Vijaya, K. (2002). Salagean-type harmonic univalent functions. *South. J. Pure Appl. Math.*, 2, 77–82

[6] Nagpal, S., Ravichandran, V. (2014). Construction of subclasses of univalent harmonic mappings. *J. Korean Math. Soc.*, 53, 567-592.

[7] Ponnusamy, S., Yamamoto, H., Yanagihara, H. (2013). Variability regions for certain families of harmonic univalent mappings. *Complex Variables and Elliptic Equations*, 58(1), 23-34.

[8] Salagean, G. S. (1983). Subclass of univalent functions. In *Complex Analysis-Fifth Romanian Finish Seminar* (pp. 362–372). Bucharest.

[9] Fejér, L. (1925). Über die Positivität von Summen, die nach trigonometrischen oder Legendreschen Funktionen fortschreiten. *Acta Litt. Ac Sei. Szeged*, 75-86.

[10] Singh, R., Singh, S. (1989). Convolution properties of a class of starlike functions. *Proc. Amer. Math. Soc.*, 106, 145-152.

Image denoising by anistropic nonlinear model and deep neural network architecture

Khadija Bouzaachane[1] and El mahdi EL Guarmah[2]

[1] *FST, Cadi Ayyad University, L2IS, Marrakesh, 40000, Morocco*
[2] *Royal Air School, Mathematics and Informatics Department, L2IS, Marrakesh, 40052, Morocco*
E-mail: k.bouzaachane@uca.ma, k.bouzaachane@gmail.com and guarmah@gmail.com

Abstract: The image's restoration is an essential step in image processing. Several filters have been developed to eliminate noise, the most interesting of which are those that allow image denoising while preserving semantically important structures. A recent class of adaptive denoising methods is the nonlinear partial differential equations, which is currently enjoying considerable success for images of acceptable size.

After the mathematical study of a nonlinear evolution partial differential equation proposed for image processing. The existence and uniqueness of the solution are established. Using a finite-difference method with the AOS scheme, we experiment the validity of the proposed model and illustrate the effectiveness of the method using a few specified images. Next, we propose another restoration technique based on deep neural networks, which has enabled us to overcome the problem of processing large images. The techniques presented in this article significantly improve the pre-processing of large images. We present some numerical experiments and compare the signal-to-noise ratio (SNR) and the RMSE error.

Keywords: Anistropic diffusion model, Deep Neural Network, image processing, Riemann boundary conditions, SNR.

Mathematics Subject Classification: 35K55, 35Q68, 68T01, 68U10

References

[1] K. Bellaj, S. Boujena, E. El Guarmah, "An improved approach for image segmentation and three dimensional reconstruction", Discontinuity, Nonlinearity and Complexity, 9(2) 199-215, 2020.

[2] K. Bellaj, S. Boujena, E. El Guarmah, "Adaptive level set evolution for image segmentation", JAMS Journal, 11, 265-273, 2018.

[3] K. Bellaj, S. Boujena, E. El Guarmah, O. Gouasnouane, "One approach for image denoising based on finite element method and domain decomposition technique", International Journal of Applied Physics and Mathematics 7(2) 141, 2017.

[4] S. Boujena, K. Bellaj, O. Gouasnouane, E. El Guarmah, "An improved nonlinear model for image inpainting", Applied Mathematical Sciences, 2015, 9(124), pp. 6189–6205.

[5] K. Zhang, W. Zuo, L. Zhang, "FFDNet: toward a fast and flexible solution for CNN based image denoising", IEEE Trans. Image Process., 2018, pp. 4608–4622.

[6] H. Zou, R. Lan, Y. Zhong, Z. Liu, X. Luo, "EDCNN: A Novel Network for Image Denoising", in IEEE International Conference on Image Processing, 2019.

Transformers for aircraft emergency landing sites semantic segmentation

Adil Illi [1], Khadija Bouzaachane [1], Salah El Hadaj [1], El Mahdi El Guarmah [2]

[1] *Laboratory of Computer Engineering and Systems "L2IS", Department of Computer Science, University Cadi Ayyad Marrakech, Morocco*
[2] *Royal Air School, Mathematics and Informatics Department, L2IS, Marrakech, Morocco*
E-mail: illiadil@outlook.com, kbouzaachane@gmail.com, elhadajs@yahoo.fr, guarmah@gmail.com

Abstract: A forced landing, which can occur unexpectedly due to factors like engine malfunctions, adverse weather conditions, or other emergencies, presents a critical challenge in aviation. So, emergency aircraft landing site detection is a critical task for ensuring the safety of passengers and crew in case of an emergency. Pilots are traditionally trained to visually identify suitable landing sites by assessing visible terrain from the cockpit, a fundamental skill in flight training. However, adverse environmental conditions such as fog, rain, or poor lighting along with the high stress conditions generated by such emergencies can significantly make this task harder, making the selection of an appropriate landing site highly dependent on the pilot's experience, which varies widely among individuals. Recognizing this challenge, there is potential for the development of a Deep Learning (DL) based automatic emergency landing site suggestion system. Surprisingly, research in this field appears to be relatively limited, leaving room for innovation. By leveraging advanced image segmentation techniques[2, 3, 4, 5], such a system could assist pilots in identifying safe and optimal emergency landing sites, ultimately enhancing the safety of the aircraft and the well-being of passengers and crew members during critical situations. We believe that our method can pave the way for more advanced and reliable emergency aircraft landing site recommendation systems in the future.

In this paper, we propose the usage of a vision transformer[1] based model tailored to identify safe landing areas. Furthermore, we make use of our own dataset specifically designed for emergency landing area segmentation. In this context of emergency landing site detection within the larger field of remote sensing, it is strikingly evident that there exists a noteworthy lack of comprehensive research dedicated to the critical domain of identifying suitable aircraft emergency landing zones. A substantial portion of the existing state-of-the-art research [6, 7, 8, 9], predominantly centers its attention on the relatively more straightforward task of pinpointing singular landing coordinates specifically tailored for unmanned aerial vehicles (UAVs). However, our primary research focus diverges from this mainstream goal, gravitating towards the considerably more intricate and consequential task of detecting secure and accessible landing strips that can be readily utilized as emergency runways for a diverse range of general-purpose aircraft, thereby addressing a pivotal gap in the existing literature. This nuanced shift in perspective underscores the significance of our research and its potential to significantly enhance the field of remote sensing for aviation safety.

Keywords: vision transformer, semantic segmentation, emergency landing site detection.

References

[1] A. Dosovitskiy, L. Beyer, A. Kolesnikov, D. Weissenborn, X. Zhai, T. Unterthiner, M. Dehghani, M. Minderer, G. Heigold, S. Gelly, J. Uszkoreit, N. Houlsby, An Image is Worth 16x16 Words: Transformers for Image Recognition at Scale (2021)

[2] C. Lu, D. Geus, G. Dubbelman, Content-aware Token Sharing for Efficient Semantic Segmentation with Vision Transformers (2023)

[3] B. Zhang, Z. Tian, Q. Tang, X. Chu, X. Wei, C. Shen, Y. Liu, SegViT: Semantic Segmentation with Plain Vision Transformers (2022)

[4] B. Zhang, L. Liu, M.H. Phan, Z. Tian, C. Shen, Y. Liu, SegViTv2: Exploring Efficient and Continual Semantic Segmentation with Plain Vision Transformers (2023)

[5] Z. Liu, Y. Lin, Y. Cao, H. Hu, Y. Wei, Z. Zhang, S. Lin, B. Guo, Swin Transformer: Hierarchical Vision Transformer using Shifted Windows (2021)

[6] L. Mejias, Classifying natural aerial scenery for autonomous aircraft emergency landing. In: 2014 International Conference on Unmanned Aircraft Systems (ICUAS), pp. 1236–1242 (2014). https://doi.org/10.1109/ICUAS.2014.6842380

[7] M. Warren, L. Mejias, X. Yang, B. Arain, L. Gonzalez, B. Upcroft, Enabling aircraft emergency landings using active visual site detection. Springer Tracts in Advanced Robotics 105, 167–181 (2015) https://doi.org/10.1007/978-3-319-07488-7 12

[8] C. Kikumoto, Y. Harimoto, K. Isogaya, T. Yoshida, T. Urakubo, Landing site detection for uavs based on cnns classification and optical flow from monocular camera images. Journal of Robotics and Mechatronics 33, 292–300 (2021) https://doi.org/10.20965/jrm.2021.p0292

[9] P.T. Eendebak, A. Eekeren, R. Hollander, Landing spot selection for uav emergency landing. In: Defense, Security, and Sensing (2013). https://api.semanticscholar.org/CorpusID:54903200

[10] A. Vaswani, N. Shazeer, N. Parmar, J. Uszkoreit, L. Jones, A.N. Gomez, L. Kaiser, I. Polosukhin, Attention Is All You Need (2023)

Optimization of Path Loss Models in Urban Areas Using 4G-LTE Networks

A. Khiredine[1*], S. Zitouni[2]**

[1]*Electrical engineering laboratory, faculty of technology, University of Bba (34000), Algeria*
[2]*Electrical engineering laboratory, faculty of technology University of Bba (34000), Algeria*
E-mail: abdelkrim.khired@gmail.com*,zit.sihiem@yahoo.fr**

Abstract: The paper discusses the influence of propagation environment and optimization of path loss models in urban areas using 4G-LTE networks. It has made it possible to achieve high speeds while reducing latency; it is based on the transmission of data only, the latter at theoretical speeds of around 100 Mb/s. It considers the measurement and prediction results for a special case of propagation. Both theoretical and measurement-based propagation models indicate that average received signal power decreases logarithmically with distance. We will then compare the different results obtained depending on the distance between the mobile and the BTS and the parameters presented above show that the model microcell is optimal for urban areas compared to all other models and COST231, using Long Term Evolution networks.

Keywords: Studies, 4G-LTE, Evolved Paquet System network, wireless, path loss, model arc/harq, Cost 231.

References

[1] Rose Qingyang Hu, Yi Qian, *Resource Management for Heterogeneous Networks in LTE Systems*, Springer USA, 2014.

[2] Y. Yu, R. Q. Hu, Z. Cai, "Optimal Load Balancing and Its Heuristic Implementation in a Heterogeneous Relay Network," in *Proc. of IEEE GLOBECOM 2011*, Houston, Texas.

[3] K. I. Pedersen, T. E. Kolding, F. Frederiksen, D. Laselva, and P. E. Mogensen, "An overview of downlink radio resource management for UTRAN long-term evolution," *IEEE Commun. Mag.*, vol. 47, pp. 86-93, Jul. 2009.

[4] Q. C. Li, R. Q. Hu, Y. Qian, and G. Wu, "Cooperative Communications for Wireless Networks: Techniques and Applications in LTE-Advanced Systems," *IEEE Wireless Commun. Mag.*, vol. 19, no. 2, pp. 22-29, Apr. 2012.

[5] YulPeng Wang, Dongyao Wang, JiYong Pang, and Gang Shen, "Self-optimization of Downlink Transmission Power in 3GPP LTE-A Heterogeneous Network," Research and Innovation Center Alcatel-Lucent Shanghai Bell Co., Ltd., 2012.

[6] R. Chen, R. Q. Hu, "Joint uplink and downlink optimization for mobile association in a wireless Heterogeneous network," in *Proc. of IEEE Globecom 2012*, Anaheim, CA, USA, Dec. 2012.

[7] 3GPP TR36.814, "Further advancements for E-UTRA physical layer aspects," v9.0.0, Mar. 2010.

[8] Rapeepat Ratasuk, Jun Tan, and Amitava Ghosh, "Coverage and Capacity Analysis for Machine Type Communications in LTE," Nokia Siemens Networks, 1421 West Shure Drive, Arlington Heights, IL 60004, USA.

[9] Jaafar A. Alkhlaifain, G. A. Yahya, R. B. Ahmad, N. Omar, Z. G. Ali, "Effect of Relay Location on Two-Way DF and AF Relay for Multi-User System in LTE-A Cellular Networks," 2013 IEEE (IBEIAC).

[10] G. GHASSEN A.A, MAHAMOD I. et KASMIRAN J., "Modeling and Performance Evaluation of LTE Networks with Different TCP Variants," Académie mondiale des sciences, 2011.

Finite difference implicit scheme for diagonal non-conservative hyperbolic systems

Rachida Boudjerada

USTHB, Faculty of Mathematics, Laboratory AMNEDP
BP 32 EL Alia, 34320, Bab Ezzouar, Algiers
E-mail: ra.boudjerada@gmail.com, rachida.boudjerada@usthb.edu.dz

Abstract: In this work we present a convergence result for an implicit Upwind scheme considering the framework of hyperbolic systems, which are not necessarily strictly hyperbolic [2]. Related to this work, it is worth noting that, in [3] the authors have proved a similar result for a semi-explicit scheme in the case of non-conservative strictly hyperbolic systems. Moreover, their result was only valid in the class of vanishing viscosity solutions, introduced by Bianchini and Bressan in [1]. Here, we show the convergence taking only Lipschitz continuous solutions, without any other restriction concerning the class of solutions.
An application of this result is done on a simplified one-dimensional model describing the dynamics of dislocations, where dislocations are microscopic defects present in materials, especially in metal alloys. The movement of these defects is the main explanation of plastic and viscoplastic deformations.
In a particular geometry, where dislocations are assumed to be punctual defects, depending on a single variable x and moving in two fixed directions, according to the vector $(1,0)$ (on the right) or according to the vector $-(1,0)$ (on the left), Groma and Balogh have modeled in [4] the dynamics of the dislocations densities by a (2×2) coupled system of non-local transport equations .

Keywords: Implicit upwind scheme, diagonal non-conservative hyperbolic systems, transport systems, discrete gradient estimates, Lipschitz discrete solutions. Error estimate

References

[1] **S. BIANCHINI and A. BRESSAN**, *Vanishining vicosity solutions of nonlinear hyperbolic systems*, Ann. Math. 161 (2005), 223-342.

[2] **R. BOUDJERADA, A. EL HAJJ and A. OUSSAILY**, *Convergence of an implicit scheme for diagonal non-conservative hyperbolic systems*, ESAIM : M2AN, 55 (2020), p.573-591.

[3] **L. MONASSE and R. MONNEAU**, *Gradient entropy estimate and convergence of a semi-explicit scheme for diagonal hyperbolic systmes*, SIAM J. Numer. Anal., 52 (2014), pp. 2792 2814.

[4] **I. GROMA and P. BALOGH**, *Investigationof dislocation pattern formation in a two-dimensional self-consistent field approximation* , Acta Mater. 47 (1999) 3647-36-54.

Existence results for p(t)-Laplacian fractional differential equations

Assia Guezane Lakoud and Rabah Khaldi

Badji Mokhtar-Annaba University, Faculty of Sciences, Dept. of Mathematics,
Laboratory of Advanced Materials
E-mail: a_guezane@yahoo.fr and rkhadi@yahoo.fr

Abstract: We explore the existence of solutions for a class of differential equation that include mixed-type fractional Caputo derivatives and the non-standard growth operator called the p(t)-Laplacian. Using various fixed point theorems, we prove that solutions exist for these equations. Furthermore, we investigate the Ulam-Hyers stability.

Keywords: Boundary value problem, Existence of solution, Fractional derivative, Stability

Mathematics Subject Classification: 34B40, 34B15.

References

[1] B. Ahmad, S. K. Ntouyas, A. Alsaedi, Existence theory for nonlocal boundary value problems involving mixed fractional derivatives. *Nonlinear Anal. Model. Control. 24, (2019) 937–957.*

[2] A. Guezane-Lakoud and R. Rodríguez-López, Positive solutions to mixed fractional p-Laplacian boundary value problems. Journal of Applied Analysis, vol. 29, no. 1, 2023, pp. 49-58.

[3] A. Guezane Lakoud, A. Ashyralyev, Existence of Solutions for Weighted p(t)-Laplacian Mixed Caputo Fractional Differential Equations at Resonance,Filomat, 36:1 (2022), 231–241

[4] T. Shen,W. Liu, Existence of solutions for fractional integral boundary value problems with p(t)-Laplacian operator, J. Nonlinear Sci. Appl. 9 (2016), 5000–5010.

[5] X. Tang, X. Wang, Z. Wang, P. Ouyang, The existence of solutions for mixed fractional resonant boundary value problem with p(t)-Laplacian operator, Journal of Applied Mathematics and Computing, 61 (2019), 559–572.

Fractional neutral differential equations involving $(k,\psi)-$Hilfer fractional derivative and control: Complete controllability exploration

Kerboua Mourad

Laboratory of Applied Mathematics and Modeling "LMAM", Faculty of Mathematics and Computer Science and Material Sciences, University May 8, 1945 Guelma, B.P. 401, 24000, Guelma, Algeria.
E-mail: kerbouamourad@gmail.com

Abstract: The complete controllability of a new class of Sobolev type nonlinear $(k,\psi)-$Hilfer fractional system in Hilbert space are studied. The results are obtained by using ideas from semigroup theory, $(k,\psi)-$Hilfer fractional calculus, fractional power of operators and fixed point theorem under the assumption that the associated linear system is completely controllable.

Keywords: Complete controllability; Fractional differential equations; (k,ψ)-Hilfer fractional derivative; Mild solution; Fractional power; Fixed point theorem.

Mathematics Subject Classification: 93B05, 26A33, 34K37, 47H10

References

[1] M. KERBOUA, Approximate controllability of fractional neutral stochastic evolution equations in Hilbert spaces with fractional Brownian motion, Stoch. Anal. Appl., 36 (2018), 209-223.

[2] R. HILFER, Applications of Fractional Calculus in Physics, Singapore: World Scientific, 2000.

[3] R. SAKTHIVEL, N.I. MAHMUDOV, J.J. NIETO, Controllability for a class of fractional-order neutral evolution control systems. Appl. Math. Comput. 218 (2012), 10334-10340.

[4] K. D. KUCCHE AND A. D. MALI, On the nonlinear $(k,\psi)-$Hilfer fractional differential equations. Chaos, Solitons and Fractals, **152** (2021), 111335.

Packing chromatic number for certain classes of graphs

Rachid Lemdani

Laboratory of Mathematics and its Applications (LaMA)",
Department of Mathematics and Computer Science, Faculty of Sciences, University of Medea, 26000, Medea, Algeria
E-mail: lemdani.rachid@univ-medea.dz

Abstract: Let $G = (V, E)$ be a simple graph with no isolated vertices. Given a positive integer i, an *i-packing* in G is a subset W of the vertices of G such that the distance between any two distinct vertices from this set is greater than i. This concept encompasses also the notion of an independent set, which is edentical to a 1-packing. The *packing chromatic number* of a graph G is the smallest integer k such that the vertex set of G can be partitioned into disjoint sets $W_1, W_2, \ldots, W_k$, where W_i is an i-packing for each $i \in \{1, 2, \ldots, k\}$. We denote this number by $\chi_\rho(G)$. The corresponding mapping $c : V(G) \to \{1, ..., k\}$, satisfying the property that $c(u) = c(v) = i$ implies $d_G(u, v) > i$, is called a *packing coloring* of order k. The packing coloring is considered to be optimal, when $k = \chi_\rho(G)$. It was introduced by Goddard et al. in [3] and study its properties. Also, they showed that it is NP-hard to determine if $\chi_p(G) \leq 4$. First, it was presented under the name broadcast chromatic number, and the current name was given by Brešar et al. in [1]. The packing chromatic number has been investigated in a number of papers (see [2, 4, 5, 6]). In this paper, we consider the packing chromatic number of the Mycielski of the $p-th$ power graph, with a special emphasis on the second power graph ($2-th$ power graph), for specific graphs such as the Mycielski graph of a path and a cycle.

Keywords: Packing chromatic number, Mycielski graph, Power graph.

Mathematics Subject Classification: 05C15, 05C12, 05C70

References

[1] B. Brešar, S. Klavžar, D.F. Rall, On the packing chromatic number of Cartesian products, hexagonal lattice, and trees, Discrete Applied Mathematics 155 (2007) 2303-2311.

[2] J. Balogh, A. Kostochka, X. Liu, Packing chromatic number of subdivisions of cubic graphs, Graphs and Combinatorics 35 (2019) 513-537.

[3] W. Goddard, S.M. Hedetniemi, S.T. Hedetniemi, J.M. Harris, D.F. Rall. Broadcast chromatic numbers of graphs, Ars Combinatoria 86 (2008) 33–49.

[4] N. Gastineau, O. Togni, On the packing chromatic number of subcubic outerplanar graphs, Discrete Applied Mathematics 255 (2019) 209-221.

[5] S. Klavžar, D.F. Rall, Packing chromatic vertex-critical graphs, Discrete Mathematics & Theoretical Computer Science 21 (2019) paper #8, 18 pages.

[6] R. Lemdani, M. Abbas, J. Ferme, Packing chromatic numbers of fnite super subdivisions of graphs, FILOMAT 34 (10) (2020) 3275-3286.

Numerical development for an integro-diffirential equation depending in acceleration trem

Segni Sami

Laboratory of Applied Mathematics and Modeling "LMAM", Faculty of Mathematics and Computer Science and Material Sciences, University May 8, 1945 Guelma, B.P. 401, 24000, Guelma, Algeria.
E-mail: segnianis@gmail.com

Abstract: The objective of this work is the analytical and numerical study of integro-differential equations by methods based on successive Picard methods. Our work is generalization other work of degrees 1 in the framework of non-linear Volterra. This kind of equations came from dynamic system especially the dynamic systems esume the seismic problems, the cases studied in the previous work depends only on the speed and my work depends on the speed and the acceleration, we obtain the existence and the uniqueness using the Nyström method adapt to solve our problem.

Keywords: Volterra integral equation, system of integral equations, integro-differential equations, Nystrom method.

Mathematics Subject Classification: 45J05, 47G20, 34K28, 45L05, 65R20

References

[1] P. Linz,"Analytical and Numerical Methods for Volterra Equations". SIAM Studies in Applied Mathematics, Philadelphia, 1985.

[2] Salah, S., Guebbai, H., Lemita, S., & Aissaoui, M.Z. (2019). Solution of an integro-differential nonlinear equation of Volterra arising of earthquake model. Boletim da Sociedade Paranaense de Matematica, 1-14.

[3] Jerri, A. (1999). Introduction to Integral Equation with Application. John Wiley and Sons.

[4] Pandey, R.K., & Singh, H. (2020). An efficient numerical algorithm to solve volterra integral equation of second kind. Topics in Integral and Integro-Differential Equations. Studies in Systems, Decision and Control, 340, 215-228.

An intelligent conditional integrator sliding mode controller for a two-degree-of-freedom robotic arm

Abdelkader Kerraci, Mohamed Fayçal Khelfi and Ahmed-Foitih Zoubir

Laboratory of Energy and Smart Systems, Djilali BOUNAAMA KHEMIS MILIANA University, Route de Theniet El Had, 44225, Ain Defla, Algeria
Laboratory of Research in Industrial Computing and Networks, University of Oran 1 Ahmed Ben Bella, Algeria
Electrical Engineering Faculty, University of Science and Technology of Oran, Mohamed Boudiaf USTO-MB, El Mnaouar, BP 1505, Bir El Djir 31000, Oran, Algeria
E-mail: a.kerraci@univ-udbkm.dz, mf_khelfi@yahoo.fr and zfoitih@yahoo.fr

Abstract: In this study, we have designed a conditional integrator sliding mode controller for a two-degree-of-freedom robotic arm based on swarm intelligence (PSO). The main idea of the designed control is that the integral action only acts when the system state reaches the sliding surface; elsewhere, it is zero or close to zero. This controller allows for the avoidance of the degradation of the system's transient response regime resulting from conventional integral action. Additionally, it avoids chattering and ensures zero static error, even in parametric uncertainties and external disturbances. The system's response is improved by scheduling the controller's switching gains with a PSO algorithm. Several numerical simulations are carried out in the Matlab/Simulink environment. Compared with three other sliding mode controllers, the results demonstrate that our controller is better regarding time criteria such as rising time, settling time, max overshoot, and stationary error.

Keywords: Sliding mode control, Conditional integrator, Particle swarm optimisation, Manipulator robot

Mathematics Subject Classification: 70E60, 68T40

References

[1] S. Seshagiri, H. K. Khalil, Robust output feedback regulation of minimum-phase nonlinear systems using conditional integrators, Automatica 41, 43–54, 2005.

[2] Y. Liu et al., «Introducing conditional integrator to sliding mode control of DC/DC buck converter», in 2009 IEEE International Conference on Control and Automation, Christchurch, New Zealand: IEEE, déc. 2009, p. 891-896. doi: 10.1109/ICCA.2009.5410307.

[3] V. C. Nguyen et G. Damm, «MIMO conditional integrator control for unmanned airlaunch: MIMO CONDITIONAL INTEGRATOR CONTROL FOR AIRLAUNCH», Int. J. Robust Nonlinear Control, vol. 25, no 3, p. 394-417, févr. 2015, doi: 10.1002/rnc.3092.

[4] H.-P. Ren et J. Hu, «Nonlinear integral sliding mode variable structure control for two-tank system with input — Limitation», in IECON 2017 - 43rd Annual Conference of the IEEE Industrial Electronics Society, Beijing: IEEE, oct. 2017, p. 5150-5155. doi: 10.1109/IECON.2017.8216890.

[5] Kelly, Rafael, Victor Santibáñez, and Antonio Loría. Control of robot manipulators in joint space. Vol. 693. London: Springer, 2005.

Enhanced Restarting PINN with Functional Link Artificial Neural Network on the Solution of Thermal Partial Differential Equation

Maharani A. Bakar and Danang A. Pratama

Faculty of Computer Science and Mathematics, Universiti Malaysia Terengganu, Kuala Nerus, Terengganu, 21030, Malaysia.
Special Interest Group Modelling and Data Analytics, Universiti Malaysia Terengganu, Kuala Nerus, Terengganu, 21030, Malaysia.
E-mail: maharani@umt.edu.my and p5564@pps.umt.edu.my

Abstract: Breast cancer is a serious health concern for women globally, spanning both developed and developing countries. One potential approach is to monitor observing abnormal surface temperatures as an early diagnostic treatment. In this research, The PDE thermal analysis is employed in terms of investigating the thermal behavior of the human breast. Physics-Informed Neural Networks (PINN) with a restarting strategy (r-PINN) is utilized to generate the numerical approximation of the PDE thermal. The restarting process monitors loss values, and if no improvement occurs, the method restarts with the best weights from the previous cycle. This ensures the efficiency of the convergence obtaining the smallest loss value, avoiding wasteful iterations. In fact, we combined the idea of the r-PINN method with a Functional Link Artificial Neural Network (FLANN). FLANN extends the r-PINN structure by introducing additional nonlinear transformations using Legendre polynomials function after the input layer. With this combination, we aim to demonstrate the effectiveness of this approach in accurately observing abnormal surface temperatures of the human breast, even in scenarios with limited sample points availability. The proposed method was compared to the basic r-PINN and PINN in terms of accuracy and efficiency. The research highlights the robustness and superiority of this approach, positioning it as a valuable tool for studying temperature behavior related to breast cancer.

Keywords: Breast cancer, PDE thermal analysis, r-PINN, FLANN, Legendre

Some new results on the coalition number

Noureddine Ikhlef Eschouf

Laboratory of Mathematics and its Applications (LaMA),
Faculty of Sciences, Medea University, Algeria
E-mail: nour_echouf@yahoo.fr

Abstract: Let $G = (V, E)$ be a simple graph of order n, and let V_1 and V_2 be two nonempty disjoint subsets of V. We say that V_1 and V_2 form a coalition in G if neither V_1 nor V_2 dominates G but their union $V_1 \cup V_2$ does dominate it. A vertex partition $\mathcal{P} = \{V_1, V_2, ..., V_k\}$ into $k \geq 2$ nonempty disjoint subsets of V is called a coalition partition, abbreviated c-partition, in G if every subset V_i in $\mathcal{P}$ is either a dominating set containing a single vertex of degree of $n - 1$, or it is not a dominating set but forms a coalition with another subset V_j. The coalition number of G, denoted $C(G)$, is the largest integer k for which G has a c-partition of cardinality k. This concept was introduced by Haynes et al. [1]. In this paper, we provide a new bound on the coalition number and we give exact values for some special graphs.
Keywords: Domination, vertex partition, coalition

References

[1] T.W. Haynes, J. T. Hedtniemi, S. T. Hedtniemi, A. A. McRae, R. Mohan, Introdution to coalitions in graphs, AKCE Int. J. Graphs combin. 17 (2), (2020) 653-659.

[2] T.W. Haynes, J.T. Hedetniemi, S.T. Hedetniemi, A.A. McRae and R. Mohan, Upper bounds on the coalition number, Austral. J. Combin. 80 (3) (2021), 442–453.

On independent [1,k]-set in graphs

Ahmed Bouchou

University of Medea, Algeria
E-mail: bouchou.ahmed@yahoo.fr

Abstract: For an integer $k \geq 1$, a subset $S \subseteq V$ in a graph $G = (V, E)$ is an independent $[1, k]$-set of G if S is independent and every vertex in $V - S$ is adjacent to one but no more than k vertices in S. The upper $[1, k]$-independence number noted $\alpha_{[1,k]}(G)$ is the maximum cardinality of an independent $[1, k]$-set of G. In this paper, we provide a constructive characterization of graphs having an independent $[1, k]$-set, while for split graphs, a necessary and sufficient condition is given for those having an independent $[1, k]$-set. Moreover, some upper bounds on $\alpha_{[1,k]}(G)$ are established for graphs having an independent $[1, k]$-set. We also establish a Nordhaus-Gaddum type result for the upper $[1, k]$-independence number, where in addition, a characterization of extremal graphs attaining each bound is provided. Finally, we show that the decision problem corresponding to the problem of computing the upper $[1, k]$-independence number is $\mathcal{NP}$-complete for bipartite and chordal graphs.

Keywords: Independent [1,k]-sets, upper [1,k]-independence number.

Mathematics Subject Classification: 05C69

References

[1] A. Bishnu, K. Dutta, A. Ghosh and S. Paul, (1,j)-set problem in graphs, Discrete Math., 339 (2016) 2515–2525.

[2] B. Chaluvaraju, M. Chellali and K. A. Vidya, Perfect k-domination in graphs, Australasian J. of Combin., 48 (2010) 175–184.

[3] M. Chellali, O. Favaron, T. W. Haynes, S. T. Hedetniemi and A. McRae. Independent [1,k]-sets in graphs, Australasian J. of Combin., 59(1) (2014) 144–156.

Analytical and Computational aspects on an Unreliable Retrial Queue with Two Distinct Customer Types

Mohamed Boualem, Nasreddine Dehamnia, and Djamil Aïssani

University of Bejaia, Faculty of Technology, Research Unit LaMOS, 06000 Bejaia, Algeria
University of Bejaia, Faculty of Exact Sciences, Research Unit LaMOS, 06000 Bejaia, Algeria
E-mail: mohammed.boualem@univ-bejaia.dz, nasreddine.dehamnia@univ-bejaia.dz, and djamil.aissani@univ-bejaia.dz

Abstract: Retrial queues serve as effective representations of numerous real-world scenarios, spanning from computer networks to telephone switching systems, telecommunications networks, and computer systems. This research delves into the analysis of a single server retrial queue, accommodating two distinct customer types: persistent and impatient. The model intricately accounts for diverse aspects of customer behavior and system dynamics, encompassing service times, retrial times, repair times, as well as specific reserved times for impatient customers only.

In order to refine the authenticity of the modeling approach, the study introduces novel concepts such as a service orbit and service repairs, activated in the event of server breakdowns. This innovative model holds promising applications across a spectrum of fields. The establishment of Chapman-Kolmogorov equations anchors the theoretical framework, while the application of the supplementary variables method facilitates the presentation of steady-state solutions. Furthermore, the provision of explicit closed-form expressions for various performance metrics aids in constructing an anticipated total cost function.

Supplementing the theoretical underpinnings, numerical results are presented to elucidate the impact of system parameters on both performance metrics and the total cost function.

s **Keywords:** Retrial queues, Markov chain, Performance metrics, Steady-state solutions

Mathematics Subject Classification: 90B22, 60K25

References

[1] Alem, L. M., Boualem, M., Aïssani, D., "Bounds of the stationary distribution in $M/G/1$ retrial queue with two-way communication and n types of outgoing calls", Yugoslav Journal of Operations Research, 29(3), pp. 375–391, 2019.

[2] Alem, L. M., Boualem, M. and Aissani, D., "Stochastic comparison bounds for an $M_1, M_2/G_1, G_2/1$ retrial queue with two way communication", Hacettepe Journal of Mathematics and Statistics, 48(4), pp. 1185–1200, 2019.

[3] Boualem, M., "Insensitive bounds for the stationary distribution of a single server retrial queue with server subject to active breakdowns", Advances in Operations Research, Article ID 985453, 12 pages, 2014.

[4] Hablal, H., Touche, N., Alem, L., Bouchentouf, A. A., Boualem, M., "Lower and upper stochastic bounds for the joint stationary distribution of a non-preemptive priority retrial queueing system", Hacettepe Journal of Mathematics and Statistics, 52(5), pp. 1438–1460, 2023.

[5] Zirem, D., Boualem, M., Adel-Aissanou, K., Aissani, D., "Analysis of a single server batch arrival unreliable queue with balking and general retrial time", Quality Technology & Quantitative Management 16, pp. 672–695, 2019.

Combination of approximation and statistical methods for the ruin probability assessment in risk models

Aicha Bareche and Zineb Harfouche

Research Unit LaMOS, University of Bejaia, 06000 Bejaia, Algeria
Faculty of Economics, Commercial and Management Sciences, University of Algiers 3, Algeria
E-mail: aicha.bareche@univ-bejaia.dz and zharfouche6@gmail.com

Abstract: We discuss in this work the benefit of combining some approximation methods (stability method, Markov chain and regenerative possesses) and statistical techniques (boundary kernel method and transformation kernel method) to enhance the ruin probability assessment in classical models presenting large claims. Numerical results based on simulation and insurance real data as well as comparative studies are presented to show the performance of our combined approach.

Keywords: Approximation, Kernel estimation, Stability, Risk model, insurance

Mathematics Subject Classification: 91B30, 34K20, 62G07

References

[1] Hocine, S. and Aïssani, D. and Bareche, A. and Benouaret, Z., "Application of Regenerative Processes Approach for the Approximation of the Ruin Probability in a Bivariate Classical Risk Model with Large Claims", Int. J. of Mathematics in Operational Research, 25(4), pp. 433-462, 2023.

[2] Harfouche, Z. and Bareche, A., "Semi-parametric approach for approximating the ruin probability of classical risk models with large claims", Communications in Statistics - Simulation and Computation, 2021.

[3] Bareche, A. and Cherfaoui, M., "Sensitivity of the Stability Bound for Ruin Probabilities to Claim Distributions", Methodology and Computing in Applied Probability, 21(4), pp. 1259-1281, 2019.

[4] Bareche, A. and Cherfaoui, M. and Aïssani, D., "Impact of the stability bound choice on the approximation of ruin probabilities", Journal Afrika Statistika, 11(2), pp. 983-993, 2016.

Solvability of a fractional boundary value problem involving Riesz fractional derivative

Rabah Khaldi and Assia Guezane-Lakoud

University of Badji Mokhtar-Annaba, Algeria
E-mail: rkhadi@yahoo.fr and a_guezane@yahoo.fr

Abstract: In this work, we study the solvability of a Riesz fractional boundary value problem. By reducing the considered problem to an equivalent singular integral equation, we provide the existence of solution via Krasnoselskii's fixed point theorem. Then, we give a new Lyapunov's inequality for the corresponding fractional boundary value problem.

Keywords: Riesz fractional derivative, existence of solution, fixed point theorem

Mathematics Subject Classification: 34A08, 26A33

References

[1] A. Guezane-Lakoud, R. Khaldi and D. F.M. Torres, Lyapunov-type inequality for a fractional boundary value problem with natural conditions, SeMA J. 75 (2018), no. 1, 157-162.

[2] R. Khaldi, A. Guezane-Lakoud, On a generalized Lyapunov inequality for a mixed fractional boundary value problem, AIMS Math. 4 (2019), no. 3, 506-515.

[3] R. Khaldi, A. Guezane-Lakoud, Lyapunov inequality for a boundary value problem involving conformable derivative, Prog. Frac. Diff. Appl. 3 (2017), no. 4, 323-329.

[4] A. M. Lyapunov, Problème général de la stabilité du mouvement, (French Translation of a Russian paper dated 1893), Ann. Fac. Sci. Univ. Toulouse 2 (1907), 27-247, Reprinted as Ann. Math. Studies, no. 17, Princeton, 1947.

[5] S.K. Ntouyas, B. Ahmad, and J. Tariboon, A Survey on Recent Results on Lyapunov-Type Inequalities for Fractional Differential Equations, Fractal and Fractional 6 (2022), no. 5, 273.

[6] S. Pichorides, On the best values of the constants in the Theorems of M. Riesz, Zygmundand and Kolmogorov, Studia Mathematica 44 (1972), no. 2, 165-179.

Optimizing a linear Fractional function over an integer efficient set of a Multi-Objective Linear Program

Younsi Née Abbaci Leila

Research Unit LaMOS, Faculty of Technology, University of Bejaia,
06000 Bejaia, Algeria
E-mail: leila.abbaci@univ-bejaia.dz

Abstract: Optimizing a linear function over a discrete efficient set problem studied by Jorge (2009) is extended in this paper to a nonlinear case. An algorithm is developed that maximize a ratio of two linear functions over the integer set of a multi-objective linear program (MOILP) without explicitly having to enumerate all the efficient solutions. The proposed exact method is based on a simple selection technique that improves the main linear fractional objective function Φ at each iteration while reducing the feasible region and eliminating dominated points. The optimal value of the function Φ is obtained in a finite number of steps of the algorithm. A numerical example illustrates the method.

Keywords: multiple objective programming, integer programming, linear fractional programming, efficient solutions

Mathematics Subject Classification: 90C29, 90C10

References

[1] A. Crema and J. Sylva, A method for finding the set of non-dominated vectors for multiple objective integer linear programs, European Journal of Operational Research, 158, pp. 46-55,(2004).

[2] Ecker, J.G., Song, H.G., 1994. Optimizing a linear function over an efficient set. Journal of Optimization Theory and Applications 83, 3, 541-563.

[3] Yamamoto, Y., 2002. Optimization over the efficient set: Overview, dedicated to Professor Reiner Horst on his 60th birthday. Journal of Global Optimization 22, 1-4, 285-317.

[4] Jorge, J.M., 2009. An algorithm for optimizing a linear function over an integer efficient set. European Journal of Operational Research 195, 1, 98-103.

Optimal Embedding of some new classes of Balanced Binary Trees in Hypercube

Kamal Kabyl

University of Bejaia, Faculty of Technology, Research Unit LaMOS, Bejaia, Algeria
E-mail: kamal.kabyl@univ-bejaia.dz

Abstract: The hypercube is a structure whose topology is used in different fields such as computer science, combinatorics, code theory, etc. The problem of embedding trees into the hypercube is much studied in the graph theory. In fact many efforts have been devoted to find sufficient conditions for which a tree T is a subgraph of the hypercube Q_n. The problem consists of giving the smallest dimension of the hypercube in which a given tree T is embeddable. In this paper, we introduced new classes of balanced binary trees and we determine their cubical dimension.
Keywords: Binary Tree, Cubical dimension, Embedding, Hypercube

References

[1] I. Havel and J. Morávek. *B-valuation of graphs*. [Czech. Math. J]. **22** (2) (1972), 338–351.

[2] L. Nebeský. *On cubes and dichotomic trees*. [Časopis Pěst. Mat]. **99** (2) (1974), 164–167.

[3] I. Havel. *On hamiltonian circuits and spanning trees of hypercubes*. [Časopis Pěst. Mat]. **109** (2) (1984), 135–152.

[4] S.A. Choudum and S. Lavanya.*Embedding a subclass of trees into hypercube*.[Discrete Math]. **311** (10-11) (2011), 866–871.

[5] K. Kabyl, A. Berrachedi and É. Sopena. *A note on the cubical dimension of new classes of binary trees*. [Czech. Math. J]. **65** (1) (2015), 151–160.

Modeling and fuzzy logic based nonlinear control of three-level grid-connected PV system with active filter functionality

Gouraya Benadjaoud, Kassa Idjdarene[1], Hocine Amimeur, Farid Hamoudi, Brahim Deffaf[2]

[1] *Laboratoire des technologies de l'information et de communication University of Bejaia 06000, Bejaia, Algeria*
[2]*Laboratoire de maitrise des énergies renouvelables University of de Bejaia 06000, Bejaia, Algeria*
E-mail: gouraya.benadjaoud@univ-bejaia.dz, kassa.idjdarene@univ-bejaia.dz,hocine.amimeur@univ-bejaia.dz, farid.hamoudi@univ-bejaia.dz,brahim.deffaf@univ-bejaia.dz

Abstract: This paper presents the modeling and fuzzy logic based nonlinear control of three-level single-stage PV system connected to the grid. The T-type inverter is used in this paper instead of conventional NPC one, which would increase the efficiency of system and ensure power quality. The control is designed for the inverter to act simultaneously as power converter and active power filter, if nonlinear loads are connected to the point of common coupling. To achieve these tasks with a good dynamic performance, a nonlinear control strategy based on the fuzzy logic controller is developed based, with a suggested adequate approach of setting the scaling factors, based on linear approximation to the proportional-integral controller, which considerably affect the system's response. The obtained results using numerical simulations confirmed the expected performances of the proposed control, in term of maximum power extracting, power quality and unity power factor. Furthermore, these performances are more highlighted when compared to the PI controller during the dynamic state.

Keywords: Grid-connected PV system modeling, Fuzzy logic control design, Active power filtering

References

[1] AQ. Al-Shetwi, MA. Hannan, KP. Jern, AA. Alkahtani. *Power quality assessment of grid-connected PV system in compliance with the recent integration requirements.* Electronics, Vol. 09, no. 2, February 2020.

[2] A. Salem and M. A. Abid, *T-Type Multilevel Converter Topologies: A Comprehensive Review.* Arabian Journal for Science and Engineering, Vol. 44, pp. 1713–1735, 2019.

[3] B. Deffaf, F. Hamoudi, N. Debdouche, Y. Ayachi Amor and S. Medjmadj. *Super-twisting Sliding Mode Control for a Multifunctional Double Stage Grid-connected Photovoltaic System.* Advances in electrical and electronic engineering, Vol. 20, no. 3, pp. 240-249, September 2022.

[4] R. Noroozian and G. B. Gharehpetian. *An investigation on combined operation of active power filter with photovoltaic arrays.* International Journal of Electric Power and Energy Systems, Vol. 41, no. 1, pp 392-399, 2013.

[5] S. Echalih, A. Abouloifa, I. Lachkar, A. El-Aroudi, Z. Hekss, F. Giri and M. S. Al-Numay. *A Cascaded Controller for a Grid-Tied Photovoltaic System With Three-Phase Half-Bridge Interleaved Buck Shunt Active Power Filter: Hybrid Control Strategy and Fuzzy Logic Approach.* IEEE Journal on Emerging and Selected Topics in Circuits and Systems, Vol. 12, no. 1, pp. 320-330, 2022.

[6] H. A. Mosalam, R. A. Amer and G. A. Morsy. *Fuzzy logic control for a grid-connected PV array through Z-source-inverter using maximum constant boost control method.* Ain Shams Engineering Journal, Vol. 9, no. 4, pp. 2931-2941, 2018.

Using least-squares adjustments to analyse nuclear data from AME2020

Djelloul Benzaid, Salaheddine Bentridi, Abdelkader Kerraci, Naima Amrani

University of KHEMIS MILIANA, Algeria,
Ferhat ABBAS University, Algeria
E-mail: d.benzaid@univ-dbkm.dz, s.bentridi@univ-dbkm.dz,
a.kerraci@univ-dbkm.dz,naima.maiza@univ-setif.dz

Abstract: In the present work, least-squares adjustments have been used to analyse nuclear data from the Atomic Mass Evaluation 2020 with the aim of determining the coefficients of the classical Bethe-Weizsäcker mass formula. The obtained set of formula coefficients allowed us to reproduce almost all the experimental values of the binding energies for each nucleus with $A > 50$. The comparison between the binding energies provided with the updated mass formula and those of AME2020 shows relative errors oscillating between 0.05% and 1.5%. The revisited Bethe-Weizsäcker formula is in very good agreement with experimental data.

Keywords: least-squares adjustments, AME2020, Binding Energy of atomic nuclei, Mass formula parameters.

References

[1] B. Demidovitch, I. Marov, *Eléments de calcul numérique*. (MIR, Moscow, 1973), pp. 272–281.

[2] C.F. von Weizsäcker. *Zur theorie der kernmassen. Z. Phys. A Hadrons Nuclei 96, 431–458 (1935)*. https://doi.org/10.1007/BF01337700.

[3] Huang, W. J., Wang, M., Kondev, F. G., Audi, G., and Naimi, S. (2021). *The AME2020 atomic mass evaluation (I). Evaluation of input data, and adjustment procedures*. Chinese Physics C, 45(3), 030002.

[4] Wang, M., Huang, W. J., Kondev, F. G., Audi, G., and Naimi, S.(2021). *The AME2020 atomic mass evaluation (II). Tables, graphs and references*. Chinese Physics C, 45(3).

Enhancing the Remaining Useful Life Prediction of Lithium-Ion Batteries Using Deep Learning Approaches

Tahar Boukra and bilel Ayachi

Laboratoire Electrotechnique Skikda – LES,
Department of Electrical Engineering, University 20 August 1955 Skikda, Algeria
E-mail: t.boukra@univ-skikda.dz

Abstract: Lithium-ion batteries occupy an important place in realm of renewable energy and e-mobility due to their unique advantages offering higher energy density and low self-discharge. Many well-known aging sources of Li-ion batteries contribute to their degradation impacting the reliability and safety of battery-powered systems. An effective way to indicate the health of lithium-ion batteries is to predict the remaining useful life (RUL) to schedule maintenance, optimize operating efficiency, and avoid unplanned downtime. The experimentation with aging Li-ion battery sources and their mathematical description for life-prediction models are still challenging issues. Data-driven methods have gained popularity due to their flexibility and ease of use. In this context, we have proposed a Transformer based neural network model benefiting from its good capture to long-time dependencies by an attention mechanism to improve the accuracy and performance of the RUL prediction and benchmarked the results to other existing deep learning models using a set of evaluation metrics. The proposed model gives better prediction results. These models are validated using publicly available datasets.

Keywords: Lithium-ion batteries, State of Health Estimation, Prognostic and Health Management, Data-driven Machine Learning, Artificial Neural Networks, Deep Learning, Long Short Term Memory Recurrent Neural Network, Transformer

References

[1] A. Vaswani, N. Shazeer, N. Parmar, J. Uszkoreit, L. Jones, A. N. Gomez, Ł. Kaiser, and I. Polosukhin, "Attention is all you need", Advances in Neural Information Processing Systems (NIPS), pp. 5998–6008, 2017.

[2] S. Wang, S. Jin, D. Bai, Y. Fan, H. Shi, C. Fernandez, "A critical review of improved deep learning methods for the remaining useful life prediction of lithium-ion batteries", Energy Reports, 7, pp. 5562–5574, 2021.

[3] K. Luo, X. Chen, H. Zheng, Z. Shi "A review of deep learning approach to predicting the state of health and state of charge of lithium-ion batteries "Journal of Energy Chemistry, 74, pp. 159–173, 2022.

[4] P. Li, Z. Zhang, R. Grosu, Z. Deng, J. Hou, Y. Rong, R. Wu, "An end-to-end neural network framework for state-of-health estimation and remaining useful life prediction of electric vehicle lithium batteries ", Renewable and Sustainable Energy Reviews, 156, 2022, 111843

[5] A. Zhang, Z. C. Lipton, M. Li, and A. J. Smola, "Dive into Deep Learning" Jul 28, 2022

[6] Y. Mo, Q. Wu, X. Li, B. Huang, "Remaining useful life estimation via transformer encoder enhanced by a gated convolutional unit", Journal of Intelligent Manufacturing, pp. 1-10, 2021.

[7] L. Driscoll, S. de la Torre, J. Antonio Gomez-Ruiz, "Feature-based lithium-ion battery state of health estimation with artificial neural networks ", Journal of Energy Storage, 50, 2022, 104584.

[8] B. Saha and K. Goebel, "Battery data set," NASA Ames Prognostics Data Repository, NASA Ames Research Center, Moffett Field, CA, 2008.

Existence results for a strongly nonlinear elliptic system in Sobolev spaces with variable exponent

Samira Lecheheb

Laboratory of Applied Mathematics and History and Didactics of Mathematics "LAMAHIS", Department of Mathematics, University of 20 August 1955, Skikda, Algeria
E-mail: lecheheb.samira24@gmail.com

Abstract: In this work, we study the existence of a distributional solution for a strongly nonlinear $(p(x), q(x))$-elliptic system. By means of the Berkovits degree theory, with suitable assumptions on the nonlinearities, we establish the existence of a nontrivial solution to our problem.

Keywords: Topological degree, Strangly nonlinear elliptic system, p(x)-Laplacian.Sobolev spaces

References

[1] M. Ait Hammou, E. Azroul , *Existence result for a nonlinear elliptic problem by topological degree in Sobolev spaces with variable exponent*, Moroccan J. of Pure and Appl. Anal. (MJPAA), 7(1): 50-65, 2021.

[2] X.L Fan, Q.H. Zhang, *Existence of solutions for $p(x)-$Laplacian Dirichlet problem*, Nonlinear Anal., 52(8): 1843-1852, 2003.

[3] S. Lecheheb and A. Fekrache, *Topological degree methods for a nonlinear elliptic systems with variable exponents*, Stud. Univ. Babe¸s-Bolyai Math., In Press.

A Method for Solving a Multicriteria Bilinear Game

Noureddine Khimoum

University of Bejaia, Faculty of Exact Sciences, Research Unit LaMOS, Dept. of Operational Research, Bejaia, 06000 Algeria
E-mail: nouredine.khimoumr@univ-bejaia.dz

Abstract: In this work, we present a procedure to find a Pareto-Nash equilibria in multicriteria bimatrix game corresponding to the Nash equilibria of a scalarized bimatrix game. For this, we used the method of "H. Benson" to solve a first multicriteria program and obtain an effective extreme point with the vector weight associated with this solution that we use to solve a second multicriteria linear program and obtain an extreme point effective with the associated weight vector. The two weight vectors are used to scalarize the original multicriteria game, that we solve by an algorithm for enumerating the extremes Nash equilibria. The resolution of the scalarized bimatrix game provides the set of Nash equilibria which corresponds to the set of Pareto-Nash equilibria in the original multicriteria bimatrix game.

Keywords: Multiobjective Linear Programming, Bimatrix Games, Benson's Procedure

Mathematics Subject Classification: 65Kxx, 91A05

References

[1] Novikova, N.M.; Pospelova, I.I. "Applying the Linear Scalarization in Multicriteria Maximin Problems", Moscow Univ. Comput. Math. Cybern. 45, pp. 71-80, 2021.

[2] Voorneveld, M.; Vermeulen, D.; Borm, P. "Axiomatizations of Pareto Equilibria in Multicriteria Games", Games Econ. Behav. 28, pp. 146-154, 1999.

[3] Corley, H.W. "A Regret-Based Algorithm for Computing All Pure Nash Equilibria for Noncooperative Games in Normal Form", Theor. Econ. Lett. 10, pp. 1253-1259, 2020.

[4] Ghose, D. and Prasad, U.R. "Solution concepts in two-person multicriteria games", J. Optim. Theory Appl. 63, pp. 167-189, 1989.

[5] Antipin, A.S.; Vasil'ev, F.P.; Delavarkhalafi, "A. Regularization methods with penalty functions for finding Nash equilibria in a bilinear nonzero-sum two-person game", Comput. Math. Math. Phys. 45, pp. 783-793, 2005.

An Efficient Simplex Algorithm for Training SVM Classification Problems

Belkacem Brahmi

LaMOS Unit Research, Department of Operations Research, University of Bejaia, 06000, Bejaia, Algeria
E-mail: belkacem.brahmi@univ-bejaia.dz

Abstract: Solving large-scale support vector machine (SVM) problems is a challenging task. Traditional classification SVM problems are formulated as a convex quadratic programming (QP) problem with bounded variables. We propose to tackle this QP using a novel Simplex algorithm, named SMQP-SVM. By introducing a new concept, called working-basis, the structure of an iteration of SMQP-SVM will be further simplified. It generates a decreasing sequence of basic feasible points that converges to the global optimal solution. SMQP-SVM algorithm has the particularity to avoid using the null-space matrix, which invokes the reduced Hessian matrix when the descent direction is calculated at each iteration. The proposed working-basis selection scheme employes the second-order information, prevents degeneracy cases, and guarantees the nonsingularity of the working-basis matrix throughout all iterations.
In order to evaluate the performance of our SMQP-SVM solver over the state-of-the-art solvers, like LIBSVM implementing the sequential minimal optimization (SMO) algorithm and the revised simplex method (SVM-RSQP), we have performed numerical experiments on several datasets. Comparison results show that our approach SMQP-SVM is efficient when solving large-scale SVM problems.

Keywords: Support vector machines, quadratic programming, simplex method, working-basis

Mathematics Subject Classification: 90C20, 68T09

References

[1] N. Cristianini, J. Shawe-Taylor, "Introduction to Support Vector Machines and other kernel-based learning methods", Cambridge University Press, United Kingdom, 2000.

[2] S. Djemai, B. Brahmi, M. O. Bibi," A primal-dual method for SVM training", Neurocomputing 211, pp. 34-40, 2016.

[3] R. Gabasov, F. M. Kirillova, V. M. Raketsky, "On methods for solving the general problem of convex quadratic programming", Soviet. Math. Dokl. 23, pp. 653-657, 1981.

[4] P. Wolfe, "The simplex method for quadratic programming", Econometrica, 27, pp. 382-398, 1959.

[5] B. Brahmi, M. O. Bibi, "Dual support method for solving convex quadratic programs", Optimization 59, pp. 851-872, 2010.

[6] C. Sentelle, G. C. Anagnostopoulos, M. Georgiopoulos, "Efficient revised simplex method for SVM training", IEEE Transactions on Neural Networks, 22, pp. 1650-1661,2011.

An inverse problem of determining a time-dependent coefficient in a time-fractional reaction-diffusion equation with involution and periodic boundary conditions

Brahim Nouiri, Salaheddine Lamine

Laboratory of Pure and Applied Mathematics, Faculty of Mathematics and Computer Science, University of M'sila, PO Box 166 Ichebilia, 28000 M'sila, Algeria.
Laboratory of Pure and Applied Mathematics, Faculty of Mathematics and Computer Science, University of M'sila, PO Box 166 Ichebilia, 28000 M'sila, Algeria.
E-mail: brahim.nouiri@univ-msila.dz,salaheddine.lamine@univ-msila.dz

Abstract: In this paper, we study an inverse problem of determining a time-dependent coefficient in one-dimensional time-fractional reaction-diffusion equation with involution. The time-fractional derivative is described in the conformable sense. The direct problem is the initial-boundary value problem for this equation with usual initial and periodic boundary conditions. To determine the unknown time-dependent coefficient, we consider with additional measurement condition at the point $x = 0$ of the reaction-diffusion process. Under some assumptions on the input data, the well-posedness of this inverse time-dependent coefficient problem is shown by using Fourier's method and Banach's fixed point theorem. Furthermore, we propose a numerical algorithm based on a collocation method and a finite-difference scheme to solve this inverse problem. Finally, some numerical examples are presented to confirm the reliability and effectiveness of this numerical algorithm.

Keywords: Inverse time-dependent coefficient problem, Fourier's method, Banach's fixed point theorem, Collocation method, Finite-difference scheme.

References

[1] T. Abdeljawad. On conformable fractional calculus. *J. Comput. Appl. Math.*, 279:57–66, (2015).

[2] N. Al-Salti and M. Kirane and B.T. Torebek, On a class of inverse problems for a heat equation with involution perturbation, *Hacet. J. Math. Stat.*, 48 (3), 669 – 681 (2019).

[3] R. Khalil and M. AlHorani, A. Yousef, and M. Sababheh. A new definition of fractional derivative. *J. Comput. Appl. Math.*, 264:65-70, (2014).

[4] M. Kirane and N. Al-Salti, Inverse problems for a nonlocal wave equation with an involution perturbation, *J. Nonlinear Sci. Appl.* 9, 1243–1251, (2016).

[5] B.T. Torebek and R. Tapdigoglu, Some inverse problems for the nonlocal heat equation with Caputo fractional derivative, *Math. Methods Appl. Sci.* 40, 6468–6479, (2017).

[6] B. Nouiri and S. Abdelkebir, A numerical approach of the space-time-fractional telegraph equations with variable coefficients, Palest. J. Math., to appear.

[7] S. Abdelkebir and B. Nouiri, An efficient algorithm for solving the conformable time-space fractional telegraph equations, Moroccan J. of Pure and Appl. Anal. (MJPAA), 7(3), 413-429, (2021).

[8] Durdimurod DURDIEV, Dilshod DURDIEV, An inverse problem of finding a time-dependent coefficient in a fractional diffusion equation, Turk. J. Math., 47, 1437-1452, (2023).

[9] A. Cabada and A.F. Tojo, Equations with involutions, Atlantis Press, 2015.

On the existence of the Berge equilibrium in the non-cooperative Bayesian game

Karima Bouibed and Aicha Anzi

LaMOS Research Unit, Operational Research Department University of Bejaia, 06000 Bejaia, Algeria.
E-mail: karima.bouibed@univ-bejaia.dz and aicha.anzi@univ-bejia.dz

Abstract: In this work, we study a class of static non-cooperative games with incomplete information introduced by Harsanyi [3], which is Bayesian games, we introduced the definition of the Berge equilibrium for a Bayesian game. By using Bayes' formula, we have simplified the definition initially introduced by Berge [1]. Based on the Shauder's fixed point theorem [5] used in the study of the problem of existence of the Bayesian Nash equilibrium and those used in the problem of existence of the Berge equilibrium for a game in normal form, we have established sufficient conditions for the existence of the Bayesian Berge equilibrium. To illustrate the obtained results some examples are given.

Keywords: Game theory, Bayesian game, Nash equilibrium, Berge equilibrium, Shauder fixed point theorem.

Mathematics Subject Classification: 91Axx, 91A10, 91A06

References

[1] C. Berge: Théorie générale des jeux à n personnes. Paris, 1957.

[2] K. Bouibed. La théorie des jeux bayesiens. Mémoire de Magister, Université Mouloud Mammeri de Tizi-Ouzou, 2009

[3] J.C. Harsanyi. Game with incomplete information played by "Bayesian" players, I. The basic model. Management science 14, 317-334, 1967.

[4] A. Meirowitz. On the existence of equilibria to Bayesian games with non finit type and action space. Economics Letters 78,213-218, 2003.

[5] E. Zeilder. Non linear functional analysis and its applications, fixed point theorem, Springer -Verlag; New York Berlin Heudeberg London Paris Tokyo Hon Kong Barcelona Budapest, 1993.

A New Complex Number Definition: Distinct Imaginary Numbers

Mehmet Pakdemirli

Güzelyurt Mah, 5789 Sk, Yunusemre, Manisa, Turkey
E-mail: pakdemirli@gmail.com

Abstract: A new base complex number is defined. To distinguish it from the usual complex number i, the name "distinct imaginary number" is proposed with a shorter referral of "dimaginary number" and symbol j. The complex number with this new base included can be referred to as dicomplex numbers (distinct complex numbers) accordingly. Based on the new definition, the basic arithmetic operations are handled first. Taylor series expansions with the new complex number are given next. Application areas such as finding roots of polynomials, analytical geometry in three and higher dimensional spaces are discussed. The new definition extends the usual two-dimensional complex plane into three and higher dimensional spaces.

Keywords: complex numbers, roots of polynomials, Taylor series expansions, analytical geometry

References

[1] Benifez, J., Gimenez, M. H., Hueso, J. L., Martinez, E. and Riera J. *Design and use of a learning object for finding complex polynomial roots*. International Journal of Mathematical Education in Science and Technology, 44(3):365–376, 2013.

[2] Kalantari, B. and Lee, E. H. *Newton-Ellipsoid polynomiography*. Journal of Mathematics and the Arts, 13(4):336–352, 2019.

[3] Kenichi, H. *Continuity of the roots of a polynomial*. The American Mathematical Mountly, 127(4):359–363, 2020.

[4] Roy, S. C. D. *A semi-analytical method for finding the roots of a polynomial*. IETE Journal of Education, 55(2):90–93, 2014.

Estimation of the regression function using the asymmetric kernel method

Lamia Djerroud

University of Bejaia, Research Unit LaMOS, Bejaia, Algeria
E-mail: lamia.djerroud@univ-bejaia.dz

Abstract: In statistics, regression plays an important role in extracting the relationship between two random variables, *X* and *Y*. Generally, parametric regression is utilized to derive and evaluate this relationship. However, this type of estimation cannot be universally applied, leading to the use of nonparametric estimation in certain cases. The kernel method is one such nonparametric estimation method, initially defined for symmetric data, which presents challenges in its application to asymmetric data. This research aims to investigate nonparametric regression using associated kernel methods in cases involving positive real data. We applied this estimation using Gamma and Beta kernels, and for other kernels, we assessed the performance of the estimation through simulation studies. Finally, we applied the proposed estimators to real data.

Keywords: Non parametric regression, Asymmetric associated kernel, Continuous univariate kernel

References

[1] Chen Song Xi. *Local linear smoothers using asymmetric kernels.* Annals of the Institute of Statistical Mathematics. 54, 312-323, 2002.

[2] Chen Song Xi. *Probability density function estimation using gamma kernels.* Annals of the Institute of Statistical Mathematics 52, 471-480, 2000.

[3] Shi Jianhong and Weixing Song. *Asymptotic results in gamma kernel regression.* Communications in Statistics-Theory and Methods 45(12), 3489-3509, 2016.

Augmented truncation approximations of discrete-time Markov chains

Badredine Issaadi

Laboratoire LITAN
École supérieure en Sciences et Technologie de l'Informatique
et du Numérique
RN 75, Amizour 06300, Bejaia, Algérie.
E-mail: issaadi@estin.dz

Abstract: Calculating the stationary distribution for a stochastic infinite matrix is typically challenging and lacks closed-form solutions. Therefore, it's advantageous to have simple approximations that quickly converge to this distribution. Suppose P represents the transition matrix of a discrete Markov chain on $\mathcal{S}$ with an invariant distribution π. Consider a sequence $\mathcal{S}_k$ within $\mathcal{S}$. We aim to find methods for approximating π using P_k, where P_k is obtained from the linear augmentation of the $(k+1)\times(k+1)$ "northwest truncation" of P. Let $V : \mathcal{S} \to [1, +\infty)$. In this work, an explicit bounds are obtained for the distance between $\widehat{\pi}_k$ and π. Finding such computable bounds is of practical importance, which enables one to determine the needed truncation size. For this, we extend the result of Hervé and Ledoux [1]. For V-geometrically ergodic chains, computable upper bounds have been derived. These bounds seem a little complex for direct application, however, they are improved and become applicable even for stochastically monotone chains. We then establish a bound for $|\pi f - \widetilde{\pi} f|$ for any f integral performance measure. Finally, we give a random walk example to illustrate the application of these bounds.

Keywords: Truncation, Queuing System, Weak Stability, Markov chain and Algorithm.

References

[1] HERVÉ, L. AND LEDOUX, J. (2014). Approximating Markov chains and V-geometric ergodicity via weak perturbation theory. *Stochastic Process. Appl.*, 124:613–638.

[2] B. ISSAADI (2020) Weak stability bounds for approximations of invariant measures with applications to queueing. *Methodol Comput Appl Probab*, 22:371-400.

[3] TWEEDIE, R. L. (1998). Truncation approximations of invariant measures for Markov chains. *J. Appl. Probab.*, 35(3):517–536.

Econometric modeling of olive oil production in Bejaia from 2000 to 2021

Kheira Mecheri[1*], **Djamila Zirem** [2**]

[1]*Skikda, Algeria*
[2]*Kobba, Algeria*
E-mail: kheira.mecheri@univ-bejaia.dz*, ziremdjamila@yahoo.fr**

Abstract: Agriculture in Algeria has a large part of the land and it has an important role in the transformation of the environment by man who has shaped the landscape and natural ways of life over the centuries.
Algerian agriculture has seen the application of a new policy since the 2000s, with the aim of encouraging investment in production sectors.
Olive growing is one of the activities practiced in the Algerian mountains. It is characterized by a wide range of 36 varieties in the Willaya of Bejaia.
The production of olive oil depends on several factors, including the existence of olive plantations, the quality and quantities of the olives harvested, as well as the use of modern techniques.
The aim of this paper is to model the production of Bejaia olive oil according to different factors, namely the surface area and the number of trees. This is why we used econometric method of analysis. This article is divided in two parts.
In the first part we built the regression model for the independent variable by estimating the model parameters using the ordinary least squares method.
The second part will be devoted to testing the significance of different parameters and validating our model, using the Eviews software.

Keywords: Agriculture, olive oil, multiple linear regression, statistical tests.

References

[1] R. Bourbonnais. *econometrics*, Ed Dunod, in Helene Hamisultane, 2000.

[2] GAUTHIER de VILLERS. *Létat et la révolution agraire en Algérie* . Revue des sciences politiques, Paris, 1980.

[3] D. N. GUJARAT, *econometrics of boeck university*, Paris, 2004.

[4] K. MECHERI and D. ZIREM. *Climate change impact on Bejaia citrus production from 1983 to 2016*. ICMS'18, Turquie, 2018.

Reliability analysis of the unreliable server and impatient customers

Djamila Zirem[1], **Kheira Mecheri**[2]

[1]*LaMOS Unite of recherche, University of Algiers 3, Algeria*
[2]*LMA Applied Mathematics Laboratory, University of Bejaia, Algeria*
E-mail: zirem.djamila@univ-alger3.dz,kheira.mecheri@univ-bejaia.dz

Abstract: Retrial queuing systems have been widely used to model many practical and real problem arising in telephone switching systems, telecommunication networks, computer systems, and production inventory systems, etc.
The main characteristic of these queues is that the customers who find the server busy upon arrival joins the retrial group called orbit in order to repeat this request for service after some random time.

In various domains ranging from customer service centers to transportation systems, queues are ubiquitous phenomena that significantly affect operational efficiency and customer satisfaction. Understanding the reliability of queues becomes paramount, particularly in scenarios where arrivals occur in groups and customers may become discouraged due to prolonged waiting times.
The main of this work is to investigate some reliability indices of the unreliable sever, bath arrival and impatient customers. We derive reliability indices from the queuing system under study, such as the availability Av and failure frequency Ff of the server. Which will provide the information required from the improvement of the system. To justify and validate the analytical results.

Keywords: Reliability, bath arrival, impatient customers, unreliable server.

References

[1] G. Choudhury, C. R Kalita. *An M/G/1 queue with two types of general heterogeneous service and optional repeated service subject to server's breakdown and delayed repair*. Quality Technology& Quantitative Management, 15, 622–654, 2017.

[2] D. Zirem, M. Boualem, and D. Aïssani. $M^X/G/1$ *queueing system with breakdowns and repairs*. International Journal of Advances in Computer Science & Its Applications, 6, 18–21,2016.

Boundary control of a viscoelastic flexible marine riser with nonlinear Terms

L. Seghour, N.-e. Tatar and A. Berkani

University of Sciences and Technology Houari Boumediene, Faculty of Mathematics, Algiers, Algeria.
E-mail: seghour.lamia@gmail.com

Abstract: In this work, we investigate the boundary stabilization of a flexible marine riser problem with nonlinear Terms. We prove a stability result which depends on the properties of the riser. This is established through the judicious choice of a control acting on top of the riser. We use the multiplier technique to prove stability result.

In this work we stabilize the system by using a viscoelastic material and an appropriate boundary control. The model is

$$\begin{cases} \rho w_{tt} + EI(w_{xxxx} - \int_0^t h(t-s)w_{xxxx}(s)ds) - Tw_{xx} + |w|^p w = 0 \\ \forall (x,t) \in (0,L) \times [0,\infty), \\ w(0,t) = w_x(0,t) = w_{xx}(L,t) = 0,\ t \in [0,\infty), \\ w(x,0) = w_0(x),\ w_t(x,0) = w_1(x),\ x \in [0,L], \\ EI\left(-w_{xxx}(L,t) + \int_0^t h(t-s)\, w_{xxx}(L,s)\, ds\right) + Tw_x(L,t) \\ = u(t) - d_S w_t(L,t) - M_S w_{tt}(L,t),\ \forall t \in [0,\infty), \end{cases} \tag{0.1}$$

where $w(x,t)$, T, EI represent the displacement, the tension and the bending stiffness of the riser respectively, the parameters: d_s, M_S, $w_t(L,t)$ represent the damping, the mass and the velocity of the vessel respectively, the uniform mass per unit length of the riser is the parameter $\rho > 0$, $w(L,t)$ is the position of the vessel and L denotes the length of the riser.
The dynamics of the flexible riser is indicated by the partial differential equation of system (0.1) and the ordinary differential equation describes the vessel dynamics. At the top boundary of the riser, a boundary control is proposed. It is important to mention that due to the infinite dimensionality of the system (P.D.E), it is difficult to control the dynamics of a flexible mechanical system. If the diameter to the length of the riser is small, we can represent the marine riser as an Euler–Bernoulli beam structure. We refer the reader to [3]-[4] and [6]-[10] where the authors used this structure to study the dynamic of a flexible marine riser. Following the ideas introduced in [5], we prove a stability result for the system.

Keywords: Boundary control, multiplier technique, Euler- Bernoulli beam structure, viscoelasticity.

Mathematics Subject Classification: 35L20, 93D15, 93D20.

References

[1] A. Berkani, N.-e. Tatar & L.Seghour (2018): Stabilization of a viscoelastic flexible marine riser under unknown spatiotemporally varying disturbance, International Journal of Control, DOI: 10.1080/00207179.2018.1518596.

[2] He W, Ge SS, How BVE, Choo YS, Hong KS. Robust adaptive boundary control of a flexible marine riser with vessel dynamics. Automatica. 2011;47:722-732.

[3] L. Seghour, A. Berkani, N.-e Tatar and F. Saedpanah (2018) : Vibration control of a viscoelastic flexible marine riser with vessel dynamics, Mathematical Modelling and Analysis 23(3) DOI:10.3846/mma.2018.026.

[4] L. Seghour, A. Khemmoudj & N.-e. Tatar (2015): Control of a riser through the dynamic of the vessel, Applicable Analysis: An International Journal, DOI: 10.1080/00036811.2015.1080249.

[5] N.-e. Tatar, How to deal with nonlinear terms in the non-dissipative case, ADJM. Vol 14, Number 1, pp. 39-53 (2012).

[6] N.-e. Tatar, On a perturbed kernel in viscoelasticity. Appl. Math. Lett. 2011;24:766-770.

[7] M. Patel and A. Jesudasen, Theory and model tests for the dynamic response of free hanging risers, J. Sound Vibration. Vol. 112, No. 1, pp. 149–166 (1987).

[8] R. D. Young, J. R. Fowler, E. A. Fisher, and R. R. Luke, Dynamic analysis as an aid to the design of marine risers, ASME, J. Pressure Vessel Technol, vol. 100, pp. 200-205 (1978).

Mann's stochastic approach for estimating parameters of the Black-Scholes model

Baya Takhedmit[1*], Massissa Soufit[2]**

[1]*LAMA, University of Bejaia, Algeria*
[2]*Lamos Research Unit, Mathematics Department, University of Bejaia, Algeria*
E-mail: bahia.barache@univ-bejaia.dz*, baya.takhedmit@univ-bejaia.dz*,massinissa.soufit@univ-bejaia.com**

Abstract: A new fixed point method is proposed for estimating volatility in the Black-Scholes model. This approach incorporates Mann's stochastic algorithm, enabling efficient iteration to achieve precise estimations. In this work, we explore the use of this method to determine the implied volatility of options.

To demonstrate the effectiveness of our approach, we conduct an empirical study applying our method to real market data, particularly to the prices of European call options. This application showcases how Mann's algorithm can adapt to real market situations and provide reliable estimates of implied volatility.

Keywords: Black-Scholes model; Volatility; Mann's stochastic approach

References

[1] A. Cegielski *Iterative Methods for Fixed Point Problems in Hilbert Spaces*. Springer, 2012.

[2] F. Black and M. Scholes. *The pricing of options and corporate liabilities*. J. Pol. Econ., 81:637-659, 1973.

A Parametric Uncertainty Analysis Based on Bayesian Approach

Katia Bachi and Karim Abbas

Research Unit LaMOS (Modeling and Optimization of Systems), Dept. of Informatics. Faculty of Exact Sciences, Bejaia University, Campus of Targua Ouzemour, Bejaia 06000, Algeria.
and Research Unit LaMOS (Modeling and Optimization of Systems), Dept. of Operational Research Faculty of Exact Sciences, Bejaia University, Campus of Targua Ouzemour, Bejaia 06000, Algeria.
E-mail: katia.bachi@univ-bejaia.dz and karim.abbas@univ-bejaia.dz

Abstract: A Bayesian approach for computing model output metrics under epistemic uncertainty in the model input parameters is proposed. Specifically, we compute the expected value and the variance of the stationary distribution associated with Markov reliability models. Numerical results are presented and compared to the corresponding Monte Carlo simulations ones.

Keywords: Epistemic uncertainty, Bayesian approach, Markov reliability model

References

[1] **A. Gandini**, *Importance and sensitivity analysis in assessing system reliability*, IEEE Transactions on Reliability, (1990), 39, 61-70.

[2] **K. Bachi, K. Abbas and B. Heidergott**, *Statistical Taylor series expansion : An approach for epistemic uncertainty propagation in Markov reliability models*, RAIRO-Oper. Res. 55 (2021) S593-S624, (2019).

[3] **K. Bachi, K. Abbas and B. Heidergott**, *Propagation of epistemic uncertainty in queueing models with unreliable server using chaos expansions*, Communications in Statistics - Simulation and Computation, (2019).

[4] **K. Mishra and K.S. Trivedi**, *Uncertainty propagation through softawre dependability models*, In Software Reliability Engineering (ISSRE), 2011 IEEE 22nd Annual International Symposium on, (2011), 80-89.

Bimodal Biometric Identification Based on the Fusion of Finger Veins and Finger Knuckle Print

Youcef Brik [1*], Bilal Attallah[2]**

[1]*Faculty of technology, University Mohamed Boudiaf of M'sila, M'sila, Algeria*
[2]*Faculty of technology, University Mohamed Boudiaf of M'sila, M'sila, Algeria*
E-mail: youcef.brik@univ-msila.dz*, bilal.attallah@univ-msila.dz**

Abstract: Multimodal biometrics, which consists of combining several biometric indicators by personal identification systems, has received increasing research interesting for biometric recognition due to several advantages. In fact, this approach reduces certain limitations of unimodal biometric systems, such as the lack of data extracted from certain people or intentional fraud. At this level, the multimodal biometric systems can represent an efficient alternative by merging several biometric indicators. In this paper, we propose an automatic identification of people through their biometric data. To this end, we use two biometric modalities, the Finger Veins (FV) and the finger knuckle print (FKP), to perform our biometric system. A set of textural features, such as Local Binary Pattern (LBP), Binarized Statistical Image Features (BSIF), Radon and Gabor, are applied on the images of these two modalities in order to extract the feature vectors. Then, Support Vector Machines (SVM) is involved to classify the combined vectors into the right classes. Our system combines the advantages of each modality for getting a robust and an accurate recognition system. The experiments conducted on FKP and FV fingerprint datasets showed that our system provides excellent results in terms of recognition rate and precision. The comparison with the state-of-the-art-method demonstrates also the superiority of the proposed system.

Keywords: Multimodal Biometrics, Finger Veins, Finger Knuckle Print, Fusion, Support Vector Machines.

References

[1] Li, S., Fei, L., Zhang, B., Ning, X., and Wu, L. (2024). *Hand-based multimodal biometric fusion: A review*. Information Fusion, 102418.

[2] Al-Mahafzah, H., AbuKhalil, T., Alksasbeh, M., and Alqaralleh, B. (2023). *Multi-modal palm-print and hand-vein biometric recognition at sensor level fusion*. International Journal of Electrical & Computer Engineering (2088-8708), 13(2).

Stochastic analysis of GI/M/s queue with negative arrivals

Louiza Berdjoudj

University of Bejaia, Bejaia, Algeria
E-mail: louiza.berdjoudj@univ-bejaia.dz

Abstract: In this work, we consider the stochastic analysis of a multiserver $GI/M/s$ queue with negative arrivals under the RCE discipline using the embedded Markov chain. We carried out the existence of stationary regime of the embedded Markov chain. We also derived some performance measures.

Keywords: Queue with negative arrivals, Stochastic Analysis, embedded Markov chain.

References

[1] J. R. Artalejo, *G-networks: A versatile approach for work removal in queueing networks works*. (German) [*European Journal of Operational Research*] 30:943-963, (1993).

[2] B. Bruneel, and B.G. Kim. *Dicrete-time models for communication systems including ATM*. Kluwer Academic Publisher, Boston, 1993.

[3] P.G. Harrison, and E. Pitel. *The M/G/1 queue with negative customers* [*On Applied Probability*]. 30: 943-963 (1993)

[4] H. L. Liu, and Q. L. Li *A new method for computing the sojourn times in the MAP/M/1 queues with three types of negative customers.*. (German) [*Quality Technology & Quantitative Management*]. 1-26, (2024).

Stability and Almost-Periodic Solutions Of Beams Networks with Structural Damping

Ahmed Bchatnia[1],Amina Boukhatem[2]

[1]*University of Tunis El Manar, Tunisia*
[2]*University of Laghouat Amar Telidji, Algeria.*
E-mail: a.boukhatem@lagh-univ.dz*, ahmed.bchatnia@fst.utm.tn*,karim.elmufti@iscae.uma.tn**

Abstract: We study the stability of a semi-infinite network of Euler-Bernoulli beams with structural damping under some interesting conditions on the damping coefficient. Additionally, we investigate the existence of almost periodic solutions to our problem.

Keywords: Euler-Bernoulli equation, beams, infinite star-shaped network, almost periodicity, structural damping, stability

References

[1] L. Amerio and G. Prouse, *Almost-Periodic Functions and Functional Equations*, Van Nostrand Rein-hold, London, 1971.

[2] K. Ammari,*Asymptotic behavior of some elastic planar networks of Bernoulli-Euler beams*,Appl. Anal., 86:1529-1548 2007.

[3] K. Ammari, Z. Liu and F. Shel, *Stability of the wave equations on a tree with local Kelvin-Voigt damping,* Semigroup Forum, (100)364-382, 2020.

[4] K. Ammari, D. Mercier and V. Régnier, *Spectral analysis of the Schrödinger operator on binary tree-shaped networks and applications*, J. Differential Equations,(259), 6923-6959,2015.

[5] K. Ammari and S. Nicaise, *Stabilization of elastic systems by collocated feedback,*Lecture Notes in Mathematics, (2124), Springer, Cham, 2015.

Investigating the Dynamics of Positive Solutions of a Three-Dimensional System of Difference Equations with rational terms

Zabat Hiba[(1,a)], **Dekkar Imane** [(1,b)], **Touafek Nouressadat**[(1,c)], **Durhasan Turgut Tollu** [(2,d)]

[(1)] *Mohammed Seddik Ben Yahia, Dept. of Mathematics, Jijel, Algeria*
[(2)] *Necmettin Erbakan Üniversitesi, Konya,Turkey*
E-mail: [(a)] zaabat.hiba@gmail.com, [(b)] imane_ dek@hotmail.fr
[(c)] ntouafek@gmail.com, [(d)] dttollu@erbakan.edu.tr.

Abstract: Difference equations play a pivotal role in various fields of science and engineering, offering a powerful framework to model dynamic systems evolving over discrete time intervals. Researchers interested in dynamic systems, nonlinear dynamics, and applied mathematics are particularly drawn to the challenges and opportunities presented by difference equation systems. Understanding the asymptotic behavior of solutions, oscillatory patterns, and periodicity in these systems is crucial for predicting long-term dynamics and designing effective control strategies.
This presentation aims to contribute to this vibrant research area by delving into the study of asymptotic behavior, oscillation, and periodicity in a class of three-dimensional difference equation systems. By using the boundedness of solutions, we establish conditions for local and global stability, we also provide conditions for the existence of periodic solutions.

Keywords: Difference Equations, Global and Local Stability, Periodicity

Mathematics Subject Classification: 39A05,39A23, 39A30

References

[1] A. M. Amleh, E. A. Grove, G. Ladas and D. A. Georgiou, On the recursive seqience $x_{n+1} = \alpha + \frac{x_{n-1}}{x_n}$, *J. Math. Anal. Appl.*, 233 , 790–798, 1999.

[2] E. A. Grove, G. Ladas, *Periodicities in nonlinear difference equations*, Advances in Discrete Mathematics and Applications, CHAPMAN and HALL/CRC, 2005.

[3] E. Camouzis, G. Papaschinopoulos, Global asymptotic behavior of positive solutions on the system of rational difference equations, *Appl. Math. Lett.*, 17(6) , 733-737, 2004.

[4] I. Yalcinkaya, D. T. Tollu, Global behavior of a second-order system of difference equations, *Adv. Stud. Contemp. Math. Kyungshang*, 26(4), 653-667, 2016.

[5] S. Elaydi, *An Introduction to Difference Equations*, Undergraduate Texts in Mathematics, Springer, 2005.

[6] Y. Akrour, M. B. Mesmouli, D. T. Tollu and N. Touafek, On the solutions of a system of max-type difference equations, *ASETMJ*, 14(4), 159-187, 2021.

Preservation of homoclinic orbits after discretization in a degenerate system

Nadia Mohdeb

Applied Mathematics Laboratory, University of Bejaia, Algeria
E-mail: nadia.mohdeb@univ-bejaia.dz

Abstract: If a differential equation has to be solved only over a finite time interval, numerical methods aim to get a precise discrete approximation of the solution. However, if behaviour of solutions over infinite time intervals is of high interest, then the errors may grow, and it could be impossible to prove that the numerical solution is close to the exact solution. Otherwise, convergence of a method over finite intervals does not guarantee persistence of long-term characteristics of solutions in the numerical approximation, which may take on many possible phenomena when applied to certain dynamical systems.
Dynamical behaviours in discrete equations are more complicated than those corresponding continuous-time differential equations. Furthermore, the difficulty is more stressed because a solution obtained by Euler's method tends to go outwards of the exact solution. In the hyperbolic case, it is shown that, subject to certain conditions, the phase portrait of the differential system is correctly reproduced in the associated discretization by a one step method, on an arbitrary time interval.
Knowing that after discretization by Euler's method the solution of a differential equation pulls outwards, contrary to the idea which consists in believing that homoclinic solutions, solutions tending to the equilibrium point when time tends to $+\infty$ and $-\infty$, do not persist in the associated discretized system, this work aims to show that in very degenerate systems, this is not necessarily the case. Our main interest in the present work is to study the homoclinic region in which any orbit started from this region is homoclinic, for a planar differential system, in the nonhyperbolic case, and for the discrete system associated by Euler's method; we describe this homoclinic region and show that the corresponding Euler discretized system has a homoclinic region converging to that of the continuous one when the step size of the discretization tends to zero.

Keywords: homoclinic orbit, discrete system, iterative method, periodic orbit

References

[1] H. Alquaraghuli, A. R. Husain, N. Rumzi, N. Idris, W. Anjum, M. Abbas Abbasi, Numerical discretization estimation for ordinary differential equation via hybrid discretization, Applications of modelling and simulations, 3(1), 55-63, 2019.

[2] D. Efimov, A. Polyakov, A. Alexandrov, Discretization of homogeneous systems using Euler method with a state-dependent step, Automatica 109, 1-9, 2019.

[3] W. Liu, D. Cai, Bifurcation, chaos analysis and control in a discrete-time predator–prey system, Advances in Difference Equations, 11, 2019.

[4] N. Mohdeb, A. Fruchard, N. Mehidi, Eliptic sectors and Euler discretization, Electronic Journal of Differential Equations, 183, 1-14, 2018.

[5] Y. Xu, Y. Zou, Preservation of Takens–Bogdanov bifurcations for delay differential equations by Euler discretization, Journal of Dynamics and Differential Equations, 26, 1029–1048, 2014.

[6] Y. K. Zou, W. J. Beyn, On manifolds of connecting orbits in discretizations of dynamical systems, Nonlinear Analysis, 52, 1499-1520, 2003.

The boundary value problem concerns a weighted fractional derivative involving a function of variable order

Ridha Dida

Department of Mathematics, University 8 May 1945 Guelma, Algeria
E-mail: didarida25@yahoo.fr

Abstract: This study aims to address weighted fractional operators of variable order within specific spaces. We investigate a boundary value problem involving the weighted fractional derivative of one function with respect to another function of variable order. It's important to note that the symmetry of a transformation for differential equations is closely linked to local solvability, which indicates the existence of solutions. Consequently, establishing existence requirements for the weighted fractional derivative of a function with respect to another function of constant order becomes necessary. Additionally, we review stability within the Ulam–Hyers–Rassias sense. The findings are obtained through the application of the Kuratowski measure of non-compactness. A model is presented to demonstrate the reliability of the obtained results.

Keywords: Weighted fractional integrals; Weighted spaces of summable functions; Fixed point theorem; Derivatives and integrals of variable order; Boundary value problem; Measure of non-compactness.

Mathematics Subject Classification: 26A33; 47H08; 34B15; 34A08; 37C25

References

[1] Samko, S.G.: Fractional integration and differentiation of variable order. Anal. Math. 21, 213–236 (1995)

[2] Sevinik Adigüzel, R., Aksoy, Ü., Karapinar, E., Erhan, I.M.: On the solution of a boundary value problem associated with a fractional differential equation. Math. Methods Appl. Sci. (2020). https://doi.org/10.1002/mma.6652

[3] Souid, M.S., Bouazza, Z., Yakar, A.: Existence, uniqueness, and stability of solutions to variable fractional order boundary value problems. J. New Theory 41, 82–93 (2022)

[4] Souid, M.S., Refice, A., Sitthithakerngkiet, K.: Stability of p(·)-integrable solutions for fractional boundary value problem via piecewise constant functions. Fractal Fract. 7, 198 (2023)

[5] Starrett, J.: Solving differential equations by symmetry groups. Am. Math. Mon. 114, 778–792 (2007)

[6] Telli, B., Souid, M.S.: L1-Solutions of the initial value problems for implicit differential equations with Hadamard fractional derivative. J. Appl. Anal. 28, 1–9 (2022)

Sensitivity analysis in genetic network models

Massinissa Soufit, Baya Takhedmit and Karim Abbas

Research Unit LaMOS, Departement of Informatics, Faculty of Exact Sciences, University of Bejaia, Bejaia 06000, Algeria
Research Unit LaMOS, Departement of Operational Reesearch, Faculty of Exact Sciences, University of Bejaia, Bejaia 06000, Algeria
E-mail: massinissa.soufit@univ-bejaia.dz

Abstract: Probabilistic Boolean Network (PBN), has a critical problem which is to study the steady-state probability distribution for network analysis. In this paper, we provide a perturbation analysis for Probabilistic Boolean Networks with gene perturbations models (PBNp), by introducing a new perturbation bound such stochastic models. Specifically, we establish efficient bound of the relative error between the disturbed model and the nominal one. Additionally, our new bound exploit more completely the stochastic features of the perturbation and which also applicable to a Markov transition matrix that has a large size. The efficiency of the proposed bound is shown with several numerical examples and obtained numerical results are compared with the known ones in the literature.

Keywords: Perturbation bound, Stochastic Boolean Network with gene perturbation, nominal model, perturbed model, Markov chains.

Mathematics Subject Classification: 30E; 37N; 65C

References

[1] Kauffman S. Metabolic,"Stability and Epigenesis in Randomly Constructed Genetic Nets", Journal of Theoretical Biology 1969; 22(3): 437–467.

[2] Wei Y, "Perturbation analysis of singular linear systems with index one", International Journal of Computer Mathematics 2000; 74: 483-491.

[3] Abbas K, Berkhout J, Heidergott B, "A Critical Account of Perturbation Analysis of Markov Chains", Markov Processes Relat Fields 2016; 22:227–265.

[4] Cho CD, "Comparison of perturbation bounds for the stationary distribution of a Markov chain", Linear Algebra and Its Applications 2001; 335: 137–150.

[5] Li W, LB C, MK N, "On computation of the steady-state probability distribution of probabilistic Boolean networks with gene perturbation", Journal of Computational and Applied Mathematics 1937; 236: 4067–4081.

The Autohomeomorphism Groups of Some Digital Lines

Othman Echi

King Fahd University of Petroleum and Minerals, Dhahran 31261, Saudi Arabia
E-mail: othechi@yahoo.com

Abstract: For a topological space X, the group of autohomeomorphisms is denoted by $\mathcal{H}(X)$. It is a well-established fact that even if two topological spaces X and Y have isomorphic autohomeomorphism groups, it does not necessarily imply that X and Y are homeomorphic. A space X is considered homogeneous if its autohomeomorphism group, $\mathcal{H}(X)$, acts transitively on X, via the action

$$\begin{array}{ccc} \mathcal{H}(X)\times X & \longrightarrow & X \\ (g,x) & \longmapsto & g(x). \end{array}$$

The degree of homogeneity of X, denoted as $d_h(X)$, is defined as the cardinality of the quotient set $X/\mathcal{H}(X)$ relative to the aforementioned action.
Regarding the Khalimsky topology defined on the set of integers, this topology, denoted by $\mathcal{K}$, is the topology generated by the family

$$\{\{x-1, x, x+1\} : x \text{ is an even integer}\}.$$

The space $(\mathbb{Z}, \mathcal{K})$, known as the Khalimsky line or digital line, is called the *Khalimsky line (or digital line)*, will be denote it by $\mathbf{KL}$ (or $\mathbf{KL}_1$). The digital line is notably influential in digital image processing and computer graphics. The aim of this paper is the construction of a sequence of Alexandroff topologies, $\{\mathcal{K}_p : p \in \mathbf{N}\}$, on the set of integers $\mathbb{Z}$. This provides new digital lines with the following properties:

- $\mathcal{H}(\mathbb{Z}, \mathcal{K}_p)$ is isomorphic to $\mathcal{H}(\mathbb{Z}, \mathcal{K})$.
- For each positive integer p, $(\mathbb{Z}, \mathcal{K}_p)$ is topologically embedded in $(\mathbb{Z}, \mathcal{K}_{p+1})$.
- $d_H(\mathbb{Z}, \mathcal{K}_p) = p + 1$.

Keywords: Alexandroff space, Degree of homogeneity, Group of autohomeomorphisms, Khalimsky line, Reversible space

Mathematics Subject Classification: 22F50, 20B27,54F65

References

[1] P. Alexandroff, *Diskrete Räume.*, Rec. Math. [Mat. Sbornik] N.S **2(44)** (1937), 501–519.

[2] E. Aşı cıand F. Karaçal, *On the T-partial order and properties*, Inform. Sci. **267** (2014), 323–333.

[3] A. Grothendieck and J. A. Dieudonné, *Éléments de géométrie algébrique. I*, Grundlehren der mathematischen Wissenschaften [Fundamental Principles of Mathematical Sciences], vol. 166, Springer-Verlag, Berlin, 1971.

[4] G. T. Herman, *Geometry of digital spaces*, Applied and Numerical Harmonic Analysis, Birkhäuser Boston, Inc., Boston, MA, 1998.

[5] B. Honari and Y. Bahrampour, *Cut-point spaces*, Proc. Amer. Math. Soc. **127** (1999), no. 9, 2797–2803.

[6] F. Karaçal and T. Köroğlu, *A principal topology obtained from uninorms*, Kybernetika (Prague) **58** (2022), no. 6, 863–882.

[7] E. Khalimsky, *Topological structures in computer science*, J. Appl. Math. Simulation **1** (1987), no. 1, 25–40.

[8] E. Khalimsky, R. Kopperman, and P. R. Meyer, *Computer graphics and connected topologies on finite ordered sets*, Topology Appl. **36** (1990), no. 1, 1–17.

[9] C. O. Kiselman, *Elements of digital geometry, mathematical morphology, and discrete optimization*, World Scientific Publishing Co. Pte. Ltd., Hackensack, NJ, 2022.

[10] S. Lazaar, T. Richmond, and H. Sabri, *The autohomeomorphism group of connected homogeneous functionally Alexandroff spaces*, Comm. Algebra **47** (2019), 3818–3829.

[11] E. Melin, *Extension of continuous functions in digital spaces with the Khalimsky topology*, Topology Appl. **153** (2005), no. 1, 52–65.

[12] E. Melin, *Digital Khalimsky manifolds*, J. Math. Imaging Vision **33** (2009), no. 3, 267–280.

[13] M. Rajagopalan and A. Wilansky, *Reversible topological spaces*, J. Austral. Math. Soc. **6** (1966), 129–138.

[14] A. K. Steiner, *The lattice of topologies: Structure and complementation*, Trans. Amer. Math. Soc. **122** (1966), 379–398.

[15] S. M. Ulam, *A collection of mathematical problems*, Interscience Tracts in Pure and Applied Mathematics, no. 8, Interscience Publishers, New York-London, 1960.

[16] J. V. Whittaker, *On isomorphic groups and homeomorphic spaces*, Ann. of Math. (2) **78** (1963), 74–91.

Finite Rings and Error Correcting Codes

Aicha Batoul

Department of Algebra and Number Theory, Faculty of Mathematics, University of Science and Technology Houari Boumediene (USTHB) Algiers, Algeria
E-mail: Email:aicha.batoul@usthb.edu.dz

Abstract: One of the most active and important research areas in algebra is the investigation of finite rings. These rings have been successfully applied in various fields, especially in coding theory and cryptography.
Error-correcting codes were introduced by Claude Shannon in 1948 to the field of information theory to address noise added by communication channels. The primary aim of coding theory is to construct codes that are easy to encode and decode, can detect and correct many errors, and have a sufficiently large number of codewords.
Algebraic codes and rings are closely connected in at least two fundamental ways. Firstly, code alphabets often have a ring structure rather than just being a set. Secondly, the codes themselves can often be constructed and studied as modules over some ring.
LCD codes have been widely applied in data storage, communication systems, consumer electronics, and cryptography. Formally self-dual codes are another important class of codes that have generated significant interest because their weight enumerators are invariant under the MacWilliams transform and they sometimes have better parameters than self-dual codes.
In this work, we present new constructions of LCD and formally self-dual cyclic codes over certain finite rings.

Keywords: Finite Principal Ideal Rings,Finite Chain Rings,Error Correcting Codes

References

[1] A.Batoul,K. Guenda, T. A.Gulliver: *On self-dual cyclic codes over finite chain rings*. Des. Codes Cryptogr. 70(3), 347-358 (2014).

[2] A. Batoul, K. Guenda1, A. Kaya, B. Yildiz,*Cyclic Isodual and Formally Self-dual Codes over* $\mathbb{F}_q + v\mathbb{F}_q$, European Journal of Pure And Applied Mathematics (2015)

[3] A. Batoul,K. Guenda, and T.A.Gulliver, *Some constacyclic codes over finite chain rings*. Advances in mathematics of communications, Vol. 10, no 4, pp. 683-694, 2016.

[4] A. Batoul, K. Guenda, and T. A. Gulliver, and N. Aydin, *Constacyclic codes over finite principal ideal rings*.In: El Hajji, S., Nitaj, A., Souidi, E. (eds) Codes, Cryptology and Information Security. C2SI 2017. Lecture Notes in Computer Science, Vol 10194, pp. 161-175, 2017.

[5] A. Batoul, K. Guenda, T. A. Gulliver and N. Aydin,*On isodual cyclic codes over finite chain rings*, In : EL Hajji S., Nitaj A., Souidi E. (eds) Codes, Cryptology, and Information Security C2SI-Carlet. Lecture Notes in Computer Science, Vol 10194, pp. 176-194, 2017.

On the multiplicity of non radial solutions for fractional p-Laplacian problems

Noria Bekkouche [1*], Fatima Dib[2] ,Daoudi-Merzagui [3***]**

[1] *University of Saïda, Department of Mathematics, Saïda, Algeria*
[2] *University centre of Maghnia, Department of Hydraulic and Civil Engineering, Maghnia, Algeria*
[3] *University of Tlemcen, Department of Mathematics, Tlemcen, Algeria*
E-mail: noria.bekkouche@yahoo.fr*, fatimadib1967@yahoo.fr**,nmerzagui@yahoo.fr***

Abstract: In this work we are mainly concerned with the existence of non radial solutions for the following Dirichlet problem,

$$\begin{cases} (-\Delta)_p^s u = f(|x|, u) & x \in \Omega \\ u = 0 & x \in \partial\Omega \end{cases}, \tag{0.2}$$

where, Ω be the ball $B(0,R)$ in $\mathbb{R}^N$, centred at 0 and of radius R, with $N \geq 2$, $|x| := \sqrt{\sum_{i=1}^{N} x_i^2}$, is the Euclidean norm of x in $\mathbb{R}^N$, $(-\Delta)_p^s$ is the fractional p-Laplacian operator with $0 < s < 1 < p < +\infty$, $sp < N$, and f is radial function satisfying some conditions.
Our approach is based on a variational method.

Keywords: fractional p-Laplacian problems, minimization with constraints, periodic solution.

References

[1] G. Molica Bisci, V. Rădulescu, R. Servadei. *Variational Methods for Nonlocal Fractional Problems*. With a Foreword by Jean Mawhin. Encyclopedia of Mathematics and its Applications, 162 Cambridge University Press (2016).

[2] C.E. Torres, *Existence and symmetry result for fractional p-Laplacian in* $\mathbb{R}^n$. Commun. Pure Appl. Anal. 2017, 16,99–113.

A multi-server queue in a multi-phase random environment with waiting servers and customers' impatience under synchronous working vacation policy

Houalef Meriem*

Mathematics Laboratory, University of Sidi Bel Abbes, Center university of Maghnia, Algeria
E-mail: houalef8o@gmail.com

Amina Angelika Bouchentouf

Mathematics Laboratory, Djillali Liabes University of Sidi Bel Abbes, Sidi Bel Abess 22000, Algeria
E-mail: bouchentouf_amina@yahoo.fr

Abstract
In this work, we study an infinite-space multi-server queueing model in random environment with impatient customers (balking and reneging) and waiting servers at which the servers are subjected to single and multiple working vacation policies. Once the system is empty, the servers have to wait a random period of time before leaving, causing the system to move to vacation phase 0 at which new arrivals can be served at lower rate. We drive the steady-state probabilities for the system using the probability generation functions. Then, we develop a cost model and provide an appropriate optimization via a quadratic fit search model (QFSM) to get the optimum values of the service rates during the both vacation and operative phases.

Keywords: Queueing models, Random environment, Working vacation policies, Impatient customers, Optimization

References

[1] J. Li., N. Tian., Z. Zhang., H. Luh . Analysis of the $((M)/G/(1))$ queue with exponentially working vacations-a matrix analytic approach *Queueing Syst* , **61**: 139–166, 2009.

[2] D. Yue., W. Yue., G. Xu. Analysis of customers' impatience in an $((M)/M/(1))$ queue with working vacations *J. Ind. Manag. Optim* , **8** (4): 895–908, 2012.

[3] P. Vijaya Laxmi., V. Goswami., K. Jyothsna. Optimization of balking and reneging queue with vacation interruption under N-policy *J.Optim*, https ;//doi.org/10.1155/2013/683708, 2013.

[4] A. A. Bouchentouf., A. Gendouzi. Cost optimization analysis for an $(M^X/M/c)$ vacation queueing system with waiting serversand impatient customers *SeMA J* , **76**(2): 309–341, 2019.

[5] M. Houalef., A. A. Bouchentouf., L. Yahiaoui. A multi-server queue in a random environment with waiting servers and customers' impatience under synchronous working vacation policy *journal of the Research Society of China* , https://doi.org/10.1007/s40305-021-00384-3, 2022.

A second order BVP with time depending operator on the whole-line

Samira Zahar

University Abd Errahmane Mira, 06000. Bejaia, Algeria
Laboratoire des Mathématiques Appliquées
E-mail: zahar_samira@yahoo.fr and samira.zahar@univ-bejaia.dz

Abstract: This paper is concerned with existence results of a boundary value problem posed on the whole line with a nonlinear term and time depending derivative operator. We will use Schauder fixed theorem to prove existence of classical and weak solutions. Existence of weak solution consists also one implication of the Molchanov criterion for the non linear problem (0.3).

$$\begin{cases} y''(x) - q(x)y(x) + h(x,y) = 0, \quad -\infty < x < +\infty. \\ \lim\limits_{|x|\to+\infty} y(x) = 0. \end{cases} \tag{0.3}$$

Keywords: infinity interval, sign changing nonlinearity, differential equation, variable coefficient, weak solution, Molchanov.

Mathematics Subject Classification: 34B40. 34B27. 34B15

References

[1] N.Chernyavskaya and L.Shuster, "Estimates for Green's function of the Sturm-Liouville operator", Journal of Differential Equations, 111(1994), 410-420.

[2] N. Chernyavskaya and L. Shuster, "Estimates for the Green function of a general Sturm-Liouville and their Application", Proc. Amer. Math. Soc. 127 (5)(1999), 1413-1426.

[3] S. Djebali and T. Moussaoui, "A class of second order BVPs on infinite intervals", Elec. J. Qual. Th. Dif. Eq., 4 (2006), 1-19.

[4] S. Djebali and S. Zahar, "multiple solutions to singular bvps with variable coefficient on the half with variable coefficients on the positive half-line", Ann. of Diff. Eqs., 29(3) (2013), 324-337.

Euler Bernoulli beam equation with two boundary fractional fedbacks

Fatiha Chouaou and Hamra Mohammed Amin

University center of Maghnia
Department of Mathematics, Tlemcen, Algeria
E-mail: drchouaou@gmail.com and ammathine@gmail.com

Abstract: We consider an Euler Bernoulli beam equation with two boundary control condition of fractional derivative type. We study the existence of solution of the system using the semigroup theory of linear operators.

Keywords: Euler Bernoulli beam equation, boundary dissipation of fractional derivative type, Frequency domain method

References

[1] W. Arendt & C. J. K. Batty, *Tauberian theorems and stability of one-parameter semigroups,* Trans. Amer. Math. Soc., **306** (1988)-2, 837-852.

[2] R. L. Bagley & P. J. Torvik, *On the appearance of the fractional derivative in the behavior of real material,* J. Appl. Mech. **51** (1983), 294-298.

[3] A. Benaissa & C. Aichi, *Energy decay for a degenerate wave equation under fractional derivative controls,* Filomat **32** (2018)-17, 6045-6072.

Euler Bernoulli beam equation with two boundary fractional fedbacks

Fatiha Chouaou and Hamra Mohammed Amin

University center of Maghnia
Department of Mathematics, Tlemcen, Algeria
E-mail: drchouaou@gmail.com and ammathine@gmail.com

Abstract: We consider an Euler Bernoulli beam equation with two boundary control condition of fractional derivative type. We study the existence of solution of the system using the semigroup theory of linear operators.

Keywords: Euler Bernoulli beam equation, boundary dissipation of fractional derivative type, Frequency domain method

References

[1] W. Arendt & C. J. K. Batty, *Tauberian theorems and stability of one-parameter semigroups,* Trans. Amer. Math. Soc., **306** (1988)-2, 837-852.

[2] R. L. Bagley & P. J. Torvik, *On the appearance of the fractional derivative in the behavior of real material,* J. Appl. Mech. **51** (1983), 294-298.

[3] A. Benaissa & C. Aichi, *Energy decay for a degenerate wave equation under fractional derivative controls,* Filomat **32** (2018)-17, 6045-6072.

Strategic Pricing for Hazelnut Producers: MN-Method and Linear Programming Approaches

Melike Muntaş [1*], Burhaneddin İzgi [2]**

[1]*Department of Mathematics, Istanbul Technical University, Istanbul, Turkey*
[2]*Department of Mathematics, Istanbul Technical University, Istanbul, Turkey*
E-mail: muntas19@itu.edu.tr*, bizgi@itu.edu.tr**

Abstract: This study proposes a solution strategy to optimize the selling price and period for hazelnut producers amidst the uncertainties inherent in agricultural production and marketing. Employing linear programming and the MN method, the research begins by defining matrix games and introducing these techniques as effective tools for resolving decision-making challenges. Subsequently, it delves into the decision-making process under uncertainty, assessing the MN method's efficacy in navigating this complexity. The study outlines the sequential steps in addressing the hazelnut pricing problem, underscoring the utility of linear programming and the MN method. Finally, the effectiveness and accuracy of the MN method are evaluated through a comparison with alternative methodologies documented in the literature.

Keywords: Linear programming, MN-method, matrix games, decision-making under uncertainty

References

[1] Thomas S. Ferguson. *A Course in Game Theory*. World Scientific, 2020.

[2] George B. Dantzig. *Linear Programming and Extensions*. Princeton University Press, 1963.

[3] Burhaneddin İzgi, Murat Özkaya.*A new perspective to the solution and creation of zero sum matrix game with matrix norms*. Applied Mathematics and Computation, 341, 148-159, 2019

[4] Burhaneddin İzgi, Murat Özkaya, N. Kemal Üre, Matjaz Perc, *Extended matrix norm method: Applications to bimatrix games and convergence results*. Applied Mathematics and Computation, 438, 127553, 2023.

[5] Odell L. Walker and Earl Orel Heady and Luther G. Tweeten and John T. Pesek, *Application of game theory models to decisions on farm practices and resource use*,1960.

Average Solutions of Differential Equations Containing Fractional Derivatives of Orders Governed by Probability Distributions with Bounded Support

Zafer Bekiryazici

Recep Tayyip Erdogan University, Dept. of Mathematics, 53100, Rize, Türkiye
E-mail: zafer.bekiryazici@erdogan.edu.tr

Abstract: In this study, various ordinary differential equations are transformed into non-integer ordered differential equations containing the Caputo fractional derivative. The orders or derivation have been selected from probability distributions with bounded supports and the resulting equations have been analyzed with fde12 algorithm to obtain the arithmetic mean of the solutions of the fractional differential equations. The mean solutions from each probability distribution are compared with each other and the solution of the ordinary differential equation to comment on the effects of the probability distributions and the order of derivation. Results show that the selection of non-integer ordered derivatives driven by a probability distribution provides a more generalized investigation for the differential equation.

Keywords: Caputo derivative, Beta distribution, fde12 algorithm, Simulation, Triangular distribution

Mathematics Subject Classification: 34A08, 34F05

References

[1] Diethelm, K., The analysis of fractional differential equations: An application-oriented exposition using differential operators of Caputo type. Springer Science & Business Media, 2010.

[2] Caputo, M. (1967). Linear models of dissipation whose Q is almost frequency independent—II. Geophysical journal international, 13(5), 529-539.

[3] Merdan, M., Bekiryazici, Z., Kesemen, T., & Khaniyev, T. (2022). Transmission of Cholera Disease with Laplacian and Triangular Parameters. Iranian Journal of Mathematical Sciences and Informatics, 17(2), 289-305.

[4] Diethelm, K., & Freed, A. D. (1998). The FracPECE subroutine for the numerical solution of differential equations of fractional order. Forschung und wissenschaftliches Rechnen, 1999, 57-71.

[5] Yusuf, A., Qureshi, S., Inc, M., Aliyu, A. I., Baleanu, D., & Shaikh, A. A. (2018). Two-strain epidemic model involving fractional derivative with Mittag-Leffler kernel. Chaos: An Interdisciplinary Journal of Nonlinear Science, 28(12).

Soliton Dynamics in the Perturbed Dispersive Nonlinear Schrödinger Equation with Multiplicative White Noise by the F–Expansion Method

Yakup Yıldırım [1, 2, 3]

[1] *Department of Computer Engineering, Biruni University, Istanbul–34010, Turkey*
[2] *Mathematics Research Center, Near East University, 99138 Nicosia, Cyprus*
[3] *Faculty of Arts and Sciences, University of Kyrenia, 99320 Kyrenia, Cyprus*
E-mail: yyildirim@biruni.edu.tr

Abstract: This paper investigates the soliton solutions of the perturbed dispersive nonlinear Schrödinger equation with multiplicative white noise. Nonlinear wave equations, particularly the nonlinear Schrödinger equation, are pivotal in describing a wide array of complex wave phenomena across various scientific fields. Solitons, as stable and localized wave packets, play a crucial role in understanding nonlinear wave behavior. However, in real-world scenarios, wave propagation is often subject to stochastic perturbations, which can significantly alter the dynamics predicted by deterministic models. By incorporating multiplicative white noise into the dispersive nonlinear Schrödinger equation, we develop a more realistic model that accounts for these stochastic effects. We employ the F-expansion procedure to derive exact soliton solutions, including dark soliton solutions, singular soliton solutions, bright soliton solutions, straddled singular-singular soliton solutions, complexiton solutions, and straddled dark-bright soliton solutions. Additionally, we explore the parametric restrictions necessary for the existence of these solutions, providing a comprehensive analysis of the conditions governing soliton formation and stability. Our findings contribute to the theoretical understanding of soliton dynamics under stochastic influences and have practical implications for physical systems where multiplicative white noise plays a crucial role.

Keywords: solitons, white noise, F–expansion

References

[1] Arnous, A. H., Biswas, A., Yildirim, Y., & Alshomrani, A. S. (2024). Optical solitons with dispersive concatenation model having multiplicative white noise by the enhanced direct algebraic method. Contemporary Mathematics, 1165-1179.

[2] Zayed, E. M., Arnous, A. H., Biswas, A., Yıldırım, Y., & Asiri, A. (2023). Optical solitons for the concatenation model with multiplicative white noise. Journal of Optics, 1-10.

[3] Zayed, E. M., Shohib, R. M., Alngar, M. E., Biswas, A., Yıldırım, Y., Moraru, L., Iticescu, C., Moldovanu, S., Bibicu, D., & Alghamdi, A. A. (2023). Dispersive optical solitons with DWDM topology and multiplicative white noise. Results in Physics, 51, 106723.

[4] Zayed, E. M., Shohib, R. M., Alngar, M. E., Biswas, A., Moraru, L., Khan, S., Yıldırım, Y., Alshehri, H. M., & Belic, M. R. (2022). Dispersive optical solitons with Schrödinger–Hirota model having multiplicative white noise via Itô Calculus. Physics Letters A, 445, 128268.

[5] Zayed, E. M., Alngar, M. E., Shohib, R. M., Biswas, A., Yıldırım, Y., Moraru, L., Mereuta, E., & Alshehri, H. M. (2022). Embedded solitons with χ (2) and χ (3) nonlinear susceptibilities having multiplicative white noise via Itô Calculus. Chaos, Solitons & Fractals, 162, 112494.

Dark and Singular Soliton Solutions in Perturbed Fokas–Lenells Equation with Nonlinear Chromatic Dispersion and Quadratic Self-Phase Modulation

Şebnem Gökdeniz Sıvakcı [1,*], Yakup Yıldırım [2], Aydin Seçer [1]

[1] *Mathematical Engineering, Yildiz Technical University, 34230, Istanbul, Turkey.*
[2] *Department of Computer Engineering, Biruni University, Istanbul–34010, Turkey.*
E-mail: seb.gkdnz@gmail.com

Abstract: In this paper, we address the quiescent optical solitons to the perturbed Fokas–Lenells equation incorporating both nonlinear chromatic dispersion and quadratic self-phase modulation. Utilizing the Modified Extended Tanh-function Method, Generalized Kudryashov Method, Auxiliary Kudryashov Method, and Addendum to Kudryashov Method, we derive a variety of soliton solutions, including dark soliton solutions, singular soliton solutions, straddled soliton solutions, complexion solutions, and singular periodic solutions. Furthermore, we perform a comprehensive analysis of the parametric restrictions necessary for the existence of these solutions, elucidating the conditions under which these solutions are valid. Our findings contribute to a deeper understanding of the dynamics of optical solitons in nonlinear media, providing valuable insights into their stability and propagation characteristics.

Keywords: perturbed Fokas–Lenells equation, nonlinear chromatic dispersion, quadratic self–phase modulation

References

[1] Ozisik, M., Cinar, M., Secer, A., & Bayram, M. (2022). Optical solitons with Kudryashov's sextic power-law nonlinearity. Optik, 261, 169202.

[2] Cakicioglu, H., Ozisik, M., Secer, A., & Bayram, M. (2023). Optical soliton solutions of Schrödinger–Hirota equation with parabolic law nonlinearity via generalized Kudryashov algorithm. Optical and Quantum Electronics, 55(5), 407.

[3] Onder, I., Secer, A., & Bayram, M. (2023). Optical soliton solutions of time-fractional coupled nonlinear Schrödinger system via Kudryashov-based methods. Optik, 272, 170362.

[4] Alotaibi, H. (2021). Traveling wave solutions to the nonlinear evolution equation using expansion method and addendum to Kudryashov's method. Symmetry, 13(11), 2126.

Qualitative Analysis for Nonlinear Fractional Difference Equations

Hakan Adiguzel

Sakarya University of Applied Sciences, Dept. of Engineering Fundamental Sciences, 54050, Sakarya, Turkey
E-mail: hadiguzel@subu.edu.tr

Abstract: This research work is devoted to exploring new results for the solutions of fractional difference equations. We have focused on the properties of the solutions like oscillation, and nonoscillation. Firstly, we have built some hypotheses. Our results are presented based on these hypotheses. Finally, we provide some examples to illustrate the effectiveness of our theoretical findings.

Keywords: Fractional, Difference operator, Difference equations, Nonoscillation

Mathematics Subject Classification: 39A10,39A21,26A33,45M05,45M20

Application of Wavelet-Galerkin Approximation Techniques on the Partial Differential Equations via Maple

Tugcem Partal and Mustafa Bayram

Recep Tayyip Erdogan University, Dept. of Mathematics, 53100, Rize, Turkey
Istanbul Gelisim University, Dept. of Computer Engineering, 34015, Istanbul, Turkey
E-mail: tugcem.partalr@erdogan.edu.tr and mustafabayram@biruni.edu.tr

Abstract: In this study, we consider the fractional SIR model and its stochastic equivalent based on fractional derivatives to model the spread of infectious diseases. The aim of the fractional SIR model is to describe disease dynamics more flexibly and realistically by incorporating uncertainties and random events. Maximum Likelihood Estimation (MLE) is used to improve the accuracy of parameter estimation. Our empirical results show that the fractional stochastic SIR model provides a more sensitive and realistic representation of disease dynamics by considering uncertainty and random events. Our simulation results show that the fractional SIR model is a powerful approach for modelling and analysing epidemic diseases.

Keywords: Dynamics of the Fractional Order SIR Model

References

[1] Gabrick, Enrique C., et al. "Fractal and fractional SIS model for syphilis data." Chaos: An Interdisciplinary Journal of Nonlinear Science 33.9 ,2023.

[2] Linda J. S. Allen, "An Introduction to Stochastic Processes with Applications to Biology", Pearson Education, INC., Upper Saddle River, New Jersev 07458, 2008.

[3] IPaul, Subrata, et al. "Study of fractional order SIR model with MH type treatment rate and its stability analysis." Bulletin of Biomathematics 2.1 (2024): 85-113.

[4] Angstmann, C. N., B. I. Henry, and A. V. McGann. "A fractional order recovery SIR model from a stochastic process." Bulletin of mathematical biology 78 (2016): 468-499.ations in multiwavelet bases", J. Comput. Phys., 182(1), pp. 149-190, 2002.

[5] Ahmad, Zubair, et al. "Dynamics of fractional order SIR model with a case study of COVID-19 in Turkey." City University International Journal of Computational Analysis 4.1 (2020): 18-35.

Derivation of optical solitons of dimensionless resonant nonlinear Schrödinger equation with the Kudryashov's law

Selvi Altun Durmus, Aydin Secer, Muslum Ozisik, Mustafa Bayram

Suleymaniye Mh. Destan Sk. Inegol, Bursa-Turkey,
Biruni University, Computer Engineering Department, Istanbul-Turkey,
Yildiz Technical University, Mathematical Engineering Department, Istanbul-Turkey
E-mail: Corresponding author:selvialtun89@gmail.com

Abstract: The main target of this study is to derive optical soliton solutions of the (1+1)-dimensional resonant nonlinear Schrödinger equation (NLSE) with the Kudryashov's law in the presence of spatio-temporal and inter-modal dispersions. First of all, the analytical method is performed to generate the analytical soliton solutions of the equation under consideration. Therefore, dark and kink soliton solutions are obtained. To show the physical attitude of some of the acquired solutions, 3D, 2D, and contour graphics are demonstrated. In particular, to find out the influences of the Kudryashov's law, spatio-temporal dispersion, inter-modal dispersion terms of the traveling wave transformation on the soliton dynamics of the proposed equation, 2D graphs for several values of coefficients are depicted. The acquired consequences ensure us with the knowledge that the considered equation can be investigate from a physical perspective. It can be concluded that the applied method is effective technique to extract the analytical solutions for the resonant NLSE.

Keywords: Resonant nonlinear Schrödinger equation, Optical fibers, Kudryashov's law, Spatio-temporal dispersion.

Mathematics Subject Classification: 35R11

References

[1] N.A. Kudryashov; First integrals and general solution of the traveling wave reduction for Schrödinger equation with anti-cubic nonlinearity, Optik, 185 (2019), 665-671, https://doi.org/10.1016/j.ijleo.2019.03.167.

[2] N.A. Kudryashov; Optical solitons of the resonant nonlinear Schrödinger equation with arbitrary index, Optik, 235 166626 (2021), https://doi.org/10.1016/j.ijleo.2021.166626.

[3] K.S. Nisar, K.K. Ali, M. Inc, M.S. Mehanna, H. Rezazadeh, L. Akinyemi; New solutions for the generalized resonant nonlinear Schrödinger equation, Results in Physics, 33 105153 (2022), https://doi.org/10.1016/j.rinp.2021.105153.

[4] W. Gao, H.F. Ismael, A.M. Husien, H. Bulut, H.M. Baskonus; Optical Soliton Solutions of the Cubic-Quartic Nonlinear Schrödinger and Resonant Nonlinear Schrödinger Equation with the Parabolic Law, Applied Sciences, 10 219 (2020), https://doi.org/10.3390/app10010219.

[5] A. Ali, A.R. Seadawy, D. Lu; Soliton solutions of the nonlinear Schrödinger equation with the dual power law nonlinearity and resonant nonlinear Schrödinger equation and their modulation instability analysis, Optik, 145 (2017) 79-88, https://doi.org/10.1016/j.ijleo.2017.07.016.

[6] M. Ozisik, A. Secer, M. Bayram, H. Aydin; An encyclopedia of Kudryashov's integrability approaches applicable to optoelectronic devices, Optik, 265 (2022) 169499, https://doi.org/10.1016/j.ijleo.2022.169499.

Revealing optical soliton solutions of the perturbed Schrödinger-Hirota equation with generalized anti-cubic law of nonlinearity

Ismail Onder[1], Aydin Secer[1,2], Muslum Ozisik[1] and Mustafa Bayram[2,*]

[1]*Department of Mathematical Engineering, Yildiz Technical University, Istanbul, Turkey*
[2]*Department of Computer Engineering, Biruni University, Istanbul, Turkey*
[*]mustafabayram@biruni.edu.tr

ABSTRACT In this study, we aimed to reveal the optical solitons of the perturbed nonlinear Schrödinger-Hirota equation with generalized anti-cubic law of nonlinearity. The relevant model is one of the phenomena that models soliton propagation in fiber optics. The model also includes a spatio-temporal dispersion term. It is known to be an inclusive model in that it includes nonlinearity, spatio-temporal dispersion and perturbation together. In this study, we obtained soliton solutions with a well-known and effective method called enhanced Kudryashov method. We also examined the effects of the parameters in the equation on the solutions we obtained and presented them with graphics.

Keywords: Optical solitons; Perturbed Schrödinger-Hirota equation; Enhanced Kudryashov method

REFERENCES

[1] Biswas, A., Yıldırım, Y., Yaşar, E., Zhou, Q., Moshokoa, S. P., & Belic, M. (2018). Optical soliton perturbation with quadratic-cubic nonlinearity using a couple of strategic algorithms. Chinese Journal of Physics, 56(5), 1990–1998. https://doi.org/10.1016/j.cjph.2018.09

[2] Alquran, M. (2022). New interesting optical solutions to the quadratic–cubic Schrodinger equation by using the Kudryashov-expansion method and the updated rational sine–cosine functions. Optical and Quantum Electronics, 54(10), 1–8. https://doi.org/10.1007/S11082-022-04070-3/FIGURES/4.

[3] Ozdemir, N., Altun, S., Secer, A., Ozisik, M., & Bayram, M. (2024). Bright soliton of the perturbed Schrödinger–Hirota equation with cubic–quintic–septic law of self-phase modulation in the presence of spatiotemporal dispersion. European Physical Journal Plus, 139(1), 1–9. https://doi.org/10.1140/epjp/s13360-023-04837-x.

[4] Ekici, M., Mirzazadeh, M., Sonmezoglu, A., Ullah, M. Z., Asma, M., Zhou, Q., Moshokoa, S. P., Biswas, A., & Belic, M. (2017). Dispersive optical solitons with Schrödinger–Hirota equation by extended trial equation method. Optik, 136, 451–461. https://doi.org/10.1016/j.ijleo.2017.02.042.

[5] Kudryashov, N. A. (2023). Dispersive optical solitons of the generalized Schrödinger–Hirota model. Optik, 272, 170365. https://doi.org/10.1016/j.ijleo.2022.170365.

[6] Inc, M., Aliyu, A. I., Yusuf, A., & Baleanu, D. (2018). Dispersive optical solitons and modulation instability analysis of Schrödinger-Hirota equation with spatio-temporal dispersion and Kerr law nonlinearity. Superlattices and Microstructures, 113, 319–327. https://doi.org/10.1016/j.spmi.2017.11.010.

[7] Onder, I., Esen, H., Secer, A., Ozisik, M., Bayram, M., & Qureshi, S. (2023). Stochastic optical solitons of the perturbed nonlinear Schrödinger equation with Kerr law via Ito calculus. European Physical Journal Plus, 138(9), 1–12. https://doi.org/10.1140/epjp/s13360-023-04497-x.

[8] Onder, I., Secer, A., Hashemi, M. S., Ozisik, M., & Bayram, M. (2023). On solution of Schrödinger–Hirota equation with Kerr law via Lie symmetry reduction. Nonlinear Dynamics, 111(20), 19315–19327. https://doi.org/10.1007/s11071-023-08879-9.

[9] Ozisik, M., Secer, A., Bayram, M., & Aydin, H. (2022). An encyclopedia of Kudryashov's integrability approaches applicable to optoelectronic devices. Optik, 265, 169499. https://doi.org/10.1016/j.ijleo.2022.169499

Producing soliton solutions for the nonlinear complex Ginzburg-Landau model including generalized quadratic-cubic law nonlinearity and chromatic dispersion

Handenur Esen[1], Aydin Secer[1,2], Muslum Ozisik[1], Mustafa Bayram[2]

[1]*Department of Mathematical Engineering, Yildiz Technical University, Istanbul, 34220, Turkey,*
[2]*Department of Computer Engineering, Biruni University, Istanbul, Turkey*
E-mail: handenur@yildiz.edu.tr, asecer@yildiz.edu.tr, ozisik@yildiz.edu.tr, mustafabayram@biruni.edu.tr

Abstract: This paper focuses on producing soliton solutions for the nonlinear complex Ginzburg-Landau model having generalized quadratic-cubic law nonlinearity and chromatic dispersion [1]. The nonlinear complex Ginzburg-Landau model serves as a principle framework for modeling wave propagation in diverse nonlinear media, such as photonic systems and optical fibers [2]. Incorporating generalized quadratic-cubic nonlinearity and chromatic dispersion, the equation captures a broader range of physical phenomena, offering a more comprehensive depiction of nonlinear interactions. The wave transformation is utilized to reduce the main equation to a nonlinear ordinary differential equation. Besides, we enforce the unified Riccati equation expansion method [3, 4, 5] to retrieve the analytical solutions for the presented model. Moreover, we depict the 3D, contour, and 2D graphical representations of the acquired solutions to investigate the physical behavior of the obtained solutions.

Keywords: Ginzburg-Landau equation, unified riccati equation expansion method, soliton solutions.

Mathematics Subject Classification: 35A24, 35C07, 35R11

References

[1] Biswas, A. (2018). Chirp-free bright optical solitons and conservation laws for complex Ginzburg-Landau equation with three nonlinear forms. Optik, 174, 207-215.

[2] Aranson, I. S., & Kramer, L. (2002). The world of the complex Ginzburg-Landau equation. Reviews of modern physics, 74(1), 99.

[3] Sirendaoreji. (2017). Unified Riccati equation expansion method and its application to two new classes of Benjamin–Bona–Mahony equations. Nonlinear Dynamics, 89, 333-344.

[4] Zayed, E. M., Gepreel, K. A., & El-Horbaty, M. (2023). Highly dispersive optical solitons in fiber Bragg gratings with stochastic perturbed Fokas–Lenells model having spatio-temporal dispersion and multiplicative white noise. Optik, 286, 170975.

[5] Ozisik, M., Onder, I., Esen, H., Cinar, M., Ozdemir, N., Secer, A., & Bayram, M. (2023). On the investigation of optical soliton solutions of cubic–quartic Fokas–Lenells and Schrödinger–Hirota equations. Optik, 272, 170389.

Introduction of a model describing two zones with an interface

Nabahats DIB and Tewfik Mahdjoub

LANLA, Department of Mathematics, University of Tlemcen, Algeria
E-mail: nabahatadiba.dib@univ-tlemcen.dz and tewfik.mahdjoub@univ-tlemcen.dz

Abstract: In this communication, we investigate the invasion of a village by the domestic species Triatoma Dimidiata. The village is located next to a forest, serving as the natural habitat for these vectors. They enter the village to feed, primarily consuming blood meals from the humans or mammals with whom they coexist. It is during this feeding phase that the primary transmission of Trypanosoma Cruzi from the vector to the host occurs.
The village is defined by the domain Ω, with the buffer zone identified as Ω_+ situated between Ω and the forest. An interface exists between Ω and Ω_+.
In our study, we examine a population of these triatomines structured both in terms of time and space. The demographic and spatial dispersion processes are described using reaction-diffusion equations in a two-dimensional space. By working within appropriate functional spaces, we convert this system of partial differential equations into an abstract differential equation. Our initial goal is to demonstrate that the operator generates an analytic semigroup. Subsequently, we establish the existence and uniqueness of a solution to the corresponding Cauchy problem.

Keywords: Transmission problem; reaction-diffusion; analytical semi-group; sector operator

Mathematics Subject Classification: 35K57, 47D06

References

[1] Chagas, C., "Nova tripanozomiaze humana: estudos sobre a morfolojia e o ciclo evolutivo do Schizotrypanum cruzi n. gen., n. sp., ajente etiolojico de nova entidade morbida do homem," Memorias do Instituto Oswaldo Cruz. 1909.

[2] N. Dib-Baghdadli, R. Labbas, M. Mahdjoub, A; Medeghri. "On some reaction-diffusion equations generated by non-domicilied triatomines, vectors of Chagas Disease," Discete Continuous Dyn. Syst, serie -B, (Number): 26-12, 2021.

[3] N.A. Dib-Baghdadli, "Application de la théorie des équations différentielles abstraites à des problèmes de dynamique de population," Thèse de Doctorat, Université de Tlemcen, 2022.

Solving the Generalized Chavy-Waddy–Kolokolnikov Model: Analytical Approaches to Bacterial Colonies

Melih Cinar[a,]

[a]*Department of Mathematical Engineering, Yildiz Technical University, 34230, Istanbul, TÜRKİYE*
E-mail: mcinar@yildiz.edu.tr

Abstract: This study examines the analytical solutions of the Chavy-Waddy–Kolokolnikov model describing the behavior of bacterial colonies. The model is characterized by a nonlinear fourth-order partial differential equation. With the help of diverse analytical methods, the explicit solutions of the considered model are obtained. The derived analytical solutions are confirmed to satisfy the main equation through Mathematica. To demonstrate the behavior of bacteria, numerical simulations of the solutions are achieved using Matlab.

Keywords: Bacterial Colonies, Analytical Solutions, Nonlinear Partial Differential Equation, Mathematical Modeling

References

[1] Nikolay A. Kudryashov, Aleksandr A. Kutukov, and Sofia F. Lavrova. *Properties of the generalized Chavy-Waddy–Kolokolnikov model for description of bacterial colonies*. Communications in Nonlinear Science and Numerical Simulation, 128, 2024.

[2] Alejandro León-Ramírez, Oswaldo González-Gaxiola, and Guillermo Chacón-Acosta. *Analytical Solutions to the Chavy-Waddy–Kolokolnikov Model of Bacterial Aggregates in Phototaxis by Three Integration Schemes*. Mathematics, 11(10), 2023.

[3] Nikolay A. Kudryashov. *Method for finding highly dispersive optical solitons of nonlinear differential equations*. Optik, 206, 2020, pages 163550. Elsevier.

[4] Muslum Ozisik, Aydin Secer, Mustafa Bayram, and Huseyin Aydin. *An encyclopedia of Kudryashov's integrability approaches applicable to optoelectronic devices*. Optik, 265, 2022, pages 169499. Elsevier.

[5] Nikolay A. Kudryashov and Sofia F. Lavrova. *Painlevé Test, Phase Plane Analysis and Analytical Solutions of the Chavy–Waddy–Kolokolnikov Model for the Description of Bacterial Colonies*. Mathematics, 11(14), 2023.

[6] Emad H. M. Zahran, Ahmet Bekir, and Reda A. Ibrahim. *Effective analytical solutions versus numerical treatments of Chavy-Waddy-Kolokolnikov bacterial aggregates model in phototaxic*. European Physical Journal Plus, 139(2), 2024.

How to Treat Gene Expression Data for Mathematical Modelling in Dynamical Sense

Ozlem Defterli

Cankaya University, Department of Mathematics, 06790, Ankara, Turkey
E-mail: defterli@cankaya.edu.tr

Abstract:
In literature, several different approaches exist to collect, process and visualize gene expression data. Gene expression analysis requires detailed consideration of confounding biological factors. Gene expression data can be viewed as a matrix of rows and columns where the rows represent the genes and the columns show the specific conditions of the array measurement. In this work, a gene expression dataset in time series format is used illustratively which belongs to a yeast bacteria microarray chip experiment. Its characteristics are identified and the underlying dynamics of the biological process are modelled in a time-discrete manner using some advanced mathematical modelling tools.
Keywords: Mathematical modelling, differential equations, data processing

References

[1] Donna K. Slonim. *From patterns to pathways: gene expression data analysis comes of age* (Review). Nature Genetics, 32(Suppl):502-508, 2002.

[2] Ozlem Defterli. *Modern Mathematical Methods in Modelling and Dynamics of Regulatory Systems of Gene-Environment Networks*. PhD Thesis, Graduate School of Natural and Applied Sciences, Department of Mathematics, METU, Turkey, 2011.

Travelling Wave Solutions of the Benney-Roskes/Zakharov-Rubenchik System

Mehmet Fatih Ucar

Istanbul Kultur University Department of Mathematics and Computer Science Istanbul, Türkiye
E-mail: f.ucar@iku.edu.tr

Abstract: This study presents the travelling wave solutions of the Benney-Roskes/Zakharov-Rubenchik system which was derived in the context of water waves. We apply the new Kudryashov method to obtain solutions effectively. This results in obtaining bright and singular solutions, and we also create graphical presentations to analyze the effects of problem parameters.

Keywords: Benney-Roskes system; Zakharov-Rubenchik system, The new Kudryashov method.

References

[1] Gönül, Ş., Özdemir, C. *Benney–Roskes/Zakharov–Rubenchik system: Lie symmetries and exact solutions*, Eur. Phys. J. Plus 137, 1107 (2022). https://doi.org/10.1140/epjp/s13360-022-03310-5

[2] H. Luong. *(In)stability and Asymptotic Analysis of the Zakharov–Rubenchik System and Related Wave type Equations*, Ph.D. Thesis, Universität Wien (2018)

Stochastic Analysis with Zili's Generalized fractional Brownian motion

Mounir Zili

University of Monastir, Research Laboratory LR18ES17 Avenue Mansour Skhiri, 5000 Monastir, Tunisia
E-mail: Mounir.Zili@fsm.rnu.tn

Abstract: We initiate a stochastic analysis theory with respect to the generalized fractional Brownian motion (gfBm) introduced by M. Zili in [1], which is a Gaussian process extending both fractional and sub-fractional Brownian motions. In fact, in the last decades, many extension kinds of fractional Brownian motion (fBm) and sub-fractional Brownian motion(sfBm) processes have been introduced such as the multifractional Brownian motion, the mixed fractional Brownian motion, the bifractional Brownian motion, the mixed sub-fractional Brownian motion and the generalized sub-fractional Brownian motion. But all these extensions do not generalize fBm and sfBm in the same time: each of them extends either only fBm or only sfBm. The Zili's Generalized fractional Brownian motion is completely different from all the above cited processes; in particular, it should allow researchers to deal with a larger class of modeled natural phenomena, including those with stationary or with non-stationary increments, whereas with fBm we can model only phenomena with stationary increments, and sfBm allows us to model only phenomena with non-stationary increments. Moreover, the gfBm depends on three parameters, that should allow us to construct more adequate models, allowing for example to control the level of correlation between the increments of the studied phenomena. This feature is not available with already known fractional and sub-fractional Brownian motions, and consequently it should overcome the deficiency of fBm and sfBm models due to their dependence on one single constant (the Hurst parameter). In this work, the main stochastic properties of the gfBm are established and its sample paths are simulated. Besides, Malliavin divergence operator and a Stochastic symmetric integral with respect to this process are defined, and sufficient integrability conditions are provided. Furthermore, corresponding Itô formulas are established, then applied to introduce a generalized version of the fractional Black–Scholes option pricing model.

References

[1] M. Zili, Generalized fractional Brownian motion. Modern Stochastics: Theory and Applications. (4), pp. 15-24. 2017.

The Qualitative Properties of Integro-Delay Differential Equations

Osman Tunç

Department of Computer Programing, Baskale Vocational School, Van Yuzuncu Yil University, Campus, 65080, Van, Turkey
E-mail: osmantunc89@gmail.com

Abstract: This work deals with behaviors of solutions of a DIDE. Four theorems, which have new sufficient conditions on the uniformly stability, asymptotic stability, exponential stability, instability of zero solution have been proved via the Lyapunov–Razumikhin method. Finally, an example is given to show applications of the given theorems.

Keywords: Integrability, exponentially stability, instability, asymptotically stability.

Mathematics Subject Classification: 34D05, 34K20, 45J05

References

[1] O. Tunç and E. Korkmaz, New Results on the Qualitative Analysis of Solutions of Vides by the Lyapunov–Razumikhin Technique. Ukrainian Mathematical Journal, 2023, 1-16.

[2] O. Tunç, Stability tests and solution estimates for non-linear differential equations. An International Journal of Optimization and Control: Theories & Applications (IJOCTA), 2023, 13.1: 92-103.

[3] M. Bohner, O. Tunç, E. Korkmaz, On the fundamental qualitative properties of integro-delay differential equations. Communications in Nonlinear Science and Numerical Simulation, 2023, 107320.

[4] O. Tunç New qualitative results to delay integro-differential equations. International Journal of Nonlinear Analysis and Applications, 2022, 13.2: 1131-1141.

Flood Modeling Using Spatial Pair-Copula Construction

[a,*]Izzat Fakhruddin Kamaruzaman , Wan Zawiah Wan Zin [b] and Noratiqah Mohd Ariff [b]

[a] *Faculty of Business, Multimedia University, Jalan Ayer Keroh Lama, 75450 Bukit Beruang, Melaka, Malaysia*
[b] *School of Mathematical Sciences, Faculty of Science and Technology, Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor, Malaysia*
E-mail: izzat.kamaruzaman@mmu.edu.my

Abstract: This paper presents a hydrological application of bivariate pair-copulas to model the spatial distribution of floods in Peninsular Malaysia. Accurate estimation of hydrological variables, such as average annual rainfall, rainfall severity, and duration, is crucial for the success of flood mitigation projects. Traditional spatial interpolation methods, such as kriging, rely on the assumption of linear spatial dependence and generate a single average value to reflect spatial correlation over a certain distance. However, this approach may not capture the non-linear dependence patterns present in the data. To overcome this limitation, the study proposes the use of spatial pair-copulas to model non-linear spatial dependence. Spatial pair-copula have the capability to capture complex spatial dependence structures more effectively than traditional methods. As a result, they provide greater accuracy in modeling relationships among hydrological variables. In the proposed spatial pair-copula model, the achieved results are promising in predicting annual maximum rainfall values at unobserved locations.

Keywords: Geostatistics Analysis, Hydrology, Spatial Copula, Multivariate Analysis

References

[1] Aas, K., Czado, C., Frigessi, A. & Bakken, H. 2009. Pair-copula constructions of multiple dependence. Insurance: Mathematics and Economics 44(2): 182–198.

[2] Atalay, F. & Tercan, A. E. 2017. Coal resource estimation using gaussian copula. International Journal of Coal Geology 175: 1–9.

[3] Bárdossy, A. & Li, J. 2008. Geostatistical interpolation using copulas. Water Resources Research 44(7): 1–15.

[4] Bárdossy, A. 2006. Copula-based geostatistical models for groundwater quality parameters. Water Resources Research 42(11): 1–12.

[5] Bárdossy, A. 2011. Interpolation of groundwater quality parameters with some values below the detection limit. Hydrology and Earth System Sciences 15(9): 2763–2775.

[6] Brunner, M. I., Furrer, R. & Favre, A. 2019. Modeling the spatial dependence of floods using the fisher copula. Hydrology and Earth System Sciences 23: 107–124.

[7] Cressie, N. 1990. The origins of kriging. Mathematical Geology 22(3): 239–252.

[8] Da Rocha, M. M. & Yamamoto, J. K. 2000. Comparison between kriging variance and interpolation variance as uncertainty measurements in the Capanema iron mine, State of Minas Gerais-Brazil. Natural Resources Research 9(3): 223–235.

[9] Department of Irrigation and Drainage Malaysia. Updating of Condition of Flooding in Malaysia. National Register of River Basins 2003, Vol. 2, 1–209.

[10] Durocher, M. & Quessy, J. F. 2017. Goodness-of-fit tests for copula-based spatial models. Environmetrics 28(5): 1–19.

[11] Durocher, M., Chebana, F. & Ouarda, T. B. M. J. 2016. On the prediction of extreme flood quantiles at ungauged locations with spatial copula. Journal of Hydrology 533: 523– 532.

[12] Graler, B. & Pebesma, E. 2011. The pair-copula construction for spatial data: A new approach to model spatial dependency. Procedia Environmental Sciences 7: 206–211.

[13] Graler, B. 2014. Modelling skewed spatial random fields through the spatial vine copula. Spatial Statistics 10: 87–102.

[14] Hernández-Maldonado, V., Díaz-Viera, M. & Erdely, A. 2014. A multivariate bernstein copula model for permeability stochastic simulation. Geofisica Internacional 53(2): 163–181.

[15] Jemain, A. A., Mohd Deni, S., Syed Jamaludin, S. S. & Wan Zin, W. Z. 2015. Penyurihan Ikhtisar Data Hujan. Kuala Lumpur: Dewan Bahasa dan Pustaka.

[16] Joe, H. 1996. Families of m-variate distributions with given margins and m(m-1)/2 bivariate dependence parameters. Lecture Notes-Monograph Series 28: 120–141.

[17] Kamaruzaman, I. F., Wan Zin, W. Z. & Mohd Ariff, N. A Generalized Bivariate Copula for Flood Analysis in Peninsular Malaysia. Malaysian Journal of Fundamental and Applied Sciences 2019, 15(1): 38–49.

[18] Kazianka, H. & Pilz, J. 2011. Bayesian spatial modeling and interpolation using copulas. Computers and Geosciences 37(3): 310–319.

[19] Kopacz, M., Sobczyk, E. J. & Galica, D. 2018. The impact of variability and correlation of selected geological parameters on the economic assessment of bituminous coal deposits with use of non-parametric bootstrap and copula-based monte carlo simulation. Resources Policy 55: 171–183.

[20] Li, F., Zhou, J. & Liu, C. 2018. Statistical modelling of extreme storms using copulas: A comparison study. Coastal Engineering 142: 52–61.

[21] Lloyd, C. D. & Atkinson, P. M. 2001. Assessing uncertainty in estimates with ordinary and indicator kringing. Computers and Geosciences 27(8): 929–937.

[22] Marchant, B. P., Saby, N. P. A., Jolivet, C. C., Arrouays, D. & Lark, R. M. 2011. Spatial prediction of soil properties with copulas. Geoderma 162(3–4): 327–334.

[23] Musafer, G. N. & Thompson, M. H. 2016. Optimal adaptive sequential spatial sampling of soil using pair-copulas. Geoderma 271: 124–133.

[24] Musafer, G. N. & Thompson, M. H. 2017. Non-linear optimal multivariate spatial design using spatial vine copulas. Stochastic Environmental Research and Risk Assessment 31(2): 551–570.

[25] Musafer, G. N., Thompson, M. H., Kozan, E. & Wolff, R. C. 2013. Copula-based spatial modelling of geometallurgical variables. The Second AUSIMM International Geometallurgy Conference / Brisbane, QLD, 30 September - 2 October 2013, pp. 239–246.

[26] Musafer, G. N., Thompson, M. H., Kozan, E. & Wolff, R. C. 2017. Spatial pair-copula modeling of grade in ore bodies: A case study. Natural Resources Research 26(2): 223–236.

[27] Musafer, G. N., Thompson, M. H., Wolff, R. C. & Kozan, E. 2017. Nonlinear multivariate spatial modeling using NLPCA and pair-copulas. Geographical Analysis 49(4): 409– 432.

[28] Nelsen, R. B. 2006. An Introduction to Copulas. Ed. 2nd. Portland: Springer.

[29] Salvadori, G. & De Michele, C. 2013. Multivariate extreme value methods. Extremes in a Changing Climate, Vol. 65. Springer.

[30] Salvadori, G., De Michele, C. & Durante, F. 2011. On the return period and design in a multivariate framework. Hydrology and Earth System Sciences 15(11): 3293–3305.

[31] Sohrabian, B. 2021. Geostatistical prediction through convex combination of archimedean copulas. Spatial Statistics 41: 100488.

[32] Van de Vyver, H. & Van den Bergh, J. 2018. The gaussian copula model for the joint deficit index for droughts. Journal of Hydrology 561: 987–999.

Fractional order of differential inclusions with lipschitz perturbations of an inverse strongly monotone and maximal monotone operators

[1] **Aicha Ouali, Abdallah Beddani and [2] Yamina Miloudi**

[1] *Department of Mathematics, University of Oran 1 Laboratory of Fundamental and Applied Mathematics of Oran (LMFAO), University of Oran 1, Ahmed BENBELLA*

[2] *Department of Mathematics, Faculty of Science and Technology Relizane University.*

E-mail: : ouali.aicha@edu.univ-oran1.dz, abdallah.beddani@univ-relizane.dz, miloudi.yamina@univ-oran1.dz

Abstract:
We study the existence and uniqueness of solutions for a class of fractional differential inclusions with lipschitz perturbations of maximal monotone operators in a real space with initial condition. The primary findings concerning existence and uniqueness are derived through the application of theory of multivalued fixed points.

References

[1] J.P. Aubin and A. Cellina, Differential inclusion, Set-valued Maps and Viability theory, Springer-Verlag. Berlin Heildelberg New york tokyo (1984).

[2] J.P. Aubin and H. Frankowska, Set-valued Analysis. Birkhauser, Berlin, (1990).

[3] S. Abbas, M. Benchohra, S. Bouriah and J.J. Nieto, Periodic solutions for nonlinear fractional differential systems, Differ. Equ. Appl, 103(2018), no. 3, 299-316.

[4] S. Adly, A. Hantoute and BT. Nguyen, Invariant sets and Lyapunov pairs for differential inclusions with maximal monotone operators, Math Anal Appl J Profile, 457 (2018) no. 2, 1017-1037.

[5] A. Bashir, A. Alsaedi, S. K. Ntouyas and J. Tariboon, Hadamard-type Fractional Differential Equations, Inclusions and Inequalities, Springer, Cham, (2017).

[6] A. Bashir and J. J. Nieto, Existence results for nonlinear boundary value problems of fractional integrodifferential equations with integral boundary conditions, Boundary Value Problems, (2009), Article ID 708576.

[7] Z. Bai, S. Zhang, S. Sun and C. Yin, Monotone iterative method for fractional differential equations, Electron. J. Differential Equations, 2016 no. 06, 1-8.

[8] H. H. Bauschke and L. Patrick, Convex Analysis and Monotone Operator Theory in Hilbert Spaces, CMS Books in Mathematics book series (CMSBM), (2017).

[9] H. H. Bauschke , W. M. Wоursi and X. F. Wang, Generalized monotone operators and their averaged resolvents, Math Program 189(2021), 55-74.

[10] A. Beddani, Finding a zero of the sum of two maximal monotone operators with minimization problem, Nonlinear Funct. Anal. Appl. 27(2022), no. 4, 895-902.

[11] M. Benchohra, S. Bouriah and M. A. Darwish, Nonlinear boundary value problem for implicit differential equations of fractional order in Banach spaces, Fixed Point Theory, 18(2017), 457-470.

[12] H. Brizis, Op´erateurs maximaux monotones et semigroupes de contraction dans un espace de Hilbert, North-Holland publishing company Amesterdam London, (1973).

[13] A.A. Kilbas, H.M. Srivastava and J.J. Trujillo, Theory and Applications of Fractional Differential Equations, Elsevier Science B.V, Amsterdam, (2006).

[14]] A.N. Kolmogorov and S.V. Fomin, Elements of Theory of Functions and Functional Analysis, Bibfismat, Dover, New York, (1984).

[15] R.T. Rockafellar and R.J.B. Wets, Variational Analysis, Springer, New York, (2004).

Advanced Control Strategies and Energy Optimization for Hybrid Energy Storage in Electrified Vehicles

Zahra Mokrani, Djamila Rekioua, Adel Oubelaid, Khoudir Kakouche , Toufik Rekioua, Chafiaa Serir, Talit Belhoul and Radia Abdelli

Université de Béjaia, Département du Genie Electrique, Faculté de Technologie, Laboratoir LTII
E-mail: zahra.mokrani@univ-bejaia.dz

Abstract: Hybrid electric vehicles (HEVs) have arisen as a significant technological innovation in the automobile industry, playing a novel and ecologically beneficial kind of transportation that is gaining popularity around the world. They are powered by electrical generators and provide a clean and sustainable alternative to traditional vehicles that use fossil fuels. Furthermore, HEVs, as symbols of the shift to more sustainable mobility, play an important role in mitigating climate change and safeguarding our planet for future generations; Direct Torque Control holds significant importance in the realm of electric vehicles. The DTC enables precise and responsive control of the motors by directly adjusting the torque produced, without the need for complex transmission systems. The incorporation of control mechanisms in HEV cars is critical for improving overall performance, efficiency, and safety. Sliding mode control (SMC) holds significant importance when applied to direct torque control (DTC) in electric vehicles. By implementing the SMC technique, the DTC system can enhance its ability to manage torque production of the electric motor, leading to improved performance and increased robustness. The control and energy management of a fuel cell-supercapacitor electric vehicle are the subject of this research. The energy management system employed in this study aims to harness the rapid charging and discharging capabilities of supercapacitors in order to mitigate the strain placed on fuel cells due to sudden power requirements. The HEV is controlled by a sliding mode controller with direct torque control. The simulation findings validate the efficacy of the provided energy management and sliding mode control solutions based on direct control.

References

[1] Mokrani. Z, Mebarki. N, Oubelaid. A, Kakouche. K, Mohammedi. A, Rekioua. D and Rekioua. T. : Direct Torque Control and Power Management Strategy Dedicated for Fuel Cell/ Supercapacitor Electric Vehicles. In The 3rd Conference on Electrical Engineering, Algiers, May 09-10 2023.

[2] Oubelaid, A., Taib, N. and Rekioua, T. : Novel coordinated power sources switching strategy for transient performance enhancement of hybrid electric vehicles. COMPEL - The international journal for computation and mathematics in electrical and electronic engineering, Vol. 41 No. 5, 1880-1919. (2022).

[3] H. F. Gharibeh, A. S. Yazdankhah, M. R. Azizian, Energy management of fuel cell electric vehicles based on working condition identification of energy storage systems, vehicle driving performance, and dynamic power factor, Journal of Energy Storage, Volume 31,2020

[4] S. F. da Silva, J. J. Eckert, F. L. Silva, F. C. Corrêa, L. C.A. Silva, A. V. Bueno, F. G. Dedini, Aging-aware optimal power management control and component sizing of a fuel cell hybrid electric vehicle powertrain, Energy Conversion and Management, Volume 292, 2023.

[5] Lu, Z.; Zhang, X. Composite Non-Linear Control of Hybrid Energy-Storage System in Electric Vehicle. Energies 2022, 15, 1567. https://doi.org/10.3390/en15041567

[6] D. Rekioua, T. Rekioua, DSP-controlled direct torque control of induction machines based on modulated hysteresis control," Proceedings of the International Conference on Microelectronics, 2009, ICM , art. no. 5418603, pp. 378-381.

Mathematical Methods Safety Barrier Performance Assessment

Hamaidi Brahim [1] **and Taibi Hicham**[2]

[1] *Electromechanical Engineering Laboratory LGE, faculty of Engineering Sciences BADJI Mokhtar University of Annaba - Algeria,*

[2] *Electromechanical Engineering Laboratory LGE, faculty of Engineering Sciences BADJI Mokhtar University of Annaba - Algeria*

E-mail: ham5615@yahoo.fr ,taibi@univ-annaba.org

Abstract: Most well-designed systems have safety barriers against such circumstances to protect humans, the environment, and material assets. This makes it harder for any one initiating event to propagate through all the barriers culminating in a hazardous event or accident. Some barriers are set up to prevent accidents from occurring (prevention barriers). Others are in place to reduce the consequences of an event once it has already occurred (mitigation barriers). The purpose of this paper is evaluating the performance of the existing safety barriers and according to risk tolerable decides if more additional barriers should be implemented.

Keywords: Barrier, Failure, Lopa, Tolerable risk, Safety instrumented system

References

[1] Rausand, M., (2014). Reliability of Safety-critical systems Theory and Applications, 1st ed. Hoboken, New Jersey.: Wiley.

[2] Todinov, M.T., (2006). Risk-Based Reliability Analysis and Generic Principles for Risk Reduction, 1st ed. Elsevier Science & Technology Books.

[3] Vinnem, J. E., (1999). Offshore Risk Assessment Principles, Modelling and Applications of QRA Studies, 1st ed. Norway.: Springer Science+Business Media Dordrecht

[4] Hokstad, P., Ingrid, B. U. and Jørn. V., (2012). Risk and Interdependencies in Critical Infrastructures A Guideline for Analysis. 1st ed. Verlag, London.: Springer.

[5] David, J. S. and Kenneth, G. L. S., (2016). The Safety Critical Systems Handbook A Straightforward Guide To Functional Safety: IEC 61508 (2010 Edition), IEC 61511 (2016 Edition) & Related Guidance Including Machinery and other industrial sectors, 4th ed. Joe Hayton, Cambridge, United States.

[6] CCPS., (2015). Guidelines for initiating events and independent protection layers in layer of protection analysis. Center for Chemical Process Safety (CCPS) of the American institute for chemical Engineers.

[7] Paul, G. and Harry, C., (2006). Safety instrumented systems: design, analysis, and justification, 2nd ed.

[8] Lazzaroni, M., Cristaldi, L., Peretto, L., Rinaldi. P. and Catelani. M., (2011). Reliability Engineering Basic Concepts and Applications in ICT, Verlag, Berlin, Heidelberg.: Springer.

On The Dynamics Of Time-Dependent Three Coupled Oscillators

Sara Hassoul and Salah Menouar

Laboratory of Optoelectronics and Compounds (LOC), Department of Physics,Faculty of Science, University of Ferhat Abbas Setif 1, Setif 19000, Algeria
E-mail: smenouar@univ-setif.dz

Abstract: Quantum dynamics of general time-dependent three coupled oscillators is investigated through an alternative approach based on decoupling of them using the unitary transformation method. From a first unitary transformation, the quantal Hamiltonian of the complicated original system is transformed to an equal but a simple one associated with the three coupled oscillators of which masses are unity. Finally, we diagonalize the matrix representation of the transformed hamiltonian by using a unitary matrix. The diagonalized Hamiltonian is just the same as the Hamiltonian of three simple oscillators.Through these procedures, the coupled oscillatory subsystems are completely decoupled. The importance of this decouplement is that it enables us to develop exact theory for mechanical treatment of the originally-coupled systems without any restriction in the form of time-varying parameters.

Keywords: Time-dependent three coupled oscillators; Unitary transformation; Hamiltonian; Wave function. unitary operators.

References

[1] H. R. Lewis Jr, W. B. Riesenfeld, Class of Exact nvariants for classical and quantum time-dependent harmonic oscillators, J. Math. Phys. 9(11), 1976-1986 (1968).

[2] H. R. Lewis Jr, W. B. Riesenfeld, An exact quantum theory of the time-dependent harmonic oscillator and of a charged particle in a time-dependent electromagnetic field, J. Math. Phys 10(8), 1458-1473 (1969).

[3] C. J. Efthimiou, D. Spector, Separation of variables and exactly soluble time-dependent potentials in quantum mechanics, Phys. Rev. A 49(4), 2301-2311 (1994).

[4] M. J. Kronenburg, A method for fast diagonalization of a 2x2 or 3x3 real symmetric matrix, arXiv:1306.6291 (2013).

[5] P. B. Denton, S. J. Parke, T. Tao, X. Zhang, Eigenvectors from eigenvalues: a survey of a basic identity in linear algebra, arXiv:1908.03795 (2019).

[6] J. E. Gentle, Matrix transformations and factorizations. In: Matrix Algebra: Theory, Computations, and Applications in Statistics. Springer, New York (2007).

[7] D. Park, Dynamics of entanglement in three coupled harmonic oscillator system with arbitrary time-dependent frequency and coupling constants, Quantum Inf. Process. 18(9), 282 (2019).

[8] Francisco M. Fernández, Comment on: Entanglement in three coupled oscillators, Phys. Lett. A 384 (25)126134 (2020).

[9] S. Pepore, P. Winotai, T. Osotchan, U. Robkob, Path integral for a harmonic oscillator with time-dependent mass and frequency, Sci. Asia 32(2), 173-179 (2006).

[10] D.Y. Song, Unitary relations in time-dependent harmonic oscillators, J. Phys. A: Math. Gen. 32(18), 3449-3456 (1999).

Parallel Active Filter Analysis, Control, and Diagnosis

Benyettou Loutfi, Rahali Hilal and Zeghlache Samir

Laboratory of Electrical Engineering, University of M'sila, Algeria
E-mail: loutfi.benyettou@univ-msila.dz, hilal.rahali@univ-msila.dz, samir.zeghlache@univ-msila.dz

Abstract: In this work we expose the problem of current degradation in electrical installations, which arises directly from the proliferation of non-linear loads, to solve it, we used a two-level inverter as a parallel active filter, which injects harmonic currents at the connection point with a compensation method called the instantaneous active and reactive power method. The second part in this work we are interested in the problems of detection and localization of some faults in a voltage inverter used as a parallel active filter which is intended for the filtering of harmonic currents with the compensation of reactive energy. To do this, a series of simulation tests, for the different defects considered, must be carried out in order to extract the different information contained in the electrical signals from the inverter.

Keywords: : Parallel Active Filter, Analysis, Control, Faults detection, Inverter.

References

[1] Aziz Boukadoum ,''Faults Diagnosis of Active Power Filter Using Fuzzy Logic Controller under Different Conditions", IEEE International Conference on Electrical Sciences and Technologies in Maghreb (CISTEM), 2022

[2] Özkaya, Hasan," Parallel active filter design, control, and implementation", Graduate School of Natural and Applied Sciences, Thesis,2007

[3] Shanshan Ji , ''Parallel sparse filtering for intelligent fault diagnosis using acoustic signal processing", Neurocomputing, Volume 462, 28 October 2021, Pages 466-477

[4] L.BENYETTOU, " Faults detection and diagnosis of multilevel inverter based on signal processing", Traitement du Signal, Volume 6, 1,2019, Pages 37-44

Comparative Analysis between Adaptive type-1 Fuzzy Field-Oriented Control and hybrid Sliding Mode-Backstepping Control of a Double Star Induction Machine (DSIM)

Rahali Hilal, Bilal Djamal Eddine Cherif, Zeghlache Samir and Benyettou Loutfi

Laboratory of Electrical Engineering, University of M'sila, Algeria,
E-mail: hilal.rahali@univ-msila.dz, cherif.bilaldjamaleddine@univ-msila.dz, samir.zeghlache@univ-msila.dz, loutfi.benyettou@univ-msila.dz

Abstract: In this work we have opted for a comparative study between two different control strategies for the double star induction machine (DSIM). The DSIM is fed by two cascaded two-level voltage inverter using the pulse-width modulation (PWM) control strategy. The two hybrid nonlinear controls studied and applied are increasingly oriented towards the application of modern control techniques, the first is the Adaptive type-1 Fuzzy Field-Oriented Control based on PI regulators by rotor flux orientation and uses a rotor flux estimator and with a hybrid control on sliding mode control synthesized by backstepping, to regulate the speed of a dual star induction machine DSIM in order to compare the performances of the system using these two control methods.

Keywords: DSIM, Fuzzy Field-Oriented Control, sliding mode Control, backstepping, Inverter.

References

[1] S. HwanIm and B. GwanGu, "Study of Induction Motor Inter-Turn Fault Part II: Online Model-Based Fault Diagnosis Method", Journal of Energies, vol. 15, pp. 977, 2022.

[2] B. Ladjal; F. Berrabah ; S. Zeghlache ," Modelling and Control of Double Star Induction Machine used Active Fault Tolerant Control based on Backstepping Controller and Non Linear Adaptive Observer" 2022 International Conference of Advanced Technology in Electronic and Electrical Engineering (ICATEEE), M'sila, Algeria, 26-27 November 2022.

[3] N. Layadi, A. Djerioui, S. Zeghlache, H. Mekki, A. Houari, J. Gong, et al., "Fault-Tolerant Control Based on Sliding Mode Controller for Double-Star Induction Machine", Arabian Journal for Science and Engineering, vol. 45, pp. 1615-1627, 2020.

[4] D. Hadiouche, H. Razik, A. Rezzoug, "Modelling of a double-star induction motor with an arbitrary shift angle between its three phase windings", EPE-PEMC'2000, Sep 2000, KOSICE, Slovakia.

Artificial Intelligence-Based Mathematical Analysis for Coupled Differential System Subject to Circular Obstacle in Corrugated Backward Facing Step

Khalil Ur Rehman [1,*] **and Wasfi Shatanawi** [1]

[1] *Department of Mathematics and Sciences, College of Humanities and Sciences, Prince Sultan University, Riyadh 11586, Saudi Arabia*
E-mail: kurrehman@psu.edu.sa

Abstract: The backward-facing step (BFS) is considered as a computational domain. The two similar triangular ribs are introduced to make BFS corrugated. The flow is taken at the inlet with the parabolic pattern. The circular obstacle is installed in BFS at the end of upstream. The coupled differential system is constructed for the backward-facing step flow field. The domain is discretized by using hybrid meshing and the finite element method is used to report the solution. The artificial neural networking (ANN) model is constructed by considering fluid density, dynamic viscosity, mean inflow velocity, and characteristics length as inputs in the first layer while lift coefficient (LC) is treated as output in the last layer. For training, we select 67 (70%) values while for both validation and testing, we own 14 (15%) each. Carrying 10 neurons in the hidden layer, the ANN is trained by using the Levenberg-Marquardt algorithm. The model is validated by conducting mean square error and regression analysis. It is found that the constructed ANN is the best model to forecast the hydrodynamic force faced by circular obstacles in BFS up to a wide range of parameters where usual methods fail to report the solution.

Keywords: Coupled differential system, Backward facing step, Hydrodynamic force, Circular obstacle, Neural networking, Finite element method

Mathematics Subject Classification: 35Q35, 76B03

References

[1] Hilo, Ali Kareem, Antonio Acosta Iborra, Mohammed Thariq Hameed Sultan, and Mohd Faisal Abdul Hamid. "Effect of corrugated wall combined with backward-facing step channel on fluid flow and heat transfer." Energy 190 (2020): 116294.

[2] Hilo, Ali Kareem. "Fluid flow and heat transfer over corrugated backward facing step channel." Case Studies in Thermal Engineering 24 (2021): 100862.

[3] Arthur, James K. "A narrow-channeled backward-facing step flow with or without a pin–fin insert: Flow in the separated region." Experimental Thermal and Fluid Science 141 (2023): 110791.

[4] Lee, Jeonghu, and Van Thinh Nguyen. "Effects of various backward-facing steps on flow characteristics and sediment behaviors." Physics of Fluids 35, no. 6 (2023).

[5] Alhasan, Muhammed, Hudhaifa Hamzah, Aisha Koprulu, and Besir Sahin. "Couette-Poiseuille flow over a backward-facing step: Investigating hydrothermal performance and irreversibility analysis." Case Studies in Thermal Engineering 53 (2024): 103954.

Mathematical modeling of organism swimming through rough inclined passage

Zeeshan Asghar and Wasfi Shatanawi

Department of Mathematics and Sciences, College of Humanities and Sciences, Prince Sultan University, Riyadh 11586, Saudi Arabia
E-mail: zasghar@psu.edu.sa and wshatanawi@psu.edu.sa

Abstract: The self-propelling mechanism of spermatozoa at low Reynolds number is investigated using Stokes equations. These equations normally hold for bodies swimming with slow speed, having small scales, and interacting with highly viscous medium. In biomedicine, these artificial crawlers useful for drug delivery, diagnostic, or therapeutic purposes are controlled via electric and magnetic sensors. In addition to the fluid rheology, these external forces tend to reduce/enhance the speed of swimming cells. To investigate such effects on active spermatozoa we calculate the speed of an undulating sheet propelling through viscous fluid. After utilizing Galilean transformation, dimensionless variables, stream function, low Reynolds, and long wavelength approximation on momentum equation one arrives at the fourth-order ordinary differential equation with four boundary conditions involving two unknowns i.e. flow rate and organism speed. Unknowns satisfying the dynamic equilibrium conditions are simulated via the modified Newton-Raphson method. Consequently, work done by the microorganism is also computed.

Keywords: Swimming organism, Navier–Stokes equations, Galilean transformation, modified Newton-Raphson method

Mathematics Subject Classification: 76A05, 76-10

References

[1] Lauga, E. (2007). Propulsion in a viscoelastic fluid. Ph ysics of Fluids, 19(8), 083104.

[2] Elfring, G. J., Pak, O. S., & Lauga, E. (2010). Two-dimensional flagellar synchronization in viscoelastic fluids. Journal of fluid mechanics, 646, 505-515.

[3] Elfring, G. J., & Lauga, E. (2015). Theory of locomotion through complex fluids. In Complex fluids in biological systems (pp. 283-317). Springer, New York, NY.

Biological effects and chemical characterization of Ilex aquifolium L. extracts: A new source of bioactive constituents

A ldjia Hadroug[1,*] and Rachid Belhattab[2]

[1]*Department of Chemistry, Med Boudiaf University,Algeria*
[2] *Department of Biochemistry, Farhat Abes University, Algeria*
E-mail: aldjia.hadrougue@univ-msila.dz

Abstract: This study gathers information about the effects of methanolic extracts from fruits and aerial parts of Ilex aquifolium L. on selected enzymes (cholinesterases, alpha-amylase and alpha-glucosidase and tyrosinase) as well as their antioxidant capacities in relation with their phenolic composition. The chemical composition was assessed by determining total phenolic and flavonoid content as well as individual phenolic compounds by HPLC-DAD. Moreover, antioxidant abilities of the investigated extracts were tested by using different assays including free radical scavenging (DPPH and ABTS), reducing power (CUPRAC and FRAP), phosphomolybdenum and metal chelating, overall fruits being indicated as a source of antioxidant compounds. Furthermore, interactions between dominant compounds from extracts and selected enzymes were investigated by molecular modeling studies in order to explain at a molecular level the interactions between selected compounds and active sites of the enzyme.

Keywords: Ilex aquifolium L.; bioactive compounds; enzyme inhibition; herbal extracts

Fractional Order Moment Parameter Estimator of Compound-Gaussian Clutter with Nakagami-Distributed Textures

Izzeddine Chalabi and Maroua Louglaib

Laboratory of Electrical Engineering, Faculty of Technology, University of M'sila, PO Box 166 Ichebilia, 28000 M'Sila Algeria.
E-mail: izzeddine.chalabi@univ-msila.dz

Abstract: This paper deals with parameter estimation of Compound-Gaussian Clutter with Nakagami-Distributed Textures (CGNG). CGNG was recently proposed to model sea clutter at medium/high grazing angles, where the parameters were estimated using the higher order moments estimator (HOME) and [zlog(z)] method. In order to improve the estimation performance, the fractional order moment estimator (FOME) is proposed in this paper. The obtained results show that the proposed FOME estimator provides the best estimation accuracy comparing to the HOME and the [zlog(z)] methods using both simulated and real data.

Keywords: Parameter estimation, Radar clutter, Compound Gaussian, Nakagami distribution.

References

[1] Yang, G., Zhang, X., Zou, P., & Shui, P. 'Compound-Gaussian Model with Nakagami-Distributed Textures for High-Resolution Sea Clutter at Medium/High Grazing Angles'. Remote Sensing, 16(1), 195. 2024.

[2] Chalabi, I. 'High-resolution sea clutter modelling using compound inverted exponentiated Rayleigh distribution'. Remote Sens. Lett. 14, 433–441. 2023.

[3] Carretero-Moya, J., J. Gismero-Menoyo, A. Blanco-del-Campo, and A. Asensio-L´opez. "Statistical Analysis of a High-Resolution Sea-Clutter Database." IEEE Transactions on Geoscience and Remote Sensing 48 (4): 2024–2037. doi:10.1109/TGRS.2009.2033193. 2010.

[4] CHALABI, Izzeddine et MEZACHE, Amar. Estimators of compound Gaussian clutter with log-normal texture. Remote sensing letters, vol. 10, no 7, p. 709-716. 2019.

[5] Iskander, D. R., and A. M. Zoubir.. "Estimation of the Parameters of the K-Distribution Using Higher-Order and Fractional Moments." IEEE Transactions on Aerospace and Electronic Systems 35 (4): 1453–1457. 1999.

Structural, elastic, vibrational and thermal properties of quaternary Lithium based Alloys

Badis Bennecer*, Nassima Guechi and Saliha Karfaf

Physics Laboratory of Guelma, Faculty of Mathematics, Computing and Material Sciences, University 8 Mai 1945 Guelma, Guelma, Algeria
E-mail: b_bennacer@hotmail.com

Abstract: Ab-initio calculations combined with the virtual crystal approximation (VCA) and the quasi-harmonic Debye model have been used to investigate the phase transition of the $LiBeAs_{1-x}Sb_x$ and $LiBeP_{1-x}Sb_x$. Phase transition has been predicted for both systems, i.e., $LiBeAs_{1-x}Sb_x$ and $LiBeP_{1-x}Sb_x$, from the Cu_2Sb (P4/nmm) phase to the polar LiGaGe (P63mc) one beyond antimony concentration of $x = 0.21$ and 0.36, respectively. These alloys are mechanically stable according to the calculated elastic constants. The phonon frequencies at the zone centre for the Raman-active and infrared-active modes are predicted for the Cu_2Sb and the LiGaGe structures for different antimony concentrations. The variations of thermal expansion coefficient, bulk modulus, Debye temperature, heat capacities at constant volume and the Grüneisen parameter as a function of pressure and temperature were all obtained and analysed.

Keywords: Abinitio methods, phase transition, elastic constants, phonon spectra

Study of the influence of cutting parameters on technological parameters in the turning process of titanium alloy

Nabil Kribes1, Younes Belbellaa1 , Khaoula Abbed, Smail Boutabba1

Applied Mechanics of New Materials Laboratory-LMANM, university 8 Mai 1945, P.O. Box 401, 24000 Guelma, Algeria
E-mail: Normila1@yahoo.fr, younesbelbellaa@gmail.com, khaoulaabbed@gmail.com, Boutabba_s_lpg@yahoo.fr

Abstract: Manufacturers' goals today are to reduce machining costs as much as possible by reducing technological parameters. Titanium alloys are widely used in several fields of engineering. Ti-6Al-4V may be considered one of the more difficult titanium alloys to machine and is known for damaging cutting tools due to its aggressiveness This work consists of studying the influence of cutting parameters (cutting speed, depth of cut and feed per revolution) on technological parameters (surface roughness, cutting force, vibrations and rate of material removed). the finishing turning operation was carried out on a part of titanium alloy Ti-6Al-4V using two different types of cutting materials, one is PVD coated carbide (GC1125) and the other uncoated (H13A). To carry out this study, we used Multi objective optimization methods (MCDM) such as the CODAS, ARAS, TOPSIS method for the purpose of determining the optimal regime to obtain the desired results.

Keywords: Ti-6Al-4V- surface roughness - Cutting force- vibrations- H13A- GC1125

Fractional Order Moment Parameter Estimator of Compound-Gaussian Clutter with Nakagami-Distributed Textures

Izzeddine Chalabi and Maroua Louglaib

Laboratory of Electrical Engineering, Faculty of Technology, University of M'sila, PO Box 166 Ichebilia, 28000 M'Sila Algeria.
E-mail: izzeddine.chalabi@univ-msila.dz

Abstract: This paper deals with parameter estimation of Compound-Gaussian Clutter with Nakagami-Distributed Textures (CGNG). CGNG was recently proposed to model sea clutter at medium/high grazing angles, where the parameters were estimated using the higher order moments estimator (HOME) and [zlog(z)] method. In order to improve the estimation performance, the fractional order moment estimator (FOME) is proposed in this paper. The obtained results show that the proposed FOME estimator provides the best estimation accuracy comparing to the HOME and the [zlog(z)] methods using both simulated and real data.

Keywords: Parameter estimation, Radar clutter, Compound Gaussian, Nakagami distribution.

References

[1] Yang, G., Zhang, X., Zou, P., & Shui, P. 'Compound-Gaussian Model with Nakagami-Distributed Textures for High-Resolution Sea Clutter at Medium/High Grazing Angles'. Remote Sensing, 16(1), 195. 2024.

[2] Chalabi, I. 'High-resolution sea clutter modelling using compound inverted exponentiated Rayleigh distribution'. Remote Sens. Lett. 14, 433–441. 2023.

[3] Carretero-Moya, J., J. Gismero-Menoyo, A. Blanco-del-Campo, and A. Asensio-L´opez. "Statistical Analysis of a High-Resolution Sea-Clutter Database." IEEE Transactions on Geoscience and Remote Sensing 48 (4): 2024–2037. doi:10.1109/TGRS.2009.2033193. 2010.

[4] CHALABI, Izzeddine et MEZACHE, Amar. Estimators of compound Gaussian clutter with log-normal texture. Remote sensing letters, vol. 10, no 7, p. 709-716. 2019.

[5] Iskander, D. R., and A. M. Zoubir.. "Estimation of the Parameters of the K-Distribution Using Higher-Order and Fractional Moments." IEEE Transactions on Aerospace and Electronic Systems 35 (4): 1453–1457. 1999.

Correlations between the Nusslet and the Reynolds Numbers: a Statistical Approach Ahsene Lanani and Rahima Benchabi

Ahsene Lanani[1] **and Rahima Benchabi** [2]

[1]*Department of Mathematics,University of Freres Mentouri, Constantine 1, 25000, Algeria*
[2] *Department of Mechanical Engineering,University of Freres Mentouri, Constantine 1, 25000, Algeria*
E-mail: alanani1@yahoo.fr and rbenchabi@yahoo.fr

Abstract: This paper presents a new statistical approach to study correlations between the Nusselt and Reynolds numbers. Also, the work is devoted to the study of the laminar fluid flow in corrugated channel and to determine the influence of certain parameters on the heat transfer. The governing equations of flow and energy were solved numerically by using volume finite method (SIMPLE algorithm and CFD code).

Keywords: Correlations, Finite volume method, Numerical study

References

[1] Arqub, O. A., Abdulbasit, G., Abdulsayid, A. 2012. Modeling of Fluid Flow in 2D Triangular, Sinusoidal, and Square Corrugated Channels, Word Academy of science, Engineering and Technology, 71, 11-23.

[2] Arqub, O. A., 2018. Numerical solutions for the Robin time - fractional partial differential equations of heat and fluid flows based on the reproducing kernel algorithm, Int. j. of numerical methods for heat and fluid flow, 28(4), 826-856.

[3] Hessami, M.A. 1998. Laminar to turbulent flow transition in cross corrugated plate cavities, 13th Australian fluid mechanics conference Manash University, Melbourne, Australia 13-18 December 1998.

[4] Murugesan, M.P., Akilamudhan, P. 2014 The heat transfer characteristics of plate heat exchanger with different corrugation angles, Int. J. of Recent Scientific Research, 5(6), 1022-1026

[5] Naphon, P. 2008. Effect of corrugated plates in an in-phase arrangement on the heat transfer and flow developments, Int. J. of Heat and Mass Transfer, 51, 3963-3971

[6] Ozbolat, V., Tokgoz, N., Sahin, B. 2013. Flow characteristics and Heat Transfer Enhancement in 2D Corrugated Channels, International Journal of Mechanical Science and Engineering, 7(10), 796-800.

[7] Rao, B. S. Varun, S., Murali Krishna, M. V. S., Sastry, R.C. 2014. Pressure Drop Studies of Newtonian Fluids in Corrugated Plate Heat Exchangers, International Journal of Mechanical

[8] Shang, Y. 2015. Analytical solution for an In-host Viral Infection Model with Time-inhomogeneous Rates, Acta Physica Polonica, Series B, 46(8), 1567-1577.

[9] Zonouz, N.O., Salmanpour, M. 2012. Numerical Analysis of Flow Field and Heat Transfer of 2D Wavy Ducts and Optimization by Entropy Generation Minimization Method, Journal of Thermodynamics Vol. 2012, 1-8.

Long-Term Dynamics of the Wave Equation under Mixed Boundary Conditions

Karima Laoubi

Department of Mathematics, University of Boumerdes, Algeria
E-mail: ka.laoubi@univ-boumerdes.dz

Abstract: This work focuses on analyzing the damped wave equation subject to mixed boundary conditions within a finite domain. Specifically, a Ventcel-type boundary condition characterized by the significant density function f(x) is applied to a portion of the boundary, while the remainder is governed by a homogeneous Dirichlet boundary condition. The decay of solutions to the wave equation is demonstrated to be logarithmic, predicated on the behavior of the resolving operator along the imaginary axis. This decay rate is substantiated through resolving estimations that leverage interpolation inequalities pertinent to an elliptic equation under Steklov-type boundary conditions.

Keywords: Semi-groups, Polynomial stability, Multiplier method, Geometric condition, Fourier Analysis

Mathematics Subject Classification: 35L05, 35B35, 35B40.

References

[1] Fu, X., Kong, L. Longtime Behavior of Wave Equation With Kinetic Boundary Condition. Appl Math Optim 84, 2803-2817 (2021). https//doi.org/10.1007/s00245-020-09730-y.

[2] M. Akil and Z. Hajjej, Exponential stability and exact controllability of a system of coupled wave equations by second order terms (via Laplacian) with only one non-smooth local damping, Math. Meth. Appl. Sci. (2023), 1-20, DOI 10.1002/mma.9724.I.

[3] S. Nicaise and K. Laoubi, Polynomial stabilization of the wave equation with Ventcel's boundary conditions, Math. Nachr.283, NO.10 ,1428-1438(2010)I. Daubechies, Comm. Pure Appl. Math. 41, 909, 1988.

[4] K. Liu. Locally distributed control and damping for the conservative systems. SIAM Journal on Control and Optimization, 35(5)1574-1590, 1997

DFT calculations of two azo-palladium (II) complexes

Meriem Lmmouchi[1] and Souheyla Chetioui[2,3]

[1] *Higher National school of Renewable Energy, Environment and sustainable Development. Constantine road, Fesdis, Batna 05078, Algeria.*

[2] *Faculty of Technology. University of M'sila. PO Box 166 Ichebilia, 28000 M'sila, Algeria.*

[3] *Research Unit for Chemistry of the Environment and Molecular Structural. University of Constantine 1, Constantine 25000, Algeria*

E-mail: meriem.lemmouchi@hns-re2sd.dz

Abstract: The transition metal-azo dye complexes are related to the possibility to obtain new compounds with various biological activities. This class of complexes is important in the progress of metalbased anticancer agents. These different areas of interest fostered inorganic chemists to develop novel approaches to the preparation of non-covalently bound anticancer drugs. Recently, Pd-arylazo complexes have found application in C–C coupling reactions interacting strongly with CT DNA and exhibiting photochromic activity , where most of their electronic and photochromic efficiency have been explained by DFT calculations. We report two novel Pd(II) coordination complexes obtained using (E)-1-((2-methoxyphenyl)diazenyl)naphthalen-2-ol [1] and (E)-1 ((3methoxyphenyl)diazenyl) naphthalen-2-ol [2] azo-ligands. These two bidentate ligand precursors are isomers differing from the ortho versus meta position of their methoxyphenyl group. In both Pd(II) complexes(I) and (II), respectively, the metal is coordinated to two N atoms and two O atoms. The DFT-optimized structures of (I) and (II) reproduce well the structural properties of their experimentally determined X-ray counterparts. Complexes (I) and (II) display large HOMO–LUMO gaps, in line with the strong metal–ligand interactions. Complex (I) is computed to be less stable by 12.0 and 11.5 kcal/mol than (II) and (III), respectively, showing the impact of the methoxy position on the molecular structures, which are planar in (II) and (III), but distorted in (I) The simulated UV–Vis spectra obtained by TD-DFT calculations are comparable to the experimental spectra, putting emphasis on the ILCT and MLCT electronic transitions involving several of the frontier molecular orbitals in the complexes.

Keywords: DFT calculations, Transition metal, Azo compounds, TD-DFT and AIM.

References

[1] Salmen R, Malterud KE, Pedersen BF (1988) Acta Chem. Scand A 42:493

[2] Gilli P, Bertolasi V, Pretto L, Antonov L, Gilli G (2005) J Am Chem Soc 127:4943

Some particular nonlinear partial differential equations solution by the Adomian and modified decompositions methods

Naima Meskine

Boumerdes University, Dept. of Mathematical, Sciences Faculty, Algeria
E-mail: n.meskine@uni-boumerdes.dz

Abstract: In this work, we aim to obtain the exact analytical solution of some particular partial differential equations of order 2 which are nonlinear and nonhomogeneous in space-time by the Adomian and modified decompositions methods accompanied by a series of Taylor expansions. The solutions of these equations are given in the form of a polynomial series which converges to their own exact solution by the two methods. It is easy to see that each method gives exactly the same solution. The comparison of exact solutions to numerical solutions is given in the form of tables including the error rate between the two solutions. The graphs presented in this work using Matlab also show the behavior and differences of this two solutions. This demonstrated the accuracy of the two cited methods for solving nonlinear partial differential equation.

References

[1] A. M. Wazwaz, Partial Differential Equations: Methods and Applications. Lisse, Netherlands: Balkema Publishers, (2002).

[2] A. M. Wazwaz, El-Sayed, S. M.: A New Modification of the Adomian Decomposition Method for Linear and Nonlinear Operators. Appl. Math. Comput. 122(3), 393-405 (2001).

[3] K. Abbaoui, Y. Cherruault, Convergence of Adomian's method applied to differential equations; Comput. Math. Appl. 28(5), 103-109 (1994).

[4] .S. Ghaleb and YQ. New Development of Adomian Decomposition Method for Solving Second Order Ordinary Differential Equations. Int J Math.6, 2:28-49. (2017).VIGRE Student Mini Conference, 2004.

Physical Properties of Mg-doped Co_3O_4 Nanocrystalline Thin Films Elaborated Using Spray Pyrolysis

Warda Darenfad[1], Noubeil Guermat[2,3], Kamel Mirouh[1], Younes Nezzari[1] and Rayene Merah[1]

[1] *Thin Films and Interfaces Laboratory (LCMI), University of Constantine 1, 25000 Constantine, Algeria*
[2] *Department of Electronics, Faculty of Technology, University of M'sila, PO Box 166 Ichebilia, 28000 M'sila, Algeria*
[3]*Laboratoire des Etudes de Matériaux d'Electronique pour Applications Médicales (LEMEAMED), Université de Constantine 1, 25000 Constantine, Algerie*
E-mail: daranfed.warda@umc.edu.dz

Abstract: In this study, we elaborated and characterized thin films of undoped and magnesium-doped (1%, 2%, and 3%) cobalt oxide. These films were deposited on ordinary glass substrates at a temperature of 400 °C, with a deposition time of 5 min, using the spray pyrolysis technique. The main objective of this work was to investigate the influence of magnesium doping on the structural, optical, and electrical properties of Co_3O_4. X-ray diffraction (XRD) results showed that all films were polycrystalline with a cubic spinel structure [1-4], and there was a decrease in the crystallite size (D) with increasing doping. The optical transmission spectra of the Mg-doped Co_3O_4 film exhibited high transmittance in the 400 to 500 nm range. Specifically, the electrical resistivity showed a significant decrease, from 8.031 Ω·cm to 0.807 Ω·cm for undoped and 2% Mg-doped films, respectively. However, for Mg concentrations of 3%, the electrical resistivity increased to 0.8217 Ω·cm.

Keywords: Thin films, Mg-doped Co_3O_4, Spray pyrolysis, XRD, Electrical resistivity.

References

[1] Darenfad, W. and Guermat, N. and Bouarissa, N. and Satour, F.Z. And Zegadi, A. and Mirouh, K.,"Improvement in optoelectronics and photovoltaic properties of p-Co3O4/n-ZnO hetero-junction: effect of deposition time of sprayed Co3O4 thin films", J. Mater. Sci.: Mater. Electron., 35, pp.162, 2024.

[2] Darenfad, W. and Guermat, N. and Mirouh, K.,"Experimental study in the effect of precursors in Co3O4 thin films used as solar absorbers", Ann. Chim. -Sci Mat., 44(2), pp. 121 – 126, 2020.

[3] Darenfad, W. and Younes, N. and Mirouh, K. and Guermat, N. and Merah, R.,"Influence of precursor solution on the properties of Co3O4 thin films deposited by spray pyrolysis", 10th International Conference on Computational and Experimental Science and Engineering, Antalya, TURKEY, (2023).

[4] Darenfad, W. and Guermat, N. and Mirouh, K.,"Preparation and characterization of Co3O4 thin films elaborated by spray pyrolysis", The 5TH International Conferene on Advances in Mechanical Engineering, Istanbul, TURKEY, (2019).

Impact of Fluorine Doping on the Structural, Optical and Electrical Characteristics of Spray Deposited SnO2 Thin Films

Noubeil Guermat[1,2],Warda Darenfad [3], Kamel Mirouh [3] and Azzedine Bellel[2]

[1] *Department of Electronics, Faculty of Technology, University of M'sila, PO Box 166 Ichebilia, 28000 M'sila, Algeria*
[2] *Laboratoire des Etudes de Matériaux d'Electronique pour Applications Médicales (LEMEAMED), Université de Constantine 1, 25000 Constantine, Algerie,*
[3] *Thin Films and Interfaces Laboratory (LCMI), University of Constantine 1, 25000 Constantine, Algeria*
E-mail: noubeil.guermat@univ-msila.dz

Abstract: In this study, we conducted a thorough analysis of the impact of fluorine doping at concentrations of 2%, 4%, and 6% on the structural, optical, and electrical characteristics of undoped SnO_2 films deposited using the spray pyrolysis technique. Various analytical methods were employed to assess these properties: X-ray diffraction (XRD) for structural examination, UV-visible spectrophotometry for optical evaluations, and the four-point probe method for electrical measurements. The XRD analysis revealed that the films deposited via spray pyrolysis exhibited a polycrystalline structure with a tetragonal rutile-type phase [1-4]. The pure SnO_2 and SnO_2:2%F films displayed a preferential orientation along the (110) plane, as indicated by the peak at $2\theta = 26.84°$. However, the films doped with 4%F and 6%F showed a change in orientation from (110) to (200). The addition of fluorine dopant resulted in increased transmittance, reaching a maximum of 83% for the SnO_2:6%F film. Electrical analysis demonstrated that fluorine doping enhanced the electrical resistivity of the pure SnO_2 film deposited via spray pyrolysis, achieving a low resistivity value of 7.11×10^{-2} Ω·cm. Based on these findings, it can be concluded that SnO_2:6%F holds potential for use as a conductive transparent electrode in thin-film solar cells.

Keywords: Thin films, F-doped SnO_2, Spray pyrolysis, XRD, Electrical resistivity.

References

[1] Khalfallah, M. and Guermat, N. and Daranfed, W. and Bouarissa, N. and Bakhti, H.,"Hydrophilic nickel doped porous SnO2 thin flms prepared by spray pyrolysis", Phys. Scr., 95, pp. 095805, 2020.

[2] Guermat, N. and Darenfad, W. and Mirouh, K. and Khalfallah, M. and Ghoumazi, M.,"Super-hydrophobic F-doped SnO2 (FTO) nanoflowers deposited by spray pyrolysis process for solar cell applications", J. Nano Electron. Phys., 15(05), pp. 05013, 2022.

[3] Guermat, N. and Daranfed, W. and Mirouh, K. and Bouarissa, N. and Khalfallah, M. and Herbadji, A.,"Effects of zinc doping on structural, morphological, optical and electrical properties of SnO2 thin films", Eur. Phys. J. Appl. Phys., 97(02), pp. 14, 2022.

[4] Guermat, N. and Daranfed, W.,"Deposition times influence on properties of 8 wt% Fluorine – doped tin oxide thin films deposited by spray pyrolysis", International Conference on Mechanics and Materials, Setif, ALGERIA, (2019).

Study of the behaviour of a hydrodynamic contact using the homogenization method

Mouassa Ahcène, Lahmar Mustapha, Boucherit Hamid and Ellagoune Salah

Laboratory of Mechanics and Structures (LMS), University 8 May 1945, Guelma 24000, Algeria
E-mail: amouassa@yahoo.fr

Abstract: A study of combined effects of surface roughness and lubricant rheology on the hydrodynamic contact behavior using the homogenization method. The combined effects of surface roughness and lubricant rheology on the performance characteristics of a hydrodynamic inclined slider bearing are investigated by means of the homogenized method. The pad surface is rough and stationary while the lower surface is assumed to be smooth and moving. The V.K. Stokes couple stress fluid model is adopted to describe the rheological behavior of the lubricant flowing between the two surfaces. The numerical simulations are performed by considering three roughness patterns (transverse, longitudinal and anisotropic), and various values of the couple stress parameter. It is found that the homogenization method is rigorous and efficient for the three roughness patterns considered. It is also found that the combined effects of the surface roughness as well as the couple stress due to the presence of polymer additives on the hydrodynamic performance characteristics such as pressure field, load carrying capacity, friction factor and power loss are significant.

References

[1] P. Wang, T.G. Keith, Combined surface roughness of dynamically loaded journal bearings, Trib. Trans. 45 (2002)

[2] M.B. Dobrica, M. Fillon, P. Maspeyrot, Mixed elasto-hydrodynamic lubrication in partial journal bearings – comparison between deterministic and stochastic models, ASME J. Trib. 128 (2006) 778–788

[3] V.A. Marchenko, E.Ya. Khruslov, Homogenization of partial differential equations, Birkh¨auser, Boston, 2006

[4] M. Lahmar, B. Bou-Said, Couple-stresses effects on the dynamic behavior of connecting-rod bearings in both gosoline and diesel engines, J. Trib. Trans. STLE 51 (2008) 44–56.

[5] Guo, Z.; Peng, L.; Feng, K.; Liu, W. Measurement and prediction of nonlinear dynamics of a gas foil bearing supported rigid rotor system. Measurement 2018, 121, 205–217..

[6] Li, C.; Du, J.; Zhu, J.; Yao, Y. Effects of structural parameters on the load carrying capacity of the multi-leaf gas foil journal bearing based on contact mechanics. Tribol. Int. 2019, 131, 318–331

An Efficient Numerical Solution for Nonlinear Poro-Elasto-Hydrodynamic (PEHD) Lubrication Problem in Dynamically Loaded Journal Bearings Lubricated with Nanofluids

Mustapha Lahmar[1], Reda Hamel[1], Hamid Boucherit[1], Ahcene Mouassa[1], and Benyebka Bou-Saïd[2] and [2]

[1] *Mechanical Engineering Department, Université 8 mai 1945 Guelma, Algeria*
[2] *LaMCoS, UMR5259, CNRS INSA-Lyon, Université de Lyon, F-69621, France*
E-mail: lahmar.mustapha@univ-guelma.dz

Abstract: The thrust of this paper is to present an efficient numerical method to solve the strongly nonlinear PEHD lubrication problem encountered in internal combustion engine journal bearings using nanofluids as lubricants and subject to an arbitrary force torsor. Under isothermal conditions, this problem is described by a set of differential equations, namely: the nonlinear Reynolds partial differential equation, the modified Darcy law, and the nonlinear motion ordinary differential equations of the crankshaft which are the second Newton's law. The Reynolds equation is derived from the momentum and mass conserving laws of the V. K. Stokes micro-continuum theory which takes into account the characteristic size of nanoparticles or agglomerates of nanoparticles dispersed in the base lubricant. This equation is then modified to account for the concentration and the bearing-liner permeability property using the Krieger-Dougherty viscosity model and the Morgan-Cameron approximation. For an arbitrary force torsor, the fluid-film pressure, the lubricating film geometry, the squeeze film velocities, and the misalignment angular velocities are determined simultaneously by solving the discrete form of Reynolds equation coupled with the film geometry equation and the nonlinear rotor (crankshaft) dynamic equations by means of the powerful damped Newton-Raphson iterative method at each crankshaft angle step. The main journal axis trajectories in the bearing's mid-plane, rear, and front sections as well as the misalignment angles are easily deduced from squeeze film velocities and misalignment angular velocities using a second order Runge-Kutta scheme. The numerical results obtained with the proposed PEHD model are compared with the theoretical published results since there are no benchmark results available for engine bearings operating with non-Newtonian nanolubricants. Finally, some relevant results of parametric study carried out with the PEHD model are graphically presented and discussed.

Keywords: Numerical modelling, Nonlinear differential equations, Finite difference method, Newton-Raphson algorithm, Runge-Kutta scheme, Poro-Elasto-Hydrodynamic Lubrication, Engine bearings, Nanolubricants, Lubricating nanoparticles, Non-Newtonian Fluid.

Periodic-Soliton Solutions by a New Perspective

Ömer Ünsal

Eskisehir Osmangazi University, Dept. of Mathematics and Computer Sciences, 26040, Eskisehir, Turkey
E-mail: ounsal@ogu.edu.tr

Abstract: This study brings a new perspective to implementation of a periodic-soliton solution approach [1,2]. This new viewpoint arises from usage of different parameters. Some restrictions are given to specify classes of obtained solutions.

Keywords: Periodic-soliton solutions, Combined solutions, Bilinear form

Mathematics Subject Classification: 35C07, 35C08, 74J30

References

[1] Ömer Ünsal, Wen-Xiu Ma, Yujuan Zhang, Multiple-Wave Solutions to Generalized Bilinear Equations in Terms of Hyperbolic and Trigonometric Solutions, International Journal of Nonlinear Science and Numerical Simulation, Vol:18, No:5, 395–401, 2017.

[2] Pinxia Wu, Yufeng Zhang, Iqbal Muhammad, Qiqi Yin, Complexiton and Resonant Multiple Wave Solutions to the (2+1)-Dimensional Konopelchenko–Dubrovsky Equation, Computers and Mathematics with Applications, Vol:76, 845–853, 2018.

Explicit Formulas for Algebraic and Non-Algebraic Limit Cycles of a Family of Planar Differential Systems

Rachid Boukoucha

Department of Technology, Faculty of Technology, University of Bejaia, Algeria.
E-mail: rachid_boukecha@yahoo.fr

Abstract: In this work, we study a family of multi-parameter polynomial differential systems of degree eleven. We prove that the considered family has an invariant algebraic curve, which is given explicitly. Subsequently, we demonstrate the integrability of these systems and derive an explicit expression for a first integral. Moreover, we provide sufficient conditions for the systems to possess two limit cycles explicitly given: one is algebraic, and the other is shown to be non-algebraic. The applicability of our results is illustrated by concrete examples.

Keywords: Planar polynomial differential system; First integral; Limit cycle.

Mathematics Subject Classification: 34C05, 34C07

References

[1] R. Boukoucha, Explicit limit cycles of a family of polynomial differential systems, EJDE, Vol. 2017 (2017), No. 217, pp. 1-7.

[2] R. Boukoucha, Explicit expression for a first integral for some classes of two-dimensional differential systems, SEMR, Vol 14 (2017), pp. 903-913.

[3] D. Hilbert, Mathematische Probleme, Lecture, Second Internat. Congr. Math. (Paris, 1900), Nachr. Ges. Wiss. Gttingen Math. Phys. Kl. (1900) 253-297.

[4] F. Dumortier, J. Llibre, J. Artés; Qualitative Theory of Planar Differential Systems, (Universitex) Berlin, Springer, 2006.

[5] A. Gasull, H. Giacomini, J. Torregrosa; Explicit non-algebraic limit cycles for polynomial systems, J. Comput. Appl. Math, 2007, vol. 200, pp. 448-457.

[6] J. Giné, M. Grau; Coexistence of algebraic and non-algebraic limit cycles, explicitly given, using Riccati equations. Nonlinearity, 2006, vol. 19, pp. 1939-1950.

Application of Response Surface Methodology for Parametric Optimization of Natural Convection in Trapezoidal Cavity containing Hybrid Nanofluid

Norihan Md Arifin[1], Mohd. Shafie Mustafa[1], Muhamad Hasif Mohd Hashim[1], Aniza Ab Ghani[1] and Ahmad Nazri Mohamad Som[2]

[1] *Department of Mathematics & Statistics, Faculty of Science, Universiti Putra Malaysia, 43400, UPM Serdang, Selangor, Malaysia*

[2] *Centre of Foundation Studies for Agricultural Science, Universiti Putra Malaysia, 43400 Serdang, Selangor, Malaysia*

E-mail: norihana@upm.edu.my

Abstract: This work presents a numerical analysis for exploring heat transfer phenomena in a trapezoidal cavity using natural convection. Because of the numerous real-world applications of nanofluids in engineering development, hybrid nanofluids are used as fluid mediums in the fluid field. The copper (Cu) and alumina (Al_2O_3) nanoparticles are suspended in water to make a hybrid nanofluid. A trapezoidal is taken with the left heated wall, and right cold wall and filled with hybrid nanofluid, and the remaining walls of the cavity are kept at adiabatic. The governing equations have been solved by the finite element method (FEM). The graphical computation of the effective parameters is precisely scrutinized on the profiles of velocity, isotherms, and average Nusselt number. As a novelty, the response surface method (RSM) has been applied to achieve the optimum value of the involved parameters. It provided a correlation for the average Nusselt number based on the investigated determinants due to the conflicting influence of the study factors.

Keywords: Hybrid Nanofluid, Natural Convection, Trapezoidal Cavity, Response Surface Methodology.

References

[1] H. Saleh, R. Roslan, Hashim, I. "Natural convection heat transfer in a nanofluid-filled trapezoidal enclosure", International Journal of Heat and Mass Transfer, 54(1-3), 194–201, 2011.

[2] A. H. Mahmoudi, I. Pop, M. Shahi, F. Talebi, F. "MHD natural convection and entropy generation in a trapezoidal enclosure using Cu–water nanofluid", Computers & Fluids, 72, 46–62, 2013.

[3] A. Alhashash, H. Saleh, "Natural convection induced by undulated surfaces in a porous enclosure filled with nanoliquid", Advances in Mechanical Engineering, 11(9), 168781401987528, 2019.

[4] M. Asmadi, Z. Siri, R. Kasmani, H. Saleh, "Nanoparticle shape effect on the natural-convection heat transfer of hybrid nanofluid inside a U-shaped enclosure", Thermal Science, 26(1 Part B), 463–475, 2022

Effect of natural and artificial aging on the mechanical properties of high density polyethylene HDPE 100

Ahmed Belbah[1], Naouri Ladaci[1], Ouarda Kirati[2]

[1] *Department of Mechanical Engeneering, LMANM, University 8 May 1945 Guelma, BP 401, 24000, Algeria.*
[2] *Process Engineering, LIAGM, University 8 May 1945 Guelma, BP 401, 24000, Algeria.*
E-mail: belbah.ahmed@univ-guelma.dz, ladaci.naouri@univ-guelma.d zand kiarati.ouarda@univ-guelma.dz

Abstract: High-density polyethylene (HDPE100) has recently emerged as the material of choice for the economical and public health-safe distribution and transportation of drinking water. For this reason, a study of the effect of natural and artificial aging was conducted on HDPE100 to verify the mechanical robustness of this material against climate change. Firstly, HDPE100 specimens were artificially irradiated using a UV lamp with a wavelength of 254 nm, with three aging durations studied: 10 hours, 20 hours, and 30 hours. Subsequently, aging under climatic stresses (natural) involved exposing various specimens directly to solar radiation and weathering for 125 days. To highlight the aging effects through the wall of the HDPE100 tube, which was cut into three layers (outer, middle, and inner), tensile tests were conducted to study the mechanical behavior of HDPE100. We observed a hardening effect of aging on the material and differences between non-irradiated and irradiated samples. Artificial irradiation leads to a cross-linking phenomenon, a higher crystallinity compared to natural aging; these effects impact the physical and mechanical properties of HDPE100. The results of the tensile tests led to a decrease in elongation at break depending on the type of aging, however, the Young's modulus varies from one case to another. DSC analysis showed that for natural aging, the fusion and crystallization enthalpies, fusion temperatures, and crystallization temperatures increase progressively with exposure time.

References

[1] G. GEUSKENS ET C. DAVID. The photo-oxidation of polymers. A comparison with low molecular weight compounds. Pure Appl. Chem, 51, 233-240, 1979

[2] CHEN Y, DAVALOS JF, RAY I, KIM HY. Accelerated aging tests for evaluations of durability performance of FRP reinforcing bars for concrete structures. Compos Struct,78,pp101–11, 2007

[3] MERCIER J, BUNSELL A, CASTAING PH, RENARD J. Characterisation and modeling of aging of composites. Composites Part A, 3,pp 428–38, 2008

[4] GUERMAZI N, ELLEUCH K, AYEDI HF, KAPSA PH. Aging effect on thermal,mechanical and tribological behavior of polymeric coatings used for pipeline application.J Mater Process Technol, 203,pp404-10, 2008,

[5] Abbès F, Tran NG, Abbès B, Guo YQ. Modelling of the degradation of mechanical properties of high-density polyethylene-based packaging exposed to amyl acetate solution. Polymer Testing,59,pp 449-461, 2017

[6] La Mantia FP, Morreale M, Botta L, Mistretta MC, Ceraulo M, Scaffaro R. Degradation of polymer blends: A brief review. Polymer Degradation and Stability,145,79-92, 2017

[7] Sahu AK, Sudhakar K. Effect of UV exposure on bimodal HDPE floats for floating solar application. Journal of Materials Research and Technology.;8(1):147-156, 2019

First Principales Calculations of the Electronic, Magnetic, and Elastic Properties of FeVYSb (Y= Sc, Y) Heusler Alloys

I. Bensehil[1,2*],H. Baaziz[3,4],A. Kolli[2], T. Ghellab[3,4],Z. Charifi[3,4]

[1] *Faculty of Technology ,University of M'sila, B.P.166 , Ichbelia M'sila Algeria*
[2] *Laboratory of Surfaces and Interfaces Studies of Solid Materials,University of Setif 1, Algeria.*
[3] *Department of Physics, Faculty of Science, University of M'sila, 28000 M'sila, Algeria.*
[4] *Laboratory of Physics and Chemistry of Materials, University of M'sila, Algeria.*
E-mail: ilhem.bensehil@univ-msila.dz

Abstract: The study of Heusler alloys has attracted more attention from the scientific community since Groot's discovery of the first half metallic material, NiMnSb, in 1983[1]. These materials have attracted a lot of attention because of their unusual and interesting structural features, magnetic properties, and several traits, such as metallic, insulating, semiconducting, half-metallic, and spin gapless semiconducting[2]. These materials are used for spintronics and magnetoelectronics applications such as spin filters, spininjection, magnetic tunnel junctions, giant magnetoresistance, spin transfer torque, memory devices, spin caloritronics, magnetic sensors, and neuromorphic and stochastic computing [3-5].
Based on the density functional theory, we have studied the electrical, magnetic, structural, and elastic properties of the FeVYSb(Y=Sc, Y) Heuslers compound in this work. The most stable structure has been found to be energetically favorable in face-centered cubic (FCC) structure with space group F43m, in which Fe, V, Y and Sb atoms are located at 4d, 4c, 4b and 4a Wyckoff positions respectively. In the stable state, FeVScSb is ferromagnetic while FeVYSb is ferrimagnetic. The determined elastic constants (C_{ij}) show that FeVYSb(Y=Sc, Y) is mechanically stable and ductile, and exhibit a notable elastic anisotropy. Electronic calculations indicate that FeVYSb(Y=Sc, Y) are semiconductors with band gap of 0.37 eV and 0.30 eV respectively. The total magnetic moment of these alloys is found to be equal to 3 μ_B which follows the Slater-Pauling rule. The magnetic moment remains equal to 3 μ_B under strain, which makes it hopeful in spintronic applications.

References

[1] R.A. Groot, F.M. Mueller, P.G. van Engen, K.H. Buschow, Phy.Rev.Lett., 50, 25, 1983.

[2] R.B. Raya, G.C.Kaphlea , R.K. Raia, , D.K. Yadava , R. Paudelc, D. Paudyal, J. Alloys and Compounds., 867, 158906, 2021.

[3] L.Bainsla, K.G. Suresh, Applied Physics Reviews., 3, 031101,2016.

[4] T. Graf,C. Fesler,S.S.P. Parkin, Sol. Stat.Chem ., 39, 1-50, 2011 .

[5] K.J. Kawasaki, S. Chatterjee, P.C.Canfeld, Guest Editors., 47, 555-558,2022.

Enhancement Multi-interest U-Net for Medical Image Segmentation

Lahouaoui Lalaoui and Zohra Zerdoumi

Mohamed Bouddiaf University, Dept. of Electronics, Faculty Technology 28004, Msila, Algeria
E-mail: lahouaoui.lalaoui@univ-msila.dz and abdelhak.djalab@ univ-msila.dz

Abstract: In recent years, state-of-the-art performance has been attained using deep learning (DL) techniques for image segmentation. Image segmentation has been effectively applied to the U-Net model, particularly in deep learning. On the other hand, conventional U-Net techniques use up sampling, convolution, and pooling blocks to extract features, gather remote data, and rebuild images. Because of the stacked local operators, the traditional method is incredibly inefficient. In this work, we offer the multi-interest U-Net for image segmentation, which is endowed with non-local blocks based self-attention, channel-attention, and spatial-attention. By inserting these blocks into U-Net, information on the plane and spatial scales may be flexibly aggregated. The multi-interest U-Net can enhance the outcomes of medical image segmentation.

Keywords: Medical image segmentation, multi-interest U-Net, non-local blocks based self-attention

References

[1] Y. Oh, S. Park and J. C. Ye, "Deep Learning COVID-19 Features on CXR Using Limited Training Data Sets", IEEE TRANSACTIONS ON MEDICAL IMAGING, vol. 39, no. 8, pp. 2688-2700, 2020.

[2] S. Motamed, P. Rogalla and F. Khalvati, "RANDGAN: RANDOMIZED GENERATIVE ADVERSARIAL NETWORK FOR DETECTION OF COVID-19 IN CHEST X-RAY", Computer Vision and Pattern Recognition, 2020.

[3] A. Djalab, L. Lalaoui, A. Bisker, A. Hadibi,. Enhancing image classification through a hybrid approach: Integrating Convolutional Neural Networks with hidden Markov mod. Traitement du Signal, Vol. 41, No. 1, pp. 383-390. 2024.

[4] L. Lahouaoui, D. Abdelhak, , B. Abderrahmane, M. Toufik, Image classification using a fully convolutional neural network CNN. Mathematical Modelling of Engineering Problems, Vol. 9, No. 3, pp. 771-778.2022.

[5] S. Minaee, R. Kafifieh, M. Sonka, S. Yazdani and G. J. Soufi, "Deep-COVID: Predicting COVID-19 from chest X-ray images using deep transfer learning", Medical Image Analysis, vol. 65, pp. 1794, 2020.

[6] Zhou, Z., Siddiquee, M. M. R., Tajbakhsh, N., and Liang, J. UNet++: redesigning skip connections to exploit multiscale features in image segmentation. IEEE Trans. Med. Imaging 39, 1856–1867. 2020.

Refined descriptive sampling with dependent variables

Kebaili Siham

Algeria
E-mail: siham.kebaili@yahoo.com

Abstract: We propose an algorithm to generate refined descriptive samples [3]from dependent random variables for estimation of expectations of functions of output variables using the Iman and Conover algorithm [2] to transform the dependent variables to independent ones. Hence, the asymptotic variance of such an estimate in case of dependent input random variables is proved, using a result from [1], to be less than that obtained using simple random sampling.

Keywords: Simulation, Monte Carlo Methods, Sampling Theory, Variance Reduction

References

[1] Baiche, L. and Ourbih-Tari, M., “Large sample variance of simulation using refined descriptive sampling: Case of independent variables”, Communications in Statistics - Theory and Methods, 46 (2017), 510–519.

[2] Iman R. L. and Conover W. J., "Distribution-free approach to inducing rank correlation among input variables", Communications in Statistics – Computation and Simulation, 11(1982), pp 311-334

[3] Tari, M. and Dahmani, A, “Refined descriptive sampling: a better approach to monte carlo simulatin”, Simulation Modeling Practice and Theory, 14 (2006), 143-160.,

Soliton Solutions and modulation instability analysis of the Lakshmanan–Porsezian–Daniel equation in the presence of parabolic law

Neslihan Ozdemir and Sinan Perktas

[1]*Department of Mathematics, Yildiz Technical University, Esenler, Istanbul-Turkey,*
[2]*Graduate School of Sciences and Engineering, Yildiz Technical University Esenler, Istanbul-Turkey*
E-mail: [1]ozdemirn@yildiz.edu.tr, [2]sinan.perktas@std.yildiz.edu.tr

Abstract: This paper explores the soliton solutions of the Lakshmanan–Porsezian–Daniel equation in the presence of parabolic law [3], which is localized wave packets that maintain their shape while traveling at constant velocities. These soliton solutions are crucial for understanding the stability and interaction of waves in nonlinear media. Using the auxiliary equation scheme [4], we construct soliton solutions of the Lakshmanan–Porsezian–Daniel equation having parabolic law. Moreover, we analyze the effect of diverse parameters in the considered model on soliton behavior. The 2D graphs are also visualized to comprehend these effects on various soliton solutions. To check the stability of this model, we also use the modulation instability analysis with the aid of linear stability analysis [3, 4].

Keywords: Auxiliary equation scheme; Parameter effects; Modulation instability

References

[1] Secer, A., & Baleanu, D. (2024). Investigation of the optical solitons for the Lakshmanan–Porsezian–Daniel equation having parabolic law. Optical and Quantum Electronics, 56(3), 363.

[2] Ma, H. C., Yu, Y. D., & Ge, D. J. (2009). The auxiliary equation method for solving the Zakharov–Kuznetsov (ZK) equation. Computers & Mathematics with Applications, 58(11-12), 2523-2527.

[3] Seadawy, A. R. (2017). Modulation instability analysis for the generalized derivative higher order nonlinear Schrödinger equation and its the bright and dark soliton solutions. Journal of Electromagnetic Waves and Applications, 31(14), 1353-1362.

[4] Rehman, S. U., Yusuf, A., Bilal, M., Younas, U., Younis, M., & Sulaiman, T. A. (2020). Application of (G^1/G^2)-expansion method to microstructured solids, magneto-electro-elastic circular rod and (2 + 1)-dimensional nonlinear electrical lines. Mathematics in Engineering, Science & Aerospace (MESA), 11(4).

DFT calculations of two azo-palladium (II) complexes

Meriem Lmmouchi[1] and Souheyla Chetioui[2,3]

[1] *Higher National school of Renewable Energy, Environment and sustainable Development. Constantine road, Fesdis, Batna 05078, Algeria.*

[2] *Faculty of Technology. University of M'sila. PO Box 166 Ichebilia, 28000 M'sila, Algeria.*

[3] *Research Unit for Chemistry of the Environment and Molecular Structural. University of Constantine 1, Constantine 25000, Algeria*

E-mail: meriem.lemmouchi@hns-re2sd.dz

Abstract: The transition metal-azo dye complexes are related to the possibility to obtain new compounds with various biological activities. This class of complexes is important in the progress of metalbased anticancer agents. These different areas of interest fostered inorganic chemists to develop novel approaches to the preparation of non-covalently bound anticancer drugs. Recently, Pd-arylazo complexes have found application in C–C coupling reactions interacting strongly with CT DNA and exhibiting photochromic activity , where most of their electronic and photochromic efficiency have been explained by DFT calculations. We report two novel Pd(II) coordination complexes obtained using (E)-1-((2-methoxyphenyl)diazenyl)naphthalen-2-ol [1] and (E)-1 ((3methoxyphenyl)diazenyl) naphthalen-2-ol [2] azo-ligands. These two bidentate ligand precursors are isomers differing from the ortho versus meta position of their methoxyphenyl group. In both Pd(II) complexes(I) and (II), respectively, the metal is coordinated to two N atoms and two O atoms. The DFT-optimized structures of (I) and (II) reproduce well the structural properties of their experimentally determined X-ray counterparts. Complexes (I) and (II) display large HOMO–LUMO gaps, in line with the strong metal–ligand interactions. Complex (I) is computed to be less stable by 12.0 and 11.5 kcal/mol than (II) and (III), respectively, showing the impact of the methoxy position on the molecular structures, which are planar in (II) and (III), but distorted in (I) The simulated UV–Vis spectra obtained by TD-DFT calculations are comparable to the experimental spectra, putting emphasis on the ILCT and MLCT electronic transitions involving several of the frontier molecular orbitals in the complexes.

Keywords: DFT calculations, Transition metal, Azo compounds, TD-DFT and AIM.

References

[1] Salmen R, Malterud KE, Pedersen BF (1988) Acta Chem. Scand A 42:493

[2] Gilli P, Bertolasi V, Pretto L, Antonov L, Gilli G (2005) J Am Chem Soc 127:4943

Analysis of the structure and behaviour of odonate populations in a number of wetlands likely to be impacted by thermal springs in the Bejaia region (north-central Algeria).

Abdelmadjid Chelli and Salhi Kelthoum

Laboratoire de Zoologie Appliquée et d'Écophysiologie Animale, Faculté des Sciences de la Nature et de la Vie, Université de Bejaia, Bejaia, Algeria
E-mail: abdelmadjid.chelli@univ-bejaia.dz

Abstract: The Odonata survey and of upstream and downstream in three geothermal springs in the Bejaia region has enabled us to draw up a report on the impact they may have on aquatic biodiversity, using odonata as a biological model. The various discharges from these thermal springs modify the chemistry and quality of the water downstream, which has repercussions on the structure and composition of the dragonflies populations between upstream and downstream. Some species can tolerate a wide range of conditions, while others are highly sensitive to their environment. A group of four ubiquitous taxa (Ischnura graellsii, Anax imperator, Orthetrum chrysostigma, and Trithemis annulata), seem indifferent to the state and conditions prevailing in the different biotopes. However, a group of seven species (Platycnemis subdilatata, Ceriagrion tenellum, Coenagrions citullum, Erythromma lindenii, Calopteryx exul, Onychogomphus uncatus and Gomphus lucasii) appear to be sensitive to water quality.

Keywords: Biodiversity analysis - Odonata - Thermal springs - Anthropization - Bejaia

References

[1] Ait taleb L., Chelli A., Sadoudi Ali Ahmed D., Zouaimia A., Bensakhri Z., Houhamdi M. & Zebsa R.2023. Survey and repartition of odonatofauna in the lotic and lentic waters of the djurdjura and soummam regions of kabylia (north central algeria). Ekológia (Bratislava), 42(3): 230–238. DOI: 10.2478/eko-2023-0026

[2] Chelli, A. & Moulaï R. (2019a). Ecological characterization of the odonatofauna in lotic and lentic waters of northeast Algeria. Ann. Soc. Entomol. Fr., 55(5), 430–445. DOI: 10.1080/00379271.2019.1660215.

[3] Chelli, A. & Moulaï R. (2019b). Diversity and ecological diagnosis of dragonflies of high-mountain temporary ponds in the Akfadou massif forest (Algeria). Zoology and Ecology, 29(1), 28–37. DOI: 10.35513/21658005.2019.1.4.

[4] Chelli, A., Moulaï, R. & Djemai A. (2020). Does the Tichi Haf dam construction affect dragonfly and damselfly (Odonata: Insecta) assemblages of the Boussellam watercourse (central north Algeria)? A preliminary study. Acta Zoologica Lituanica, 30(1), 37–47. DOI: 10.35513/21658005.2020.1.5.

[5] Chelli, A., Zebsa, R. & Khelifa R. (2019). Discovery of a new population of the endangered Calopteryx exul in central North Algeria (Odonata: Calopterygidae). Not. Odonatol., 9(4), 150–154. DOI: 10.5281/zenodo.1230409.

Study of Spatial Conformation of Anomeric Xylose Esters by Density Functional Theory

Chahra Bidjou-Haiour*

LOMOP. Groupe Synthèse Bio-Organique et Modélisation. Department of Chemistry. Faculty of Sciences. UBM. BP 12 El-Hadjar. 23000. Annaba. Algeria.
E-mail: *bidjouch@yahoo.fr

Abstract: Gaussian 09 software and DFT modeling method were investigated to determine the spatial conformation of synthesized anomeric xylose esters. Two basis sets 3.21 G and 6.31 G of B3LYP were tested. The most stable optimized geometry was obtained from B3LYP/6-31G with the basis set combination 6-31 G (d, p) and 6-31 G (d) method.
The frontier molecular orbitals HOMO and LUMO are the orbitals that are involved in the reactivity. The lowest unoccupied molecular orbital (LUMO) and the highest occupied molecular orbital (HOMO) are located over the whole skeleton of the molecule except the methyl groups of the hydrophobic chain. Their energy value and their energy gaps reflect the reactivity of the molecule. A molecule having a small frontier orbitals gap is a soft molecule with a high chemical reactivity. While a large HOMO-LUMO gap indicates a hard molecule more stable /less reactive molecule. The compound which has the lowest energetic gap is octadecanoyl-α-D-xylopyranose (ΔE_{gap} = 0.26237 eV). The results of energy gap indicate that the α-anomers of the two studied products 1α (ΔE_{gap} = 0.26294 eV) and 2α (ΔE_{gap} = 0.26237 eV) are the softest compounds compared to their β-anomers 2β (ΔE_{gap} = 0.26315) and 2β (ΔE_{gap} = 0.26311). According to these results (Table 1), the α-compounds are more reactive than the β ones.

Table 1: Calculated energy values using B3LYP/6-31G basis set.

Compound & **HOMO** & **LUMO** & **Energy gap (eV)**
1α & -0.25801 & 0.00493 & 0.26294
1β & -0.25548 & 0.00767 & 0.26315
2α & -0.25866 & 0.00371 & 0.26237
2β & -0.25548 & 0.00763 & 0.26311

Keywords: Xylose ester, anomers, molecular modeling.

Thermal performance enhancement of LHTES using enhanced PCMs with fins

Ghulam Rasool

College of Mechanical and Energy Engineering, Beijing University of Technology, China
E-mail: grasool@bjut.edu.cn

Abstract: In this work, the application of enhanced PCMs and different geometry of fins is used to numerically study the performance enhancement of an LHTES setup. Through several fins, the paraffin wax RT35 phase change material (PCM) fills the annular area of the cylinder and absorbs heat from hot water. The influence of fin numbers and shape geometry on the heat transfer properties of PCM during the melting process is investigated, with the constant total cross-section area of all tubes and fins serving as the constraint condition. It is suggested that the geometrical shape of heat transfer tubes be changed from circular to petal to enhance the thermal performance of LHTES. An increase in the number of fins helps improve the heat capacity by a large ratio. When compared to the base case, which has a single circular HTF tube and straight fins, the storage capacity increases drastically.

References

[1] A.A. Al-Abidi, S. Mat, K. Sopian, M.Y. Sulaiman, A.T. Mohammad, Internal and external fin heat transfer enhancement technique for latent heat thermal energy storage in triplex tube heat exchangers, Appl. Therm. Eng. 53 (2013) 147–156.

[2] Y.B. Tao, Y.-L. He, A review of phase change material and performance enhancement method for latent heat storage system, Renew. Sustain. Energy Rev. 93 (2018) 245–259.

[3] R. Kothari, A. Ahmad, S.K. Chaurasia, O. Prakash, Experimental analysis of the heat transfer rate of phase change material inside a horizontal cylindrical latent heat energy storage system, Mater Sci for Energy Technol. 5 (2022) 208–216.

[4] A. Joulin, Z. Younsi, L. Zalewski, S. Lassue, D.R. Rousse, J.-P. Cavrot, Experimental and numerical investigation of a phase change material: thermal energy storage and release, Appl. Energy 88 (2011) 2454–2462.

[5] F. Agyenim, N. Hewitt, P. Emaes, M. Smyth, A review of materials, heat transfer and phase change problem formulation for latent heat thermal energy storage systems (LHTESS), Renew. Sustain. Energy Rev. 14 (2010) 615–628.

Application of the Maud program to monitor the microstructural evolution of nanosized Cr50Ni50 alloy

L. Dekhil[1] , N. Hanneche[2], M. Fellah[3], M. Bououdina [4]

[1] *Shaping of Metallic Materials Laboratory (LMF2M), Department of Metallurgy and Materials Engineering, Technology Faculty, Badji Mokhtar University, Annaba, Algeria.*
[2] *Laboratory of Physique - UMR6087, University of Maine, Le Mans Cedex 9, France.*
[3] *Mechanical Engineering Department , Abbes Laghrour University, Khenchela, P.O 1252, 40004, Algéria.*
[4] *Department of Physic, College of Science, University of Bahrain, PO Box 32038, Kingdom of Bahrain*
E-mail: Leila.dekhil@univ-annaba.dz

Abstract: Nanocsized Cr50Ni50 material was obtained by high energy ball milling from pure Cr and Ni powders in a planetary ball-mill P7 under argon atmosphere at ambient temperature. Microstructural, structural, morphological, magnetic were studied by X-ray diffraction, scanning electron microscopy and magnetic measurements . The Maud program which is based on the Rietveld method combined with Fourier analysis was used to monitor the microstructural evolution Rietveld refinement of the X-ray diffraction pattern reveals after 1 h of milling, the formation of the disorderd fcc- Ni(Cr) solid solution in addition to pure Cr and Ni. After 25 h of milling, the interdiffusion between Cr and Ni atoms leads to the formation of a mixture of disordered fcc-Ni(Cr) and bcc-Cr(Ni) solid solutions. The average thickness of the grains boundaries <EJ>, of bcc-Cr(Ni) and fcc-Ni(Cr) are of about 3.5 and 2.3 nm, respectively. The morphological observations reveals the fragile aspect of the powder particles which is explained by their fragmentation at different stages of milling process. The existence of small magnetic particles which are typically single domains is evidenced by Mr/Ms (0.1-0.5) v

References

[1] Kurata Yuji, Tsuji Hirokazu, Shindo Masami, Nakajima Hajime, Creep rupture properties of a Ni-Cr-W superalloy in air environment, J Nucl Mater 246 (1997)196-205.

[2] Huang Her-Hsiung, Effect of chemical composition on the corrosion behavior of Ni-Cr-Mo dental casting alloys. Wiley Period 458 (2002).

[3] Bezzon Osvaldo Luiz, Pedrazzi Hamilton, Zaniquelli Osvaldo, da Silva Tania Bose Cambuy, Effect of casting technique on surface roughness and consequent mass loss after polishing of NiCr and CoCr base metal alloys: a comparative study with titanium. J Prosthet Dent, 92 (2004) 7-274.

[4] A. Perez-Campos, G. F, Iriarte, V. Lebedev, F. Calle, Post CMOS compatible sacrificial layers for aluminum nitride microcantilevers, Journal of Micro/ Nanolithography. 13(4) (2014).

[5] L. Lutterotti, MAUD CPD Newletter, IUCR 24, 2000.

[6] H.M. Rietveld, A profile refinement method for nuclear and magnetic structures, J. Appl. Cryst, 2 (1969) 45-48.

Modeling of discharge currents and dielectric losses in electrically aged cable insulation by filamentary trees

Nacéra Rouha and Aissa Saiche

Laboratoire de Génie Electrique, faculté de Technologie, Université de Bejaia, 06000 Bejaia, Algérie
E-mail: nacera.rouha@univ-bejaia.dz

Abstract: This paper presents a model of a filamentary treeing structure expanding in an insulating polymer used as cables protection. By likening the tree to a cylindrical channel with a hyperboloidal front and by considering the polymer /tree interface without charge, we establish a mathematical expression describing the dynamics of the tree propagation. This shows the relationship between the treeing length, the current and the loss factor and their dependency on many parameters such as the amplitude, the duration and the shape of the applied voltage, the frequency, the electrode geometry (thickness of the polymer sample, the electrode gap and radius), the density of the polymer, the permittivities and conductivities of both polymer and tree.

Keywords: Modeling, cable insulation, ageing, filamentary trees, discharge currents and dielectric losses

References

[1] David, J. L. Parpal, J. P. Crine, " Influence of internal mechanical stress and strain on electrical performance of polyethylene electrical treeing resistance", IEEE Transactions on Dielectrics and Electrical Insulation, Vol. 3, N°. 2, pp 248 – 257, 1996.

[2] G. Mazzanti, G.C. Montanari, L.A. Dissado, "Electrical aging and life models: The role of space charge", IEEE Trans. Dielectr. Electr. Insul. Vol. 12, pp 876–890, 2005.

[3] Xiaoquan Zheng, G. Chen, "Propagation Mechanism of Electrical Tree in XLPE Cable Insulation", IEEE Transactions on Dielectrics and Electrical Insulation, Vol. 15, N°. 3, pp. 800-807, 2008.

[4] A. El-Zein, M. Talaat, M.M. El Bahy, "A numerical model of electrical tree growth in solid insulation ", IEEE Transactions on Electrical Insulation, Vol.16, Issu 6,pp. 1724-1734, 2009.

[5] A. Xie, X. Zheng, S. Li and G. Chen, "Investigations of electrical trees in the inner layer of XLPE cable insulation using computer-aided image recording monitoring", IEEE Transactions on Dielectrics and Electrical Insulation, Vol. 17, N°. 3, pp. 685- 693, 2010.

[6] J.Su, B. Du, J. Li, Z. Li, "Electrical tree degradation in high-voltage cable insulation: Progress and challenges. High Volt". Vol. 5, pp 353–364, 2020.

[7] M. Choudhary, M. Shafiq, I. Kiitam, A. Hussain, I. Palu, P. Taklaja, "A Review of Aging Models for Electrical Insulation in Power Cables Adaptive solution of partial differential equations in multiwavelet bases", Energies , 15(9), 3408, 2022.

Statistical analysis of COVID-19 Monthly Pandemic Evolution in Algeria

Zohra Chekroud*, Salim Heddam, Nadjah Khannat and Bouchra Khalfaoui

Research Laboratory of Interactions, Biodiversity, Ecosystems and Biotechnology, LRIBEB. University of 20th August 1955, B.P.26, El Hadeik road 21000 Skikda, Algeria.

E-mail: chekroudzohra@yahoo.fr, heddamsalim@yahoo.fr, khannatnadjah@gmail.com, khalfaouibouchra141@gmail.com

Abstract: Our study's objective was to retrospectively evaluate the pandemic Coronavirus Infection Disease first appeared in 2019 (COVID-19) in Algeria from July 2020 until February 2022 by studying the evolution and relationship between three variables: the number of new cases, the number of new deaths, and the number of cases hospitalized in intensive care. Data were obtained from "Our world in Data Organisation" (https://ourworldindata.org/coronavirus) on 01 March 2022. They were proceeded by descriptive and multivariate analysis. The correlation between the three variables and the analysis of individual principal components (PCA) were conducted. The number of new cases shot up the month of January 2022 with 33685 cases, the peak number of cases in intensive care was recorded in July 2021 with 1261 cases whereas the number of new deaths reached its peak in the month of August 2021 with 1015 cases. A significant linear dependence has been identified between the number of new cases and the number of cases in intensive care (R^2>0.5). The PCA analysis allowed us to distinguish the months of August 2020, November 2020, July 2021, August 2021, September 2021, and January 2022. They were characterized by high levels of new confirmed cases, new deaths and/or cases in intensive care. Algeria passed by three waves characterized by peaks in the number of new cases and new deaths

Keywords: Correlation, COVI-19, New cases, New deaths, Intensive care, PCA

References

[1] Rodriguez-Morales AJ, Bonilla-Aldana DK, Balbin-Ramon GJ, Rabaan AA, Sa R, Paniz-Mondolfi A, et al. History is repeating itself: Probable zoonotic spillover as the cause of the 2019 novel Coronavirus Epidemic. Infez. Med. 28(1), pp.3-5. 2020.

[2] Roy S, Bhunia GS, Shit PK. Spatial prediction of COVID-19 epidemic using ARIMA techniques in India. Model. Earth Syst. Environ.7(2),pp.1385-91. 2021.

[3] Jahn B, Sroczynski G, Bicher M, Rippinger C, Mühlberger N, Santamaria J, et al. Targeted COVID-19 Vaccination (TAV-COVID) Considering Limited Vaccination Capacities-An Agent-Based Modeling Evaluation. Vaccines.9(5), pp.434. 2021.

[4] Jahn B, Friedrich S, Behnke J, Engel J, Garczarek U, Münnich R. On the role of data, statistics and decisions in a pandemic. AStA Adv. Stat. Anal. 2022.

[5] Sebbagh A, Kechida S. EKF-SIRD model algorithm for predicting the coronavirus (COVID-19) spreading dynamics. Sci Rep. 12, pp.134156. 2022.

[6] Hamidouche M. COVID-19 Outbreak in Algeria: A Model to Predict Cumulative Cases. J Contemp Stud Epidemiol Public Health.1(1), pp.ep20004. 2020.

[7] Aouissi HA, Hamimes A, Ababsa M, Bianco L, Napoli C, Kebaili FK, et al. Bayesian Modeling of COVID-19 to Classify the Infection and Death Rates in a Specific Duration: The Case of Algerian Provinces. Int J Environ Res. Public Health.19, pp. 9586. 2022.

Dynamic insights into vitamin E and cholesterol encapsulation for enhanced ovine sperm cryopreservation: A semi-empirical modelization approach

Sofiane Fatmi[*,1,2,3], Lamia Taouzinet[1,2,4], Zahra Toutou[1,2], Mohamed Skiba[3] and Mokrane Iguerouada[1,2]

[1] *Associated Laboratory in Marine Ecosystems and Aquaculture, Faculty of Nature and Life Sciences, Université de Bejaia, 06000 Bejaia, Algeria.*
[2] *Technology Pharmaceutical Laboratory, Department of Processes Engineering, Faculty of Technology, Université de Bejaia, 06000 Bejaia, Algeria.* [3] *UNIROUEN, DC2N INSERM U1239-Galenic Pharmaceutical Team, UFR of Health, Normandy University, 22 Bd Gambetta, 76000 Rouen, France.* [4] *Centre de Recherche en Technologies Agroalimentaires. Route de Targa Ouzemmour, Campus Universitaire, Bejaia, 06000. Algeria.* [*]*Corresponding Author: Prof. Dr. Sofiane FATMI, Technology Pharmaceutical Laboratory, Department of Processes Engineering, Faculty of Technology, Université de Bejaia, , 06000, Bejaia, Algeria.*
E-mail: sofiane.fatmi@univ-bejaia.dz

Abstract: In the realm of ovine sperm cryopreservation, the encapsulation of vitamin E and cholesterol stands out as a promising strategy. This study delves into the intricate dynamics of these compounds within innovative encapsulation systems, shedding light on their release kinetics and antioxidant activities. Utilizing a semi-empirical modelization approach, we explored the in vitro release profiles of vitamin E and cholesterol encapsulated in cyclodextrins and liposomes. The results unveiled a Fickian diffusion mechanism, emphasizing the role of concentration gradients in the release process. Notably, cyclodextrin encapsulation significantly improved solubility, enhancing vitamin E and cholesterol release. Our findings provide valuable insights into controlled release strategies, with implications for improving sperm viability and motility during cryopreservation.

Keywords: Ovine sperm cryopreservation, vitamin E, cholesterol, encapsulation, in vitro release, semi-empirical modelization.

References

[1] W.S. Blaner, I.O. Shmarakov, M.G. Traber, Vitamin A and Vitamin E: Will the Real Antioxidant Please Stand Up?, Annu. Rev. Nutr. 41 (2021) 105–131. https://doi.org/10.1146/annurev-nutr-082018-124228.

[2] S. Rizvi, S.T. Raza, F. Ahmed, A. Ahmad, S. Abbas, F. Mahdi, The role of vitamin e in human health and some diseases, Sultan Qaboos Univ. Med. J. 14 (2014) e157–65. https://www.ncbi.nlm.nih.gov/pubmed/24790736.

[3] J. Chen, Q. Guo, Y.-H. Pei, Q.-L. Ren, L. Chi, R.-K. Hu, Y. Tan, Effect of a short-term vitamin E supplementation on oxidative stress in infertile PCOS women under ovulation induction: a retrospective cohort study, BMC Womens. Health. 20 (2020) 69. https://doi.org/10.1186/s12905-020-00930-w.

[4] F.D. Safiyeh, M. Mojgan, S. Parviz, M.A. Sakineh, S.O. Behnaz, The effect of selenium and vitamin E supplementation on anti-Mullerian hormone and antral follicle count in infertile women with occult premature ovarian insufficiency: A randomized controlled clinical trial, Complement. Ther. Med. 56 (2021) 102533. https://doi.org/10.1016/j.ctim.2020.102533.

[5] A.M. Hammad, B. Shawaqfeh, S. Hikmat, T. Al-Qirim, L. Hamadneh, S. Al-Kouz, M.M. Awad, F.S. Hall, The Role of Vitamin E in Protecting against Oxidative Stress, Inflammation, and the Neurotoxic Effects of Acute Paracetamol in Pregnant Female Rats, Toxics. 11 (2023). https://doi.org/10.3390/toxics11040368.

[6] K. Benhenia, A. Lamara, S. Fatmi, M. Iguer-Ouada, Effect of cyclodextrins, cholesterol and vitamin E and their complexation on cryopreserved epididymal ram semen, Small Rumin. Res. 141 (2016) 29–35. https://doi.org/10.1016/j.smallrumres.2016.06.009.

[7] S.M. Vanderhout, M. Rastegar Panah, B. Garcia-Bailo, P. Grace-Farfaglia, K. Samsel, J. Dockray, K. Jarvi, A. El-Sohemy, Nutrition, genetic variation and male fertility, Transl. Androl. Urol. 10 (2021) 1410–1431. https://doi.org/10.21037/tau-20-592.

[8] L. Taouzinet, S. Fatmi, A. Khellouf, M. Lahiani-Skiba, M. Skiba, M. Iguer-Ouada, Drug Release, Stability And Efficiency Of Vitamin E Loaded In Liposomes For Bovine Sperm Protection In Cryopreservation Medium, Cryoletters. 43 (2022) 50–57. https://doi.org/10.54680/fr22110110612.

[9] S. Fatmi, L. Taouzinet, A. Benslimane, N. Chibani, D. Hammiche, Drug release and sperm motility protection studies of vitamin E encapsulated in liposome, cyclodextrin or polyethylene glycol, Materials Today: Proceedings. 53 (2022) 71–75. https://doi.org/10.1016/j.matpr.2021.12.332.

[10] L. Taouzinet, S. Fatmi, A. Khellouf, M. Skiba, M. Iguer-ouada, Alpha tocopherol loaded in liposome: Preparation, optimization, characterization and sperm motility protection, Drug Deliv. Lett. 10 (2020) 228–236. https://doi.org/10.2174/2210303110666200302113209.

[11] L. Taouzinet, O. Djaoudene, S. Fatmi, C. Bouiche, M. Amrane-Abider, H. Bougherra, F. Rezgui, K. Madani, Trends of Nanoencapsulation Strategy for Natural Compounds in the Food Industry, Processes. 11 (2023) 1459. https://doi.org/10.3390/pr11051459.

[12] L. Taouzinet, S. Fatmi, Y. Salhi-Amrani, M. Lahiani-Skiba, M. Skiba, M. Iguer-Ouada, Development and validation of HPLC method for simultaneous quantification of alpha-tocopherol (free or encapsulated) and cholesterol in semen cryopreservation media, Biomed. Chromatogr. 35 (2021) e5018. https://doi.org/10.1002/bmc.5018.

[13] A. Khellouf, K. Benhenia, S. Fatami, M. Iguer-Ouada, The Complementary Effect of Cholesterol and Vitamin E Preloaded in Cyclodextrins on Frozen Bovine Semen: Motility Parameters, Membrane Integrity and Lipid Peroxidation, Cryo Letters. 39 (2018) 113–120. https://www.ncbi.nlm.nih.gov/pubmed/29734420.

[14] L. Taouzinet, S. Fatmi, M. Lahiani-Skiba, M. Skiba, M. Iguer-Ouada, Encapsulation Nanotechnology in Sperm Cryopreservation: Systems Preparation Methods and Antioxidants Enhanced Delivery, Cryo Letters. 42 (2021) 1–12. https://www.ncbi.nlm.nih.gov/pubmed/33973986.

[15] S. Fatmi, L. Bournine, M. Iguer-Ouada, M. Lahiani-Skiba, F. Bouchal, M. Skiba, Amorphous solid dispersion studies of camptothecin-cyclodextrin inclusion complexes in PEG 6000, Acta Pol. Pharm. 72 (2015) 179–192. https://www.ncbi.nlm.nih.gov/pubmed/25850214.

Statistical Analysis of Wear in Contaminated Dry Rolling Contacts

Abdelhakim Djalab, Mohamed Rafik Sari

[1] *Mechanical Engineering Department, Mohamed Boudiaf University of M'sila, Po Box 166 Ichebilia, 28000 M'sila, Algeria*
[2] *Laboratory of Industrial Mechanics, Mechanical Engineering Department, Badji Mokhtar University of Annaba, B. O. 12, 23000 Sidi Amar Annaba, Algeria*
E-mail: abdelhakim.djalab@univ-msila.dz

Abstract: It is well-established that the presence of solid particles between contacting surfaces can significantly degrade the lifetime of machine components. This study focuses on investigating the failure of dry rolling contacts under the influence of solid contaminants. To achieve this, the researchers conducted experiments using a custom experimental setup that closely represents the real operating conditions of gears or roller bearings. Specifically, the dry rolling contact tests were carried out using the contact between two steel disks. In order to examine the influence of three operating variables - particle size (S), rotational speed (V), and load (Q) - on the studied response, which was wear (W), the Taguchi L9 orthogonal array was utilized. The analysis of the obtained experimental results was performed using both response surface methodology (RSM) and analysis of variance (ANOVA) techniques. The results revealed that particle size (S) was the dominant factor affecting the wear of the contaminated dry rolling contact, contributing 59.93% to the observed wear. Furthermore, the developed RSM models for wear demonstrated a strong correlation between the predicted and experimental data, with determination coefficients exceeding 75

Keywords: dry rolling contact, solid particles, Taguchi technique, wear, Statistical Analysis

References

[1] Bouchireb A, Sari MR. Effect of solid particles on gear tooth failure. J of Central South Univ 2015; 22(5): 1667-75

[2] Cho MH, Bahadur S, Anderegg JW. Design of experiments approach to the study of tribological performance of Cu-concentrate-filled PPS composites. Tribol Int 2006; 39(11); 1436-46

[3] Dharmalingam S, Subramanian R, Kök M. Optimization of abrasive wear performance in aluminium hybrid metal matrix composites using Taguchi–grey relational analysis. Proc IMechE Part J: J of Eng Tribol 2013; 227(7): 749-760.

[4] Nixon HP, Zantopulos H. Fatigue life performance comparisons of tapered roller bearings with debris damaged raceways. Lubrication Eng 1995; 51(9): 732-36

Oscillatory Solutions of a new Class of Fredhom Type Integrodifferential Equations

Farouk Chérif and Salsabil Hajjaj

University of Sousse, MaPSFA Laboratory, ESSTHS , Tunisia
E-mail: farouk.y.cherif@gmail.edu.tr,salsabilhajjaji@gmail.com

Abstract: The main objective of this work is to study the existence uniqueness and other properties of the solution of a new class of integrodifferential equation. The well-known Banach fixed point theorem coupled with Bielecki type norm and integral inequalities with explicit and suitable estimate are used to establish the desired results. Also, the invariance and the stability of the solutions under a perturbation of the kernel is studied.

Keywords: Fixed point Theorem, Kernel, Differential equations

Mathematics Subject Classification: 34K45, 35B15

References

[1] L. Amerio and G. Prouse. Almost-periodic functions and functional equations. Van Nostrand Reinhold Co., New York-Toronto, Ont.-Melbourne, 1971.

[2] F. Chérif. A various types of almost periodic functions on Banach spaces: I. Int. Math. Forum, 6(17-20):921–952, 2011.

[3] S. Hajjaji and F. Chérif. S p -almost periodic and Sp -almost automorphic solutions of an integral equation with infinite delay. Miskolc Math. Notes, 22(1):211–244, 2021.

[4] R. Yazgan, S. Hajjaji, and F. Chérif. Weighted pseudo almost-automorphic solutions of quaternion-valued RNNs with mixed delays. Neural Processing Letters, 55(1):423– 440, 2022.

[5] C. Zhang. Almost Periodic Type Functions and Ergodicity. Springer Netherlands, 2003.

High Gain Reconfigurable Trapezoidal Patch Antenna On Thick YIG Substrate

Linda Djouablia, and Aziza Zermane

University 20 Aout 1955 of Skikda, Department of Electrical Engineering,Technology Faculty, Skikda, Algeria
LHS Laboratory of Hight Frequencies and Semi-Conductors, University Contantine1, Algeria
University of Batna2, Department of Technology, Algeria
E-mail: l.djouablia@univ-skikda.dz

Abstract: Currently, passive components made of magnetic materials are widely used in microwave applications. Ferrites, or metal oxides, are among the most commonly employed magnetic materials in the microwave range, in order to guarantee optimal efficiency and gain for an electronic frequency agility device. The principal objective of this study was to introduce a simple and efficient ferromagnetic material-based reconfigurable microstrip antenna construction. On a ferrite material YIG (Iron and Yttrium Garnet), a trapezoidal patch shape with two circular slots was selected for implantation. The use of YIG offers significant agility of resonant frequencies in the frequency range from 10.4GHz to 14.1GHz, through external excitation by magnetic fields applied to the antenna. Note that the adjustment range narrows slightly with higher frequencies and weaker magnetic fields. At greater magnetic fields, stable radiation was seen with a high gain of 8.85dB. The results verify that YIG provides greater radiation characteristics in terms of gain, directivity, and radiation efficiency which can reach 94% on the antenna while providing frequency agility when compared to FR4.

Keywords: Microstrip antenna, Ferrite substrate, YIG (Yttrium Iron Garnet)

References

[1] Polder. D, "On the theory of ferromagnetic resonance ", Philos Mag, 40. p. 99-115, 1949.

[2] B. D. Cullity and C. D. Graham, "Introduction to magnetic materials", 2nd edition, John Wiley & Sons, Inc, USA, 2009.

[3] Kasahara K, Sueda S, Manago T, "Thickness dependences of the dynamicmagnetic properties of epitaxial YIGfilms prepared by a metal–organicdecomposition method ", AIP Advances 12, 015204, 2022.

[4] Zermane.A, Sauviac.B, Djouablia.L, Benghalia.A, "Tunability of metamaterial compact band-stop filters using YIG substrate ", Journal of Electromagnetic Waves and Applications, 33.13, 1726-1734, 2019.

[5] Ashraf E. Ahmed,Wael A. E. Ali, and Sudipta Das, "High Gain 3-D Printed 2 × 2 Trapezoidal Planar Antenna Array for X-band Wireless Applications ", Proceedings of the 3rd International Conference on Communication, Devices and Computing, Lecture Notes in Electrical Engineering 851, 2022.

Mathematical Modeling and an Adaptive PID Control of Quadrotor

Abderrahmen Bouguerra[1], Keltoum Loukal[1], Samir Zeghlache[2]

[1] *LGE Research Laboratory, Department of Electrical Engineering, University Mohamed Boudiaf of M'sila, BP 166, Ichbilia, 28000 M'sila, Algeria*

[2] *LASS Research Laboratory, Department of Electrical Engineering, University Mohamed Boudiaf of M'sila, BP 166, Ichbilia, 28000 M'sila, Algeria*

E-mail: abderrahmen.bouguerra@univ-msila.dz, keltoum.loukal@univ-msila.dz, samir.zeghlache@univ-msila.dz

Abstract: The objective of this paper is to develop an adaptive proportional-integral-derivative control for a nonlinear quadrotor system. we start by modeling of this system with state space and presenting the idea of this adaptive control. We presented the theory of the type 2 fuzzy logic, in order to use in the adaptation of the gains parameters of the PID control. The adaptive PID (T2FAPID) technique are applied to the unmanned aerial vehicle (UAV) system, their performance results are compared to a designed non adaptive PID controller. The effectiveness of the suggested adaptive methods is demonstrated in simulations with a quaternion-based nonlinear dynamic model of a quadrotor derived in this work. The results of the study prove the higher performance of the T2FAPID technique in regulating the attitude stabilization of the quadrotor.

Keywords: Interval type 2 fuzzy logic technique, Adaptive PID control, PID control, state space system, quadrotor.

References

[1] N. Dalwadi, D. Deb and S. Ozana," Adaptive Hybrid Control of Quadrotor Drones", Book Chapter, Studies in Systems, Decision and Control, Vol. 561, pp. 1-174, 2023.

[2] V. N. Sankaranarayanan, S. Satpute and G. Nikolakopoulos, "Adaptive Robust Control for Quadrotors with Unknown Time-Varying Delays and Uncertainties in Dynamics", Conceptual Design, Modeling, and Control Strategies of Drones, 6(9), 220, 2022.

[3] K. Loukal, A. Bouguerra and S. Zeghlache," Fuzzy Adaptive Gains Fault Tolerant Control Based on Feedback Linearization of the Two Tanks System", The IEEE International Conference of Advanced Technology in Electronic and Electrical Engineering (ICATEEE), Msila, Algeria, 2022.

[4] I. Palunko and R. Fierro, "Adaptive Control of a Quadrotor with Dynamic Changes in the Center of Gravity" IFAC Proceedings Volumes, 44(1), pp. 2626-2631, 2016.

[5] K. Loukal, A. Bouguerra and S. Zeghlache," Fuzzy Gains-scheduled Actuator Fault-Tolerant Control Comparative Study for Two Tanks Level System", 2nd International Conference on Engineering and Applied Natural Sciences, Konya, Turkey, 2022.

Modeling and interval type 2 fuzzy logic controller of manipulator robot

Keltoum Loukal[1] , Abderrahmen Bouguerra[1] and Samir Zeghlache[2]

[1] *LGE Research Laboratory, Department of Electrical Engineering, University Mohamed Boudiaf of M'sila, BP 166, Ichbilia, 28000 M'sila, Algeria*

[2] *LASS Research Laboratory, Department of Electronics, University Mohamed Boudiaf of M'sila, BP 166, Ichbilia, 28000 M'sila, Algeria*

E-mail: keltoum.loukal@univ-msila.dz, abderrahmen.bouguerra@univ-msila.dz and samir.zeghlache@univ-msila.dz

Abstract: This paper presents the interval type 2 fuzzy logic controller (IT2FLC) for a manipulator robot system. After dynamic modeling and system state modeling, we presented the method of the fuzzy logic control, the efficient interval type-2 fuzzy controller is designed for trajectory tracking of two DOF robotic manipulator. A comparative study is made between the proposed interval type 2 fuzzy logic control technique in the presence of variation of parameters. The results obtained show that the proposed IT2FLC has a superior robustness against difference of parameters where the two DOF robotic manipulator system functions with satisfactory performance.

Keywords: Interval type 2 fuzzy logic technique, PID control, state space system, two DOF robotic manipulator.

References

[1] A. Kumar and V. Kumar," Design of Interval Type-2 Fractional-Order Fuzzy Logic Controller for Redundant Robot with Artificial Bee Colony", Arabian Journal for Science and Engineeringl, Vol. 44, pp. 1883-1902, 2019.

[2] Y. Bouteraa, K. A. Alattas, O. Alshammari, S. Ben Aoun, M.A. Regaieg and S. Mobayen, "Interval Fuzzy Type-2 Sliding Mode Control Design of Six-DOF Robotic Manipulator", Mathematics, 10(24), 4835, 2022.

[3] M.A. Aghaseyedabdollah, M. Abedi and M. Pourgholi," Interval type-2 fuzzy sliding mode control for a cable-driven parallel robot with elastic cables using metaheuristic optimization methods", Mathematics and Computers in Simulation, Vol. 218, pp. 435-461, 2024.

[4] A. Kumar, R. Raj, A. Kumar and B. Verma, "Design of a novel mixed interval type-2 fuzzy logic controller for 2-DOF robot manipulator with payload", Engineering Applications of Artificial Intelligence, 123 (B), 106329, 2023.

[5] P.J. Gaidhane, M.J. Nigam, A. Kumar and P.M Pradhan," Design of interval type-2 fuzzy precompensated PID controller applied to two-DOF robotic manipulator with variable payload", ISA Transactions, Vol. 89, pp. 169-185, 2019.

Approximation method for performance analysis of a retrial queuing system with collisions and transmission errors for wireless networks

Lamia Lakaour[1], Karima Adel-Aissanou[1], Djamil Aïssani[1], Amel Boulahouad[1], Nadia Hani[1]

[1] *Research Unit LaMOS (Modeling and Optimization of Systems), Faculty of Exact Sciences, Bejaia University, Bejaia 06000, Algeria*
E-mail:
lakaour.lamia@gmail.com,ak_adel@yahoo.fr,lamos_bejaia@hotmail.com,amelespoir95@gmail.com,nadiahani1994@gmail.com

Abstract: In many situations, involving data transmission from diverse sources there can be conflict for a limited number of channels or other facilities. Uncoordinated attempts by several Sources to use a single server facility can result in 'Collision' leading to the loss of the transmission. Several protocols are developed to try to solve the problem of collisions in wireless networks and each time the authors try to obtain a negligible collision rate. We use an approximate approach, here the strong stability method, to answer the question: under which conditions (the parameters of the network) can one say that the collisions are negligible?. The purpose is to determine the conditions under which the performance of an M/M/1 retrial queuing system with collision and transmission errors, modeling the operation of a wireless channel access method, can be approached by those of an M/M/1 retrial queuing system with transmission errors (without collisions). In this work, we have calculated the error bound made during this approximation, and it is noted that we were interested much more in the conditions of application of the approximation than in the calculation of the performances themselves.

Keywords: Retrial queue, Collisions, Transmission errors, Strong stability, Inequalities of stability.

References

[1] Aissani, D. and Kartashov, N. V., Ergodicity and stability of Markov chains with respect to operator topology in the space of transition kernels, in Doklady Akademii Nauk Ukrainskoi SSR, Vol. 11, No. seriya A, pp. 3-5, (1983).

[2] Aissani, D., and Kartashov, N. V., Strong stability of the imbedded Markov chain in an M/G/1 system, theory Probab. Math. Stat, 29, 1-5, (1984).

[3] Artalejo, J. R., Accessible bibliography on retrial queues: Progress in 2000-2009. Mathematical and Computer Modelling, vol. 51, pp. 1071–1081, (2010).

[4] Berdjoudj, L., and Aissani, D., Strong stability in retrial queues. Theory of Probability and Mathematical Statistics, 68, 11-17, (2004).

[5] Benaouicha, M., and Aissani, D., Strong stability in a G/M/1 queueing system. Theory of Probability and Mathematical Statistics, 71, 25-36,(2005).

[6] Kim, J. S.. Retrial queueing system with collision and impatience. Communications of the Korean Mathematical Society, vol. 25, pp. 647–653,(2010).

[7] Kumar, B. K., Vijayalakshmi, G., Krishnamoorthy, A., and Basha,S. S.. A single server feedback retrial queue with collisions. Computers and Operations Research, vol. 37, pp. 1247–1255,(2010).

[8] Lakaour, L., Aissani, D., Adel-Aissanou, K., and Barkaoui, K., M/M/1 Retrial Queue with Collisions and Transmission Errors. Methodology and Computing in Applied Probability, 1-12,(2018).

[9] Lakaour, L., Aissani, D., Adel-Aissanou, K., Barkaoui, K., and Ziani, S. An un- reliable single server retrial queue with collisions and transmission errors. Communicationsin Statistics-Theory and Methods, 51(4), 1085-1109, (2022).

[10] Rabta B., Lekadir O, and Aissani D., Strong stability of queueing systems and networks: a survey and perspectives. In the Book "Advanced Trends in Queueing Theory", Vladimir Anisimov and Nikolas Limnios Editors, "Mathematics and Statistics" series,Sciences, in lste & J. Wiley, London, 2019.

[11] Yang, T. and Templeton, J. G. C., A survey on retrial queues. Queueing Systems, vol. 2, pp. 201–233.

Stochastic Modelling of Rumour Spreading with the Adjusting Control Mechanism Attitude in Homogeneous Network

Norhayati Rosli[1], Muhammad Fahmi Ahmad Zuber[1], Hamdi Agustin[2], Lo Hai Hiung[3], Imelda Atastina[4]

[1]*Centre for Mathematical Sciences, Universiti Malaysia Pahang Al-Sultan Abdullah Lebuh Persiaran Tun Khalil Yaakob, 26300, Kuantan, Pahang, Malaysia*
[2]*Universitas Islam Riau, Jl. Kaharuddin Nasution 113, Pekanbaru 28284, Riau, Indonesia*
[3]*Electrical and Electronics Engineering Department, Universiti Teknologi Petronas, 32610 Seri Iskandar, Perak, Malaysia*
[4]*School of Computing, Telkom University, Bandung, West Java, Indonesia*
E-mail: norhayati@umpsa.edu.my, mfahmi.aor@gmail.com, hamdiagustin@eco.uir.ac.id, lo_haihiung@utp.edu.my and imelda@telkomuniversity.ac.id

Abstract: Rumour spreading in social media networks has emerged as a pervasive phenomenon, profoundly impacting information dissemination, public opinion formation, and societal behaviour. This paper presents a stochastic modelling approach to analyze the dynamics of rumour spreading in homogeneous networks, integrating an adjusting control mechanism attitude. We introduce stochasticity into the epidemic deterministic compartmental model, distinguishing susceptible (S), ignorant (I), propagation (P), and hesitant (H) individuals. The characteristic of this model is examined to investigate its stability properties, equilibrium states, and sensitivity to parameter variations. Numerical simulation is performed to validate its efficacy. This research contributes to the understanding of rumour spreading processes in homogeneous networks and provides insights into designing effective control strategies to mitigate the spread of misinformation and rumours.

Keywords: Stochastic modelling, Rumour spreading, Homogeneous network

Mathematics Subject Classification: 60H10

References

[1] Li, D. and Ma, J., "How the government's punishment and individual's sensitivity affect the rumor spreading in online social networks", Physica A 469, pp. 284-292, 2017.

[2] Li, M., Zhang, H., Georgescu, P. and Li, T., "The stochastic evolution of a rumor spreading model with two distinct spread inhibiting and attitude adjusting mechanisms in a homogeneous social network", Physica A: Statistical Mechanics and Its Application 562, pp. 125321, 2021.

[3] Norhayati Rosli, Muhammad Fahmi Ahmad Zuber and Ali Turab," Mathematical Modelling of a Rumour Spreading with the Attitude of Adjusting Mechanisms", Sains Malaysiana 53(3), pp. 719-731, 2024.

[4] Xia, L.L., Jiang, G.P., Song, R. and Song, Y.R., "Rumor spreading model considering hesitating mechanism in complex social networks", Physica A 437, pp. 295-303, 2015.

[5] Zan, Y., Wu, J., Li, P. and Yu, Q., "SICR rumor spreading model in complex networks: Counterattack and self-resistance", Physica A: Statistical Mechanics and its Applications 405, pp. 159-170, 2014.

[6] Zhao, L., Qiu, X., Wang, X. and Wang, J., "Rumor spreading model considering forgetting and remembering mechanisms in inhomogeneous networks", Physica A 392, pp. 987-994, 2013.

[7] Zhou, Y., Zhang, J., Zhu, C. and Wang, H., "Modelling and analysis of rumour propagation based on stochastic optimal control. Alexandria Engineering Journal 61(12), pp. 12869-12880, 2022.

Statistical Optimization of Culture Media of Lipolytic Enzyme from a Thermophilic Actinomycete Isolated from Local Poultry Compost

Fatiha Benamia[1,*], Noura Semache[1], Selma Bounour, Mohammed Lotfi Souici[1], and Ali Ladjama[2]

[1]*Laboratory of Applied Organic Chemistry, Chemistry Department, Faculty of Sciences, Badji Mokhtar University, P.O. Box 12, 23000 Annaba, Algeria*

[2]*Laboratory of Applied Biochemistry and Microbiology, Biochemistry Department, Faculty of Sciences, Badji Mokhtar University, P.O. Box 12, 23000, Annaba, Algeria*

E-mail: fatiha.benamia@univ-annaba.org

Abstract: Microorganisms are essential sources for enzyme production for industrial applications. In the last few years, there has been an increasing interest in the use of enzymes for the biosynthesis of molecules in organic media [1]. Among enzymes, lipases were considered as a great biotechnological and industrial catalyst after carbohydrases and proteases [2]. Lipases are prevalent in nature and are produced by plants, animals, and microorganisms including actinomycetes, fungi, and bacteria [3]. This work describes the production of a new lipase from a thermophilic Actinomycete strain Cpt29 isolated from local poultry compost in North East of Algeria, for industrial applications. This study aims to improve the lipase production by strain Cpt29, through mathematical modeling and optimization of culture media components using statistical approaches. For this purpose, eleven culture parameters were considered using lipase activity as production reference parameter. Plackett-Burman design used for screening step, selected three significant variables (incubation temperature, cultivation time, and Tween 80) for optimization using a response surface method (RSM) generated by a Box-Behnken design. Increase in these three parameters markedly increased the production of lipase from strain Cpt29. A 4.1-fold increase in the lipase production was obtained in the optimized medium. A maximum lipase activity of 185 U/mL was recorded under the following optimal condition. RSM shows that the observed values of lipase activity with predicted ones, obtained with high correlation coefficient (R^2 = 0.995 with P-value< 0.0001) confirmed the validity of the statistical mathematical model of optimization.

Keywords: Statistical optimization; Lipase; Actinomycete; RSM; Plackett-Burman design

References

[1] Erdemir, S. and Sahin, O. and Uyanik, A., "Effect of the glutaraldehyde derivatives of Calix[n]arene as cross linker reagents on lipase immobilization", J Incl Phenom Macrocycl Chem, 64, pp. 273–282, 2009.

[2] Hasan, F. and Shah, A. A. and Hameed, A., "Industrial applications of microbial lipases", Enzym Microb Technol, 39, pp. 235–251, 2006.

[3] Al-Dhabi, N. A. and Ghilan, A. K. M. and Esmail, G. A. and Arasu, M. V. and Duraipandiyan, V. and Ponmurugan, K., "Bioactivity assessment of the Saudi Arabian Marine Streptomyces sp. Al-Dhabi-90, metabolic profiling and its in vitro inhibitory property against multidrug resistant and extended-spectrum beta-lactamase clinical bacterial pathogens", J Infect Public Health, 12, pp. 549–556, 2019.

Predicting Stock Volatility: Machine Learning versus Classical Approaches

Nassim Touche and Aicha Anzi

University of Bejaia, ,Faculty of Exact Sciences, Research Unit LaMOS, 06000 Bejaia, Algeria
E-mail: nassim.touche@univ-bejaia.dz and aicha.anzi@univ-bejaia.dz

Abstract: In this work, our objective is to predict the monthly rolling volatility of Repsol's stocks. To do this, we considered several models, namely: Artificial Neural Networks (ANN), three Machine Learning models: XGBoost, LightGBM, and CatBoost. We also used the GARCH model: Generalized Autoregressive Conditional Heteroskedasticity, which is widely used for forecasting the variance of financial time series and is particularly useful for modeling stock volatility. We adapted these models and used them to make short-term forecasts on stock volatility. Additionally, we compared the performance of the different models. Our results show that the three Machine Learning models (XGBoost, LightGBM, and CatBoost) are capable of accurately predicting Repsol's monthly rolling stock volatility and outperform the GARCH model and ANN in out-of-sample forecasting. This work demonstrates the usefulness and power of Machine Learning models in predicting stock volatility.

Keywords: Prediction, stock Volatility, Machine learning models, GARCH model, Artificial Neural Networks model

Mathematics Subject Classification: 62M10; 62M86; 62F12; 62J12

References

[1] C. Chen, M., and R. Gerlach, Neural network forecasting of short-term stock market prices. International Journal of Forecasting, 32(3), 763-778, 2016.

[2] K. M. Dimitrios and D. Nikolaos, Volatility Forecasting using Hybrid GARCH Neural Network Models: The Case of the Italian Stock Market, International Journal of Economics and Financial Issues, 11(1), 49-60, 2021.

[3] J. Shen and M.O. Shafiq, Short-term stock market price trend prediction using a comprehensive deep learning system. J Big Data 7, 66 2020.

[4] G. Ke, Q. Meng, T. Finley, T. Wang, W. Chen, W. Ma, Q. Ye, and T.-Y. Liu, "Lightgbm: A highly efficient gradient boosting decision tree," Advances in neural information processing systems, 30, 2017.

[5] T. Chen and C. Guestrin, "Xgboost: A scalable tree boosting system," in Proceedings of the 22nd acm sigkdd international conference on knowledge discovery and data mining, 785–794, 2016.

Thermal properties of $Fe_{0.6}Al_{1-x}Co_x$ alloys in Magnetic Induction Melted

Abdelhak Fekrache[1], Mohamed Yacine Debili[2], and Salim boulkhessaim[3]

[1]*University of 20 August 1955 Skikda, Dept. of physics, Algeria,*
[2]*University of badji-mokhtar annaba, Dept. of physics, Algeria,*
[3]*University of 20 August 1955 Skikda, Dept. of physics, Algeria,*
E-mail: abde.fek@gmail.com ,mydebili@yahoo.fr and salimbou21@yahoo.fr

Abstract: In contrast to the abundance of studies in Fe-Al and Fe-Co, those in the Fe-Al-Co ternary system are scarce. Consequently, the phase separation and phase diagram of this system remain still ambiguous. Ternary $Fe_{0.6}Al_{1-x}Co_x$ (x values in a molar ratio of 0.05, 0.1, 0.15, and 0.2) have been elaborated by high frequency magnetic induction fusion, in order to study the effect of cobalt ternary addition on the structural behaviour such as phase separation, thermal and mechanical properties of Fe-based alloy system, by means of x-ray diffraction, thermal analysis (DSC) and Vickers microhardness. An unexpected allotropic phase transformation from stable HCP to metastable FCC Cobalt has been observed in all alloys.

Keywords: Fe-Al-Co, phase transformation, phase separation, lattice parameter

References

[1] H. Xiao, I. Backer: Acta Metallurgica et Materialia, Vol. 43, 1995, No. 1, p. 391-396

[2] C. Li-Fang et al.: Rare Metal Materials and Engineering, Vol. 35, 2009, No. 3, p.451-455

[3] H. Shao et al.: Journal of Alloys and Compounds, Vol. 479, 2009, No. 9, p. 409-413, DOI: 10.1016/j.jallcom.2008.12.067

[4] S. Sun, C.B. Murray: Journal of applied Physics, Vol. 85, 1999, No. 8, p.4325-4331, DOI: 10.1063/1.370357

Investigating an algorithmic solution for a two person game problem

Aicha Anzi and Karima Bouibed

University of Bejaia, Faculty of Exact Sciences, Research Unit LaMOS, 06000 Bejaia, Algeria
E-mail: aicha.anzi@univ-bejaia.dz and karima.bouibed@univ-bejaia.dz

Abstract: In this study, we present a numerical investigation of an algorithm designed to address a specific class of two-person game problems [1]. Initially, we reframe the game formulation into a linear complementarity problem (LCP) [2]. Notably, the LCP does not inherently represent an optimization problem, lacking an explicit objective function. Consequently, we formulate an equivalent optimization problem derived from the resulting LCP. Subsequently, we develop an algorithm rooted in a nonconvex methodology [3]to tackle the optimization task. We conduct a numerical analysis on randomly generated game instances to assess the efficacy of the proposed approach. Furthermore, we perform a comparative analysis with a widely recognized method from the existing literature to provide further insights into our results.

Keywords: two person game, nonconvex technique, LCP.

Mathematics Subject Classification: 91A05, 91A10, 90C26.

References

[1] J. Nash, "Noncooperative games", Annals of Mathematics, 54(1951).

[2] R. Savani, "Finding Nash equilibria of bimatrix games", PhD Thesis, London school of economics (2006).

[3] H. A. Le Thi and T. Pham Dinh, "On solving Linear Complementarity Problems by DC programming and DCA", Comput. Optim. and App., 50(2011), 507-524.

Abamectin induced renal injuries and the protective effect of Ajuga iva in domestic pigeon (Columba livia domestica)

Souheila Slimani

Laboratory of Research in Biodiversity Interaction, Ecosystem and Biotechnology 'LRIBEB' University of 20 Auguest 1955 Skikda- Algeria
E-mail: shsouheila@yahoo.fr

Abstract: This study was performed to investigate the effects of Abamectin an insecticide of the avermectin family, as well as the protective effect of "Ajuga iva" (Chendgoura) a medecinal plant , on the kidney function of domestics pigeons (Columba livia domestica). The study was conducted on 24 pigeons, divided into 4 groups; the 1st one was the negative control, the 2nd was treated by the insecticide with a dose of 20mg/Kg/D, the 3rd was treated with 0.1mg / ml of the infusion of the plant, the 4th goup was treated with a mixture of abamectin and Ajuga iva for 45th day of the experiment. the biochemical profile was determined and the animals were sacrificed, and the histopathological studies were done. The obtained results showed that abamectin causes a significant increase in albumin and uric acid, a non-significant increase in calcium and total proteins with a significant decrease in kidney weight. However, pigeons treated by Ajuga shows a significant decrease in uric acid, an increase in potassium, as well as a significant decrease in albumin in the abamectin / plant mixture group, and decreased. uric acid level in the combined group, which explains the protective and detoxifying effect of the plant. The histological examination revealed a structural degradations of renal parenchyma, glomeruli wall and tubules which confirms the toxic effect of abamectin.

Keywords: Ajuga iva, abamectin, pigeons, biochemical parameters, ionogram, kidneys,

References

1. Bondm M. R., Al-Hillo Y., Lamara K., Ladjel S., Bruno M., Piozzi F., Simmonds M.S.J., (2000). Occurrence of the antifeedant 14, 15-dihydroajugapitin in the aerial parts of Ajuga iva from Algeria Biochemical S ystematics and Ecology, 28, 1023-1025. 2. Bouderbala S., Lamri-Senhadji M., Prost J., Lacaille-Dubois M.A., and Bouchenak M., (2008). Changes in antioxidant defense status in hypercholesterolemic rats treated with Ajuga iva. Phytomedicine 3. Abamectine, (2009). In : Index Phytosanitaire ACTA, Paris. Key words: Ajuga iva, abamectin, pigeons, biochemical parameters, ionogram, kidneys,

Application of Artificial Neural Networks (ANN) and Response Surface Method (RSM) for enhancing the Immobilization Conditions for Lipase on Ion-Exchange Resin

Fatiha Benamia[1,*], Samah Bouchagra[1,2], Noura Semache[1], Selma Bounour[1]

[1] *Laboratory of Applied Organic Chemistry, Chemistry Department, Faculty of Sciences, Badji Mokhtar University, P.O. Box 12, 23000 Annaba, Algeria*

[2] *Chemistry Department, Faculty of Exact Sciences, Echahid Hamma Lakhdar University - El Oued, P.O. Box 789, 39000 El-oued Algeria*

E-mail: fatiha.benamia@univ-annaba.org

Abstract: In recent years, artificial neural network (ANN) has been used as a very powerful and flexible method in various processes [1]. ANN constitutes a central element and a main key tool used in the field of artificial intelligence. It could be considered as a main developed variant of response surface methodology (RSM) for several chemistry processes. This approach facilitates the learning of data models, leading to precise decision-making based on exploratory data [2]. It is an effective statistical technique for developing, improving, and optimizing complex processes [3]. In this study, ANN-RSM approach is used for enhancing immobilization conditions for *Candida rugosa* lipase (CRL) as an important industrial enzyme that is successfully utilized in a variety of organic reactions, on the anionic resin Amberjet®4200-Cl. This work mainly describes the optimization of immobilization conditions (enzyme/support ratio, immobilization temperature, and buffer concentration), using the lipase enantioselectivity parameter (E) as the response (y) of the calculated mathematical models. The results show that both models performed by ANN and RSM gave stable responses in the prediction of the response (y), with a coefficient of determination (R^2) and the root mean square error (RMSE) values between the calculated and estimated responses. R^2 and RMSE values were equal to 0.99 and 0.06 for the ANN training set, 0.97 and 0.2 for the ANN testing set, and 0.94 and 0.4 for the RSM training set, respectively. The fitted plots between the observed values of response (y) and predicted ones calculated by RSM and ANN models show the goodness of fit for the obtained mathematical models (R^2 = 94% and 97.1%, respectively). These models provided good quality predictions, yet the ANN showed a clear superiority over RSM for both data fitting and estimation capabilities.

Keywords: Optimization; Mathematical model; Artificial Neural Network (ANN); Response Surface Methodology (RSM); Lipase; Enantioselectivity; Immobilization.

References

[1] Zhang, Y. and Xu, J. and Yuan, Z. and Xu, H. and Yu, Q. Artificial Neural Network-Genetic Algorithm Based Optimization for the Immobilization of Cellulase on the Smart Polymer Eudragit L-100.Bioresource Technol, 101(9), pp. 3153–3158, 2010.

[2] Richa, R. and Shahi, N.C. and Lohani, U. C. and Kothakota, A. and Pandiselvam, R. and Sagarika, N. and Singh, A. and Omre, P. k. and Kumar, A. Design and development of resistance heating apparatus-cum-solar drying system for enhancing fish drying rate. J. Food Process Eng., 45 (6), 2022.

[3] Soyer, A. and Bayraktar, E. and Mehmetoglu, U. Optimization of Lipase-Catalyzed Enantioselective Production of 1-Phenyl-1-propanol Using Response Surface Methodology. Preparative Biochem. Biotechnol, 40(4), pp. 389–404, 2010.

Crystal Structure and Hirshfeld Surface Analysis of E-1-(3-nitrophenylazo)-2-naphtol

Mohamed Amine Benaouida[1,2] and Ali Benosmane[2,3]

[1] *University of 20 Août 1955-SKIKDA, Department of chemistry, 21000, Skikda, Algeria*
[2] *Constantine1 University, Research Unit of Environmental Chemistry and Structural Molecular, 25000, Constantine, Algeria*
[3] *Larbi Ben M'hidi University, Department of chemistry, 04000, Oum El Bouaghi, Algeria*
E-mail: m.benaouida@univ-skikda.dz

Abstract: In the title compound, the molecule $C_{16}H_{11}N_3O_3$ belongs to the family of azo dyes, and the asymmetric unit displays an intramolecular N—H$\cdots$O hydrogen bond. In the light of a single crystal X-ray study, it is evident that of the tautomeric forms (Azo-hydrazone), the hydrazone form is the predominant form in the solid state. The naphthol and benzene fragments attached to the -N=N- moiety adopt the s-trans conformation. Furthermore, the molecules are nearly coplanar, implying a dihedral angle of 2.63 (5)°. There are only two types of intermolecular interactions in the crystal structure: strong hydrogen-bonding C—H$\cdots$O interactions and π-π stacking interactions. The importance of C—H$\cdots$O interactions in the molecular packing is reflected in the relatively high contributions made by O$\cdots$H/H$\cdots$O contacts to the Hirshfeld surface, i.e., 28.5%.

Keywords: azo dyes, X-ray diffraction, crystal structure, intermolecular interactions, Hirshfeld surface.

References

[1] R. M. Christie, Colour chemistry. in RSC paperbacks. Cambridge, UK: Royal Society of Chemistry, 2001.

[2] L. Antonov, Tautomerism: Concepts and Applications in Science and Technology. Wiley, 2016.

[3] M. A. Benaouida, A. Benosmane, H. Bouguerria, S. E. Bouaoud, et H. Merazig, « Bis1-[(E)-(2-chlorophenyl)diazenyl]naphthalen-2-olatocopper(II) », Acta Crystallogr. Sect. E Struct. Rep. Online, vol. 69, no 7, p. m405-m405, juill. 2013.

[4] M. A. Benaouida, A. Benosmane, M. Boutebdja, et H. Merazig, « Crystal structure and Hirshfeld surface analysis of 1-[(E)-2-(3-nitrophenyl)diazen-1-yl]naphthalen-2-ol », Acta Crystallogr. Sect. E Crystallogr. Commun., vol. 79, no 3, p. 142-145, mars 2023.

[5] A. Benosmane, B. Gündüz, M. A. Benaouida, C. Boukentoucha, et H. Merzig, « Experimental structural and optoelectronic properties and theoretical investigation of novel square planar nickel (II) complex with (o-tolyldiazenyl) naphthalen-2-ol ligand », J. Mol. Struct., vol. 1273, p. 134254, févr. 2023.

[6] M. A. Benaouida, S. Chetioui, et S. E. Bouaoud, « 1-(4-Hydroxyphenyl)-2-(2-oxidonaphthalen-1-yl)diazen-1-ium methanol hemisolvate », Acta Crystallogr. Sect. E Struct. Rep. Online, vol. 69, no 6, p. o867-o868, juin 2013.

Analysis of Sub-Synchronous Resonance in a wind farm with Thyristor-controlled series capacitor

Rayane Leulmi and Salima Lekhchine and Ammar Medoued

University 20 August 1955, Dept. of Electrical Engineering, 21000, Skikda, Algeria
E-mail: rayane.leulmi@univ-skikda.dz and slekhchine@yahoo.fr and amedoud75yahoo.fr

Abstract: Renewable energies play a crucial role in the economic development of countries. Recently, wind power has been the most widely used energy source, due to its advantages. One of the economically viable generation systems in the wind energy market is the doubly fed induction generator (DFIG), but it poses several problems. One of the main problems is system instability and control when a large number of turbines are connected to the grid in the form of a wind farm. Scientists have developed numerous articles to control wind energy systems, guarantee system stability and reliability, and increase the power available to the grid. Implementation of a fixed series capacitor in a transmission line increases transmissible power but can cause a significant negative effect known as sub-synchronous resonance (SSR). The phenomenon of sub-synchronous resonance (SSR) causes significant damage and degrades the performance of wind farms. Power systems research is currently focusing on mitigating and limiting the effects of this phenomenon in wind power installations. Thyristor-controlled series capacitors (TCSC) are one technique for improving system stability and damping the SSR. A 66-turbine wind farm powered by a double-fed induction generator (DFIG) connected to a TCSC with P controllers was used to study the SSR phenomenon. The results were presented in MATLAB.

Keywords: Renewable energy, Wind turbine, Doubly fed induction generator, sub-synchronous resonance, Thyristor-controlled series capacitors.

References

[1] Musarrat, M. N., & Fekih, A. (2023). Event-Triggered robust control scheme for sub-synchronous resonance mitigation in DFIG-based WECS. International Journal Of Electrical Power & Energy Systems, 148, 109006. https://doi.org/10.1016/j.ijepes.2023.109006

[2] Virulkar, V. B., & Gotmare, G. V. (2016). Sub-synchronous resonance in series compensated wind farm : A review. Renewable & Sustainable Energy Reviews, 55, 1010 1029. https://doi.org/10.1016/j.rser.2015.11.012

[3] Abdeen, M., Emran, A., Moustafa, A., Kamal, D., Hassan, R., Hassan, E., Ahmed, F., Mahmoud, M., Kamel, S., & Jurado, F. (2021). Investigation on TCSC Parameters and Control Structure for SSR Damping in DFIG-Based Wind Farm. International Renewable Energy Congress (IREC 2021. https://doi.org/10.1109/irec52758.2021.9624934

[4] M. Abdeen et al., "A Recent Analytical Approach for Analysis of Sub-Synchronous Resonance in Doubly-Fed Induction Generator-Based Wind Farm," IEEE Access, vol. 9, pp. 68888- 68897, 2021.

Maximizing Efficiency: Simulation-Based Modeling of Hybrid Power Systems with MPPT Technology

Manal Toumi and Omar Boudebbouz

20 August 1955 University, Dept. of Electrical Engineering, 21000, Skikda, Algeria
E-mail: m.toumi@univ-skikda.dz and boudebouz7@yahoo.fr

Abstract: The paper introduces a study focused on the behavior analysis and performance control of a hybrid power system (HPS) comprising two renewable energy sources: photovoltaic and wind systems connected to a continuous bus. The investigation encompasses two main aspects: control strategies and maximizing the utilization of renewable resources.
Given the inherent fluctuation of renewable resources, there exists a risk of compromising energy efficiency concerning specific demand requirements. Therefore, in pursuit of maximizing the efficiency of the renewable energy system, it becomes imperative to implement methods for tracking the maximum power point of the input sources, a task undertaken within the MATLAB/Simulink platform.
To enhance the efficiency of photovoltaic energy conversion, a Maximum Power Point Tracker (MPPT) utilizing perturb and observe set theory is proposed. This approach is grounded in linguistic rules applied to control the step-up converter for MPPT purposes.In the case of the wind system, optimization is achieved by considering the optimal power curve as the load characteristic, incorporating knowledge of the turbine characteristic Cp (λ).

Keywords: MPPT, Hybrid Power Systems, Simulation, wind power system

References

[1] B.Benlahbib, N.Bouarroudj, F.Bouchafaa,"A Single Input T-S FLC Algorithm for System MPPT-Experimental Validation", International Conference on Artificial Intelligence in Renewable Energetic Systems. Univercite Tipaza, Algeria, 2017.

[2] B. Kanagasakthivel and D. Devaraj, "Simulation and performance analysis of Solar PV-Wind hybrid energy system using MATLAB/SIMULINK," 2015 International Conference on Computing and Communications Technologies (ICCCT), Chennai, India, 2015.

[3] G. An et al., "Short-Term Wind Power Prediction Based On Particle Swarm Optimization-Extreme Learning Machine Model Combined With Adaboost Algorithm," in IEEE Access, vol. 9, pp. 94040-94052, 2021.

[4] L. G. Vasant and V. R. Pawar, "Solar-wind hybrid energy system using MPPT," 2017 International Conference on Intelligent Computing and Control Systems (ICICCS), Madurai, India, 2017

[5] P. Roy, J. He, T. Zhao and Y. V. Singh, "Recent Advances of Wind-Solar Hybrid Renewable Energy Systems for Power Generation: A Review," in IEEE Open Journal of the Industrial Electronics Society, vol. 3, pp. 81-104, 2022

Sub-synchronous oscillation in a wind park with series compensation

[1]Lekhchine Salima and Bahi Tahar[2] , Leulmi Rayane[3]

[1] *LGMM Laboratory, University of 20 August 1955 Skikda, 21000, Algeria*
[2]*LASA Laboratory, Badji Mokhtar University - Annaba, 23000, Algeria*
[3]*LES Laboratory, University of 20 August 1955 Skikda, 21000, Algeria*
E-mail: slekhchine@yahoo.fr and tbahi@hotmail.fr, rayane.leulmi@univ-skikda.dz

Abstract: In wind power systems based on the doubly-fed generator (DFIG), sub-synchronous oscillations (SSO) are becoming increasingly frequent in weak areas of power grids with high levels of energy production, affecting their operation. This effect can damage the turbine-generator shaft system and could be a potential point of origin for generator failure and subsequent power system instability. The grid-controlled series compensator (GCSC) is one of the techniques that have been used to solve the problem of sub-synchronous oscillations (SSO). In this article, the GCSC was used in the electrical network to improve power transfer and system stability. The results have been demonstrated with MATLAB/SIMULINK.

Keywords: Wind power system, Doubley-fed induction generator, sub-synchronous oscillations, Grid-controlled series compensator

References

[1] M. Abdeen, H. Li, and L. Jing, "Improved subsynchronous oscillation detection method in a DFIG-based wind farm interfaced with a series-compensated network," International Journal of Electrical Power & Energy Systems, vol. 119, p. 105930, 2020

[2] Gong, Y., Huang, Q., Cai, D., & Olorunfemi, B. O. (2023). Characteristics of sub-synchronous oscillation in grid-connected wind farm system. Journal Of Electronic Science And Technology/Journal Of Electronic Science And Technology, 21(4), 100228. https://doi.org/10.1016/j.jnlest.2023.100228

[3] Chen, C., Du, W., Wang, H., & Littler, T. (2018). Sub-synchronous oscillations in power systems caused by grid-connected wind farms — A survey of mechanism studies. CSEE Journal Of Power And Energy Systems, 4(4), 495 503. https://doi.org/10.17775/cseejpes.2018.00560

[4] Sadiq, R., Wang, Z., & Chung, C. (2023). A multi-model multi-objective robust damping control of GCSC for hybrid power system with offshore/onshore wind farm. International Journal Of Electrical Power & Energy Systems, 147, 108879. https://doi.org/10.1016/j.ijepes.2022.108879

Nonlinear Wavelet Estimators of Spatially varying coefficients

Karima Kimouche

20 août 1955 University, Dept. of Mathematics , 21000, Skikda, Algeria
E-mail: k.kimouche@gmail.com

Abstract: In this paper, we propose nonlinear wavelet estimators of spatially varying coefficients of a linear system based on kernel and wavelet estimators of the evolutionary spectrum and cross-spectrum. We obtain large sample properties of these estimators.

Keywords: Evolutionary spectrum, Kernel estimator, wavelet.

Mathematics Subject Classification: 60G60, 60G20

References

[1] Huang, G., Chen, X. Wavelets-based estimation of multivariate evolutionary spectra and its application to nonstationary downburst winds. Engineering Structures 31, 976-989. 2009.

[2] Moulines, E., Priouret, P., Roue, F. On recursive estimation for locally stationary time varying autore-gressive processes. Annals of Statistics 33, 2610 2654. 2005.

[3] Von Sachs. R., Schneider. K. (1996). Wavelet Smoothing of Evolutionary Spectra by Nonlinear Thresholding. Applied and Computational. Harmonic analysis 3. No. 3, 268-282.

The role of modeling with statistical structural equations in psychology

Awatif Bouguerra [1] **and Halima Bouguerra** [2]

[1] *University of Bouira,*
[2] *University of M'sila,*
E-mail: awatif.bouguerra@univ-msila.dz

Abstract: Psychological characteristics are among the most important factors that affect human behavior and his interaction with the surrounding environment. To accurately assess these characteristics, many tools and methods are used, including psychometrics and tests. However, these tools may suffer from some limitations that affect the accuracy of the assessment, such as the combined effect of factors, measurement errors, and biases. To remedy this problem, structural equation modeling came to improve the accuracy of assessing psychological characteristics, to control common effects, estimate measurement errors, and test biases. What is statistical structural equation modeling?

A Numerical Study of Mixed Convection Ternary Hybrid Nanofluid Flow in a Duct Subjected to a Fluctuating Temperature

Aicha Bouhezza[1] **and Ammar Laichi**[2]

[1]*Department of Technology, Technology Faculty, 20 August 1955-Skikda University, Skikda, 21000, Algeria*
[2] *Department of Physics, Faculty of Sciences, University of 20 August 1955 Skikda, 21000, Algeria*
E-mail: Phy_bouhezza@yahoo.fr, a.bouhezza@univ-skikda.dz

Abstract: Numerical investigation of the mixed convection of ternary hybrid nanofluid is carried out in a duct subjected to a fluctuating temperature. The governing equations with boundary conditions are discretized using finite volume method (FVM). A code is developed based on SIMPLER and TDMA algorithms. Computations are carried out for both aiding and opposing flows, different Richardson numbers, different nanoparticle mean diameter and different nanoparticle volume fraction .

Keywords: Finite Volume Method, Differential Equations, Mixed Convection, Ternary Hybrid Nanofluid.

Modeling of fatigue crack growth by special mathematical function: Exponential function

Mustapha Benachour, Nadjia Benachour, F.Z. Seriari

Mechanical Systems & Materials Engineering Laboratory, Dpt of Mechanical Engineering Faculty of Technology, University of Tlemcen, BP 230, 13000, Tlemcen, Algeria
E-mail: bmf_12002@yahoo.fr, nbenachour2005@yahoo.fr and fsdoctorat@gmail.com

Abstract: In the present study an attempt has been made to evaluate the fatigue crack growth in V-notch Charpy specimens in four point bending tests of 2024 T351 Al-alloy. For this reason, new fatigue crack growth model is developed based on "Exponential function" under constant amplitude loading. The exponential model depends principally on physical parameters and materials properties in non-dimensional form. The validation of the performance of the mathematical model of fatigue crack growth is ensured by evaluation of deviation percentage, band error and prediction ratio. The fatigue crack growth rates results determined from exponential model are in good agreement with experimental fatigue crack growth rates and those obtained by Paris law. Also fatigue lives curves show that fatigue life depends on stress ratio and the amplitude of the applied stress.

Keywords: Special function, exponential function, fatigue crack growth model

References

[1] U, Zerbst., .C,Klinger. "Material defects as cause for the fatigue failure of metallic components". International Journal of Fatigue, Volume 127,(2019) 312-323.

[2] J Shan, Z Wei, Li Xiaoyang., S., Fuqiang. "An analytical model for fatigue crack propagation prediction with overload effect". Hindawi Publishing Corporation Mathematical Problems in Engineering, Volume (2014).

[3] P.Paris, F.Erdogan.. "A critical analysis of crack Propagation law". J. Basic. Engng; 85 (1963) 528-34.

[4] R.I.Amaro, N. Rustagi.,K.O Findley, E.S Drexler, A.J Slifka.. Modeling the fatigue crack growth of X100 pipeline steel in gaseous hydrogen". International Journal of Fatigue, 59 (2014), 262–271. https://doi.org/10.1016/j.ijfatigue.2013.08.010.

[5] A,De Iorio, M. Grasso,F. Penta, and G. Pucillo "A three-parameter model for fatigue crack growth data analysis", Frattura ed Integrità Strutturale, 6(21) (2012). 21–29.

[6] M.Grasso, F.Penta, P. Pinto, and G. Pucillo, "A four-parameters model for fatigue crack growth data analysis", Frattura ed Integrità Strutturale, 7(26) (2013), 69–79. https://doi.org/ 10.3221/IGF-ESIS.26.08.

[7] JR Mohanty, BB Verma, PK Ray. "Prediction of fatigue life with interspersed mode-I and mixed-mode (I and II) overloads by an exponential model: Extensions and improvements". Engineering Fracture Mechanics 76 (2009), 454-468.

[8] C Boris,"Introduction à l'analyse complexe" book Tome 1 "fonctions d'une variable". (1990).

[9] P.Heuler, W.Schuetz, , Z.Werkstofftech, , "Assessment of concepts for fatigue crack initiation and propagation life prediction,", vol. 17(1986),397-405.

Maintenance efficiency assessment in virtual age reduction models

Radouane Laggoune and El Hassene Ait Mokhtar and Farid Zeffane

Université de Bejaia, Faculté Technologie, Unité de Recherche LaMOS, 06000 Bejaia, Algérie
E-mail: redouane.laggoune@univ-bejaia.dz and Elhassene.aitmokhtar@univ-bejaia.dz and farid.zeffane@ft.univ-bejaia.dz

Abstract: When we aim to avoid failures and improve the performance of industrial systems, we usually use preventive maintenance (PM). To establish appropriate PM models well describing the operational behavior of repairable systems, we need to know and integrate the imperfect maintenance parameters, which express the impact of the maintenance actions on the system state (reliability) [1, 2]. However, it is hard to quantify this impact, this difficulty is due to several facts such as unavailability or/and imprecision data, hardness and/or time-consuming computation procedures [3]. In the present work, to take into account the effect of preventive and corrective maintenance on the system reliability, we used the virtual age concept [4], and several assumptions are investigated to assess the imperfect maintenance parameters using the software tool MARS [5]. Among all the hypotheses explored, the most realistic is chosen. A numerical example is provided to illustrate the effectiveness of the approach.

Keywords: Repairable systems, Imperfect maintenance, Virtual age, Assessment.

References

[1] L. Doyen and O. Gaudouin,"Classes of imperfect repairs models based on reduction of failure intensity or virtual age", Reliability Engineering & System Safety, 84(1), pp. 45-56, 2004.

[2] M. Brown and F. Proshan,"Imperfect repair", Journal of applied probability, 20, pp. 851-859, 1983.

[3] E.H. Ait Mokhtar and R. Laggoune and A. Chateauneuf, " Imperfect maintenance modeling and assessment of repairable multi-component systems", Reliability Engineering & System Safety, 234, pp. 109189, 2023.

[4] M. Kijima,"Some reults for repairable systems with general repair", Journal of applied probability, 26(9), pp. 89-102, 1989.

[5] E. Remy and M.A. Gamero and V. Verrier and L. Doyen and O. Gaudouin, "MARS: a software tool for maintenance assessment of repairable systems", 16ème Congrès de Maîtrise des Risques et de Sûreté de Fonctionnement, Avignon, France, 2008.

Study of The Impact of Lubricating Oil Additives on The Reduction The Effects of Solid Pollution on The Stability of The Rotor-Bearing System

Hamid Boucherit, Mustapha Lahmar, Mouassa Ahcene

1Laboratory of Mechanics and Structures (LMS), University 8 May 1945, Guelma, Algeria
E-mail: bouchrit_f@yahoo.fr

Abstract: The theoretical and numerical study proposed, aims to predict the effects of additives (polymers) improving the quality of lubricant oils on the linear dynamic behavior of hydrodynamic bearings lubricated by oils polluted by solid particles (lubricant polluted or contaminated by solid particles due to wear of the contact surfaces). The presence of the additives in lubricant oils makes the rheological behavior of the lubricant non-Newtonian. The study of the flow of these types of fluids is based on the application of the theory of continuum theory of Vijay Kumar Stokes. Ball and Richmond's simple model is retained to take into account the presence of pollution due to the existence of solid particles in lubricating oils. The perturbation method is used for prediction of the eight dynamic coefficients of stiffness and damping of the rotor-bearing system. The modified Reynolds equation is transformed into a system of three second-order partial differential equations. The equations of the system are discretized by the method of centered finite differences. The system of algebraic equations obtained is solved using an iterative Gauss-Seidel process with over-relaxation coefficient. The parametric study showed in evidence on the one hand the presence of solid pollution in lubricant oil makes it to increase the pressure peak in the lubricating film of the journal bearing and to significantly reduce the stability of the rotor-bearing system compared to the journal bearing lubricated by clean fluid no additive (no polluted). On the other hand, the addition of additives improving the quality of lubricant oils significantly reduces the effects of the presence of solid pollution on the stability of the rotor-bearing system of rotating machines.

Keywords: Polluted lubricant oils, Additives oils, Hydrodynamic journal bearings, V.K Stokes Theory, Modified Reynolds Equation.

Application of Three Exact Solution Methods on the (3+1)-dimensional Boiti-Leon-Manna-Pempinelli Equation

Tugba Aydemir

Yalova University, Dept. of International Trade and Finance, Yalova, Turkey
E-mail: tgb.aydemir@yalova.edu.tr

Abstract: In this study, we consider the following (3+1)-dimensional Boiti-Leon-Manna-Pempinelli (BLMP) equation via three diverse exact solution methods. The mathematical form of the BLMP equation as a class of KdV-type equation is given as follows:

$$u_{yt} + u_{zt} + u_{xxxy} + u_{xxxz} - 3u_x(u_{xy} + u_{xz}) - 3u_{xx}(u_y + u_{(z)}) = 0,$$

which models wave propagations in compressible fluid. The BLMP equation and its various forms have attracted great interest in recent years due to its emerging applications in fluid dynamics. The main goal of this study is to obtain new exact solutions in more general forms with free parameters including hyperbolic, trigonometric and rational function solutions. Besides, considering applications of the BLMP equation on real world problems in compressible fluid, some 2D and 3D graphs are plotted to show the dynamical characteristics of some selected exact solutions.

Keywords: Boiti-Leon-Manna-Pempinelli equation, The Generalized Unified Method, The Modified Extended tanh Method, The G'/G-expansion Method, Exact Solution Method.

Mathematics Subject Classification: 35B08, 76B15

References

[1] Boiti, M., Leon, J. P., Manna, M., Pempinelli, F. (1986). On the spectral transform of a Korteweg-de Vries equation in two spatial dimensions. Inverse problems, 2(3), 271.

[2] Boiti, M., Leon, J. P., & Pempinelli, F. (1987). Integrable two-dimensional generalisation of the sine-and sinh-Gordon equations. Inverse Problems, 3(1), 37.

[3] Darvishi, M. T. A., Najafi, M., Kavitha, L. C., Venkatesh, M. C. (2012). Stair and step soliton solutions of the integrable (2+ 1) and (3+ 1)-dimensional Boiti—Leon—Manna—Pempinelli equations. Communications in Theoretical Physics, 58(6), 785.

[4] Liu, J. G., Du, J. Q., Zeng, Z. F., Nie, B. (2017). New three-wave solutions for the (3+ 1)-dimensional Boiti–Leon–Manna–Pempinelli equation. Nonlinear Dynamics, 88, 655-661.

[5] Li, B. Q., Ma, Y. L. (2018). Multiple-lump waves for a (3+ 1)-dimensional Boiti–Leon–Manna–Pempinelli equation arising from incompressible fluid. Computers & Mathematics with Applications, 76(1), 204-214.

[6] Wazwaz, A. M. (2020). Painlevé analysis for Boiti–Leon–Manna–Pempinelli equation of higher dimensions with time-dependent coefficients: multiple soliton solutions. Physics Letters A, 384(16), 126310.

A Review of Stochastic Population Dynamics Models

Lallouche Abdallah

Department of mathematics, University of SKIKDA, ALGERIA
E-mail: a.lallouche@univ-skikda.dz

Abstract: The dynamics of a population and its response to environmental change depend on the balance of birth, death and age-at-maturity, and there have been many attempts to mathematically model populations based on these characteristics. Stochastic population dynamics studies the evolution of a given population in time under the effect of randomness. Recently, there has been great interest in studying the stochastic Population Dynamics Models , one of the reasons for this is a necessity for some techniques which can be used in investigating equations arising in mathematical models describing real life situations in population biology, genetics, psychology and so forth. The goal of this paper is to review about the dynamical behavior of the positive solutions of the systems of difference equations. The present study gives review of recent studies and developments to this subject will be provided, in particular about the long term behaviour of such models such as the probability of extinction or stability of the population.

Keywords: – differential equations –stochastic perturbation, asymptotic behavior, approximation, Population dynamics.

References

[1] McKendrick, A. G. (1925). Applications of mathematics to medical problems. Proceedings of the Edinburgh Mathematical Society, 44, 98–130

[2] Nagylaki, T. (2013). Introduction to theoretical population genetics. Biomathematics. SpringerShen, M. , Peng, Z. , Xiao, Y. , & Zhang, L. (2020). Modeling the epidemic trend of the 2019 novel coronavirus outbreak in China. The Innovation, 1(3), 100048.

[3] Khasminskii, R. (2012) . Stochastic stability of differential equations. Springer.

[4] Lande, R. , Engen, S. , & Sæther, B.-E. (2003). Stochastic population dynamics in ecology and conservation. Oxford series in ecology and evolution. Oxford University Press

Access to valuable building blocks by the regio-and enantioselective ring opening of itaconic anhydride by lipase catalysis

Nabila Braia, F.Z. Smaine and M. Merabet-Khelassi

Ecocompatible Asymmetric Catalysis Laboratory.(LCAE) Badji Mokhtar Annaba-University. B.P 12, 23000 ANNABA, ALGERIA
E-mail: nabilabraia@gmail.com

Abstract: Herein, we report for the first time the highly regio- and enantioselective ring opening of a biobased itaconic anhydride catalyzed by the Pseudomonas cepacia lipase (PCL) in tert-butyl methyl ether (TBME) at room temperature. This method is easy, efficient and eco-friendly and can be performed in one step with a series of highly valuable monoester itaconates using various alcohols as nucleophiles with 100% atom economy. In all cases, the β-monoester isomer was the predominant product of the reaction. Using achiral primary alcohols as substrates, a variety of novel itaconates were obtained in moderate to excellent yields (50–90%). For select examples, product characterization was carried out using X-ray diffraction, in addition to the standard techniques.

References

[1] O. V. Kharissova, B. I. Kharisov, C. M. Oliva González, Y. P. Méndez and I. López, R. Soc. Open Sci., 2019, 6(11), 191378.

[2] P. T. Anastas and J. C. Warner, Principles of green chemistry, in Green chemistry: theory and practice, ed. P. Anastas and J. Warner, Oxford University Press, Oxford, UK, 1998, pp. 29–56.

[3] (a) S. R. O. Weastra, Determination of market potential for selected platform chemicals—itaconic acid, succinic adis, 2, 5-furandicarboxylicacid,Bratislava,Slovakia,2016; (b) T. Willke and K. D. Vorlop, Appl. Microbiol. Biotechnol., 2001, 56, 289–295. 4. M. Okabe, D. Lies, S. Kanamasa and E. Y. Park, Appl. Microbiol. Biotechnol., 2009, 84, 597.

[4] (a) J. C. de Carvalho, Al. Magalhaes and C. R. Soccol, Chem. Today, 2018, 36, 56–58; (b) J. C. da Cruz, A. M. de Castro and E. F. C. Servulo, 3 Biotech., 2018, 8(3), 138.

[5] I. Bassanini, K. Hult and S. Riva, Beilstein J. Org. Chem., 2015, 11(1), 1583–1595.

[6] R. A. Sheldon, Green Biocatalysis, in Biocatalysis and green chemistry, ed. R. N. Patel, Wiley online library, 2011, ch. 1, pp. 1–15.

Study and tribological analysis of the mechanical behavior of a hydrodynamic bearing

Soumia Teyar, Hassina Gheribi

Department of Mechanical Engineering, Faculty of Technology, University 20 Août 1955-Skikda, Skikda 21000, Algeria
E-mail: s.teyar@univ-skikda.dz, h.gheribi@univ-skikda.dz

Abstract: The hydrodynamic bearings are organs supporting and guiding in rotation the most used in many industrial machines. Their main role is to support a radial or axial load. They allow to reduce the friction, increase efficiency and improve the durability of mechanical equipment. Severe conditions applied to the level of operating temperature, the thickness of the fluid film, serves to the birth of probable problems at an early stage which become by the time major failures. In order to understand the origin of defects in these bearings, tribological analysis is one of the techniques followed wich inables to study and solve problems related to friction, wear and lubrication of the surfaces in contact. It plays a crucial role in ensuring their proper functioning and improving their performance. In this context, the objective of this work is focused on the tribological analysis of the mechanical behavior of a hydrodynamic thrust bearing with oscillating pads. Different parameters are studied such as: the flash point of the lubricant, the viscosity, the rotation velocity and the applied load. The results obtained illustrate that these parameters are important factors in the analysis of the faults of these thrust bearings to ensure the conditions of correct operation.

Keywords: Tribological analysis, Wear, Friction, Hydrodynamic bearing with oscillating pads , Flash point of lubricant.

Study of the tribological behavior of a plain bearing

Gheribi Hassina, Teyar Soumia

Department of Mechanical Engineering, University August 20, 1955 of Skikda, BP 26, Skikda 21000, Algeria
E-mail: h.gheribi@univ-skikda.dz

Abstract: Bearings are tribological components that support a load and allow relative movement between two elements. Their performance is directly linked to the quality of the materials, the geometric design and the tribological conditions, which govern their mechanical behavior. Increasing the rotational speed can generate more heat due to friction between the shaft and the bearing. This can cause an increase in local temperature, which in turn can reduce lubricant viscosity and increase friction torque. In this context, the present work is interested in studying the influence of tribological parameters on the mechanical behavior of a plain bearing in order to quickly and accurately detect possible defects.

Keywords: Tribology, wear, friction, lubricant, bearing.

Study and analysis of diesel engine performance

C. Boubechou1, A. Bouchoucha2, H. Zaidi3

[1] *Faculty of Technology, Department of Mechanical Engineering, University of 20 August 1955, Skikda 21000, Algeria, e-mail:choubeila_boubechou@yahoo.fr*

[2] *Laboratory of Mechanics, Faculty of Sciences of Technology, Department of Mechanics Engineering, Constantine University1, 25000, Algeria, e-mail: bouchoucha_ali1@yahoo.fr*

[3] *Pprime Institute UPR3346-IUT, University of Poitiers, Futuroscope, F-86960, Poitiers, France.*

E-mail: choubeila_boubechou@yahoo.fr, bouchoucha_ali1@yahoo.fr

Abstract: The main objective of this work is to study and analyze the effect of certain technical and geometric parameters (injection advance and duration, engine speed and piston crown design) on the performance of diesel engines, in particular the 1.9 TDI ALH diesel engine, using a Diesel-RK calculation code. It is essential to know the dimensional characteristics, geometric properties of the combustion chamber, injector design, orientation and diameter of the holes and the composition of PM particles and NOx nitrogen oxides under different conditions, so that they can be used safely and effectively in practical installations. However, numerical calculation may be the most suitable solution, given the progress made in the field of computing and modeling. The results obtained show that the above-mentioned parameters have a significant influence on engine behavior, and had a noticeable effect on performance and the reduction of pollutant emissions.

Keywords: Diesel engine, Performance, Diesel-RK software, Injection advance, Injection duration, Engine speed, Piston crown design, Pollutant emissions, Combustion chamber.

Data analysis of the contribution of the spark plasma sintering (SPS) technique into the optimization of the mechanical properties of certain titanium alloys

Settouti Nadera and Liani Bachir

Abou Bekr BELKAID Tlemcen University, Dept. of Physics, 13000, Tlemcen, Algeria
E-mail: nadera_settouti@yahoo.fr

Abstract: The aim of this study is to investigate and evaluate the impact of the spark plasma sintering (SPS) technique on enhancing the mechanical properties of specific titanium alloys (such as Ti-Al, Ti-Mo, etc.). This will be achieved by employing data mining and multivariate analysis techniques to identify correlations and similarities among the mechanical properties of these alloys. The ultimate goal is to demonstrate the role of the SPS technique in optimizing the properties of these alloys.

Keywords: Data mining; multivariate analysis techniques; Spark plasma sintering (SPS); Titanium alloys.

References

[1] N. Settouti, H. Aourag, "A Comparative Study of the Physical and Mechanical Properties of Hydrogen Using Data Mining Research Techniques", JOM, Vol. 67, No. 9, 2015. DOI: 10.1007/s11837-015-1545-y.

[2] Dhansay Nur Mohamed, Tai Robert, Becker Thorsten, Fatigue and Fracture Toughness of Ti-6Al-4V Titanium Alloy Manufactured by Selective Laser Melting, Advanced Materials Research Vol. 1019 (2014) pp 248-253.

[3] G. Malakondaiah* and T. Nicholas, on the increase in young's modulus of Ti-24Al-11Nb alloy as result of hold time during low cycle fatique at 650 °C, Scripta Mctallurgica et Materialia, Vol. 3 I, No. I, pp. 9-14, 1994.

[4] Li Kuang, Hanyu Hu, Shule Xiang, Hui Zhang, Guangnan Liu, Rui Tai,Lingyun Wang, Yu Sheng, Social network and related factors in older people with sensory impairment in the community: Using principal component analysis, L. Kuang et al. / Geriatric Nursing 57(2024) 109-116. https://doi.org/10.1016/j.gerinurse.2024.04.007.

Modeling Wheat Evapotranspiration in Semi-Arid Regions Using Satellite Remote Sensing

Tarek Bouregaa

Plant and animal improvement production laboratory Department of agronomy, Faculty of nature and life sciences, University Ferhat Abbas, Sétif1, Algeria
E-mail: ibnziad_1983@hotmail.com

Abstract: Recent research has highlighted the potential of remote sensing for retrieving crop water requirements through mathematical modeling and analysis of vegetation indices. This study investigates the application of linear regression models to estimate wheat evapotranspiration in the semi-arid Setif region of Algeria, contributing to the understanding of data-driven dynamical systems in agricultural contexts. Utilizing Sentinel 2 data, we derived vegetation indices (NDVI, NDRE, MSAVI, ReCI, NDMI) and analyzed their relationship with evapotranspiration values obtained from a smartphone application through linear regression analysis. Results revealed strong correlations between the indices and crop water requirements, particularly during the January-March period (R^2 values exceeding 0.9 for several indices), with corresponding root mean square error (RMSE) values as low as 1.68 mm/decade. These findings demonstrate the efficacy of satellite remote sensing and vegetation indices, coupled with linear regression techniques, for modeling and estimating crop water needs in semi-arid environments.

Keywords: Remote sensing, semi-arid, linear regression, wheat, evapotranspiration, vegetation indices

References

[1] Allen, R. G., Pereira, L. S., Raes, D., & Smith, M. (1998). Crop evapotranspiration-Guidelines for computing crop water requirements-FAO Irrigation and drainage paper 56. Food and Agriculture Organization of the United Nations, Rome, 300(9), D05109.

[2] Jensen, J. R. (2007). Remote sensing of the environment: An Earth resource perspective. Pearson Prentice Hall.

On the solutions of an abstract system of difference equations

Imane Dekkar

LMAM Laboratory and Department of Mathematics, Mohamed Seddik Ben Yahia University, Jijel, Algeria,
E-mail: imane_dek@hotmail.fr, dekkar.imane@univ-jijel.dz

Abstract: Our main objective in this work is to give and study the solutions of a rational system of difference equations on the complex domain. Then, we present some results for an abstract system of difference equations defined by one-to-one continuous functions.

Keywords: Systems of difference equations, closed form, periodicity.

Mathematics Subject Classification: 39A05, 39A06, 39A10, 39A23, 39A45.

References

[1] I. Dekkar, N. Touafek," Existence and global attractivity of periodic solutions in a max-type system of difference equations", Turk. J. Math., 41, 412-425 (2017).

[2] I. Dekkar, N. Touafek, I. Yalcinkaya, M.B. Almatrafi, "Explicit formulas for the solutions of a system of difference equations of fourth order in the complex domain", Math. Eng. Sci. Aerosp., 14(2), 931-959 (2023).

[3] S. Elaydi, "An introduction to difference equations, undergraduate texts in mathematics", 3rd edition, Springer, New York, USA, 2005

[4] E. A. Grove, G. Ladas, "Periodicities in nonlinear difference equations", Chapman & Hall/CRC, 2005.

[5] H. Hmioud, I. Dekkar, N. Touafek, "Solvability of a third-order system on nonlinear difference equations via a generalized Fibonacci sequence", Miskolc Math. Notes, 2023, Accepted

Influence of glass addition on the crystallization kinetics of spinel in porcelain insulators prepared from economic raw materials

Hocine Belhouchet

Physics Department, Facultu of Sciences, University of M'sila, P.O. Box 166 Ichbilia, 28000, M'sila, Algeria.
E-mail: hocine.belhouchet@univ-msila.dz

Abstract: In this work, we studied the kinetics of spinel (Al-Si) crystallization from Algerian kaolinite (DD2) in different mixtures under non-isothermal conditions using DTA. Although many mathematical equations were proposed for the calculation, the Johnson-Mehl-Avrami (JMA) equation and Kissinger method are the most commonly used. Four compositions marked as N00, G10, G20, and G30, corresponding to 0, 10, 20, and 30 wt% of glass, were fabricated and studied. Recycled waste glass was added to kaolin and quartz to partially replace potash feldspar for the prepared white porcelain. The DTA conducted at heating rates of 2, 5, 10, and 15 °C/min showed an exothermic peak in all compositions at about 950 °C associated with spinel crystallization. This crystallization temperature decreased slightly with increasing glass content. The activation energies measured from non-isothermal treatments for four compositions: 00, 10, 20, and 30 wt% of glass, were, 694, 684, 615, and 498 kJ/mol, respectively. The activation energy decreases with the increase in glass percentage. The n values (Avrami parameter) obtained for all compositions are about 2, the spinel crystallization of these composites is followed by three-dimensional growth (controlled by diffusion).

References

[1] Hocine Belhouchet, Mohamed Hamidouche, Neureddine Bouaouadja, Vincent Garnier, Gilbert Fantozzi, "Kinetics of mullite formation in zircon and boehmite mixture", Ann. Chim. Sci. mat., 35 (1), 17-25, 2010.

[2] Hocine Belhouchet, Mohamed Hamidouche, Ramon Torrecillas, Gilbert Fantozzi, "The non-isothermal kinetics of mullite formation in boehmite–zircon mixtures", J. Therm. Anal. Calorim., 116, pp. 795-803, 2014.

[3] Foudil Sahnoune, Menad Heraiz, Hocine Belhouchet, Nouari Saheb, Djaida Redaoui, "Thermal Decomposition Kinetics of Algerian Tamazarte Kaolin by Differential Thermal Analysis (DTA)", Acta Physica Polonica A., 131 (3), pp. 382-385, 2017.

[4] Foudil Sahnoune, Djaida Redaoui, Messouad Fatmi, "Kinetic parameters of Al–Si spinel crystallization from Algerian tamazarte kaolin", High. Temp. High. Press., 46, pp. 497-508, 2017.

[5] Smail Lamara, Foudil Sahnoune, Nouari Saheb, Djaida Redaoui, Khadidja Laziri, "Kinetics of mullitization from sol-gel synthesized precursors", J. Indian Chem. Soc., 99 (6), pp. 100473, 2022.

Synthesis and characterization of GNP/Fe3O4 catalyst: Application for the removal of Crystal Violet dye

Hassan Ayadia[1,2], Mohamed Amine Benaouida[1,2], Issam Boudraa[2,3], and Sabrina Halladja[1,4]

[1] *University of 20 Août 1955-SKIKDA, Department of chemistry, 21000, Skikda, Algeria*
[2] *Constantine1 University, Research Unit of Environmental Chemistry and Structural Molecular, 25000, Constantine, Algeria*
[3] *École Nationale polytechnique de Constantine, Laboratoire de technologie des matériaux avancés, 25000, Constantine, Algérie*
[4] *University of 20 Août 1955-Skikda, Laboratory of Anticorrosion-Materials, Environment and Structures, 21000, Skikda, Algeria*
E-mail: ayahadz@yahoo.fr

Abstract: The aim of this work is to synthesize and characterize a composite material based on graphene nanoplatelets and magnetite (GNP/Fe_3O_4), for application in the photocatalytic degradation of the basic crystal violet (CV) dye. The GNP/Fe_3O_4 nanocomposites were prepared by the co-precipitation method. Then GNP/Fe_3O_4 catalyst was characterized by x-ray diffraction and Raman spectroscopy. The results confirm the success of the synthesis and the functionalization of the surface of GNP by iron oxide (Fe_3O_4).
The effect of the GNP/Fe_3O_4 catalyst on the degradation of the crystal violet dye by the heterogeneous photo-Fenton process was investigated. The influence of certain systems was verified and compared, according to the degradation and the rate constant.
Compared to the other systems, the CV/GNP/Fe_3O_4/H_2O_2 system showed a very high degradation rate (Over 70%) and rate constant was 6.71×10^{-3} min^{-1}, during 180 min at room temperature and an acidic pH (2.5). These results reveal the importance of the GNP/Fe_3O_4 catalyst in the treatment of water by the heterogeneous photo-Fenton process, and show the possibility of its use even at industrial scale.

Keywords: Nanocomposite; Crystal violet; heterogeneous photo-Fenton;degradation.

References

[1] Hassan Ayadi, Ammar Khaled, Sabrina Halladja, Issam Boudraa, Zehoua Rehimi, Mohamed M. Chehimi, Fe3O4/MMT Fenton-like heterogeneous catalyst for the methylene blue degradation, Desalination and Water Treatment, : 260, (2022), 179 -186.

[2] A. Bonilla-Petriciolet, D.I. Mendoza-Castillo, H.E. Reynel-Ávila, Adsorption Processes for Water Treatment and Purification, Springer International Publishing, Cham, Switzerland, 2017.

Some classical theorems of factorizations in the sublinear case

Tiaiba Abdelmoumen

Department of Physics, Mohamed Boudiaf University of (M'sila), Algeria
E-mail: abdelmoumen.tiaiba@univ-msila.dz

Abstract: This participation is part of the development of some theorems of factorizations in the sublinear case. Many problems in commutative analysis involve the principle of factorization, in other word summing operators in all its dimensions. The tudies in this field have given rise to a rich and vast literature that will be cited in our work as we go along.

Keywords: Banach space, Factorization theorem, sublinear operator.

Mathematics Subject Classification: 46B25, 46B28, 46B42

References

[1] D. Achour and L. Mezrag, Little Grothendieck's theorem for sublinear operators, J. Math. Anal. Appl. 296 (2004), 541-552.

[2] D. Achour, L. Mezrag and A. Tiaiba, On the strongly p-summing sublinear operators,Taiwanesse J. Math. 11 (2007), no. 4.

[3] D. Blecher, The standard dual of an operator space, Pacific J. Math. 153 (1992), 15-30.

[4] D. Blecher, The standard dual of an operator space, Pacific J. Math. 153 (1992), 15-30.

Computational studies of Electronic, optical and elastic properties of half-Heusler SrMgA (A= Si, Sn) Compounds for optoelectronic applications

S. Djellab[1,2], L. Tairi[1,3], S. Ghemid[1], H Meradji[1]

[1] *LPR Laboratory, Department of Physics, Badji Mokhtar University, Annaba, Algeria.*
[2] *Physics department, Faculty of Sciences, Skikda University , Algeria.*
[3]*Research Center in Industrial Technologies CRTI, P.O. Box 64, Cheraga 16014 Algiers, Algeria.*
E-mail: s.djellab@univ-skikda.dz, djellab_sihem@yahoo.fr

Abstract: The development and optimization of optoelectronic devices depends on the availability of suitable semiconductor materials. During the last years, many researches have been devoted to multinary compounds such as Half-Heusler that comprise a large number of semiconductors characterized by a large variation in the energy interval of their bandgap. This variation in energy bandgap allows for many applications in optoelectronics.
In general, the half-Heusler materials with eight valence electrons can be II-VI, I-II-V, I-III-IV, II-II-IV, and III-II-III type.
Among these materials, we have studied SrMgA (A= Si, Sn) compounds to highlight their physical properties. SrMgA (A= Si, Sn) are II-II-IV compounds that crystallize in a structure space group F-43m (no. 216), and the structure is made up of 4 distinct face-centered cubic (fcc) sublattice where the Sr atom is located at (0, 0, 0), the Mg atom at (½, ½, ½) and the A atom at (¼, ¼, ¼).
In order to perform the structural optimization, we used the generalized gradient approximation (GGA) of DFT introduced by Perdew, Burke, and Ernzerhof (PBE). With the optimized lattice constant, the electronic, optical and elastic properties were subsequently determined.

Keywords: DFT, Half-Heusler, semiconductors, optical properties, elastic properties.

Smart control of photovoltaic system with batteries in a standalone area

Djamila Rekioua[1], Saloua Belaid[1], Toufik Rekioua[1], Pierre Olivier Logerais[2], Zahra mokrani[1], Adel Oubelaid[1], and Khoudir Kakouche[1]

[1] *Université de Bejaia, Faculté de Technologie, Laboratoire de Technologie Industrielle et de l'information (LTII), 06000 Bejaia, Algérie*

[2] *Univ. Paris-Est, CERTES, IUT de Sénart-Fontainebleau, Lieusaint, France*

E-mail: djamila.ziani@univ-bejaia.dz

Abstract: The subject of our study is the optimization and smart control of an isolated photovoltaic system. To achieve this, a power management control (PMC) is used. It is based on fuzzy logic control with specific decision criteria aided in the control of the studied system. The key decision factors for a PMC strategy are the power level provided by the PV generator and the state of charge of the batteries (SOC). The use of the management allows producing maximum power from the PV generator, protecting the batteries against overcharge, and deep discharge and satisfying the energy needs [14-24]. Depending on the different tests, the system operates in one of the following modes. The principle of the fuzzy logic controller is to generate four control signals, K_1, K_2, and K_3, from four inputs: charging power P_{Load}, ΔP: excess power, battery state of charge SOC, and photovoltaic generator power PPV. Hence the output signals are: K_1: Control signal for the switch supplying the load with PV power, K_2: control signal for the switch that charges the battery with phototovoltaic power, K_3: control signal for the switch that supplies the load, and battery. Through the application of the PMC, the batteries were protected from deep discharges and overloads, ensuring uninterrupted power supply to the load. The studied system is composed of PV panels and batteries interconnected with a bidirectional converter enabling the bi-directional flow of current. This feature facilitates the charging and discharging of the batteries various under meteorological conditions. Two different algorithms have been used for power optimization. The simulation results demonstrate the superior performance of the proposed power management approach utilizing the fuzzy logic control method. These findings were consistent across two diverse profiles, underscoring the efficacy of our approach in diverse operating conditions.

References

[1] L. Gómez, J. C.; De León Aldaco, S.E.; A. Alquicira, J., "A Review of Hybrid Renewable Energy Systems: Architectures, Battery Systems, and Optimization Techniques," Eng, 4, pp.1446-1467, 2023.

[2] P. Roy, J. He, T. Zhao, Y.V. Singh, "Recent Advances of Wind-Solar Hybrid Renewable Energy Systems for Power Generation: A Review," IEEE Open J. Ind. Electron. Soc. 3, pp.81–104, 2022.

[3] D. Rekioua, "Energy Storage Systems for Photovoltaic and Wind Systems: A Review", Energies, 16, 3893, 2023.

[4] R.S. Sankarkumar, R. Natarajan, "Energy management techniques and topologies suitable for hybrid energy storage system powered electric vehicles: An overview," Int. Trans. Electr. Energy Syst. 31, e12819, 2021.

[5] J.M. A. Elgendy, B. Zahawi and D. J. Atkinson, "Assessment of Perturb and Observe MPPT Algorithm Implementation Techniques for PV Pumping Applications, " IEEE Transactions on Sustainable Energy, Vol. 3, no. 1, pp. 21-33, 2012.

[6] M. E. Sahin and H. İ. Okumus, "Fuzzy logic controlled buck-boost DC-DC converter for solar energy-battery system," 2011 International Symposium on Innovations in Intelligent Systems and Applications, Istanbul, Turkey, 2011, pp. 394-397.

[7] D Rekioua, T Rekioua, K Idjdarene, A Tounzi, "An approach for the modeling of an autonomous induction generator taking into account the saturation effect, "International Journal of Emerging Electric Power Systems 4 (1), pp.1-10, 2005.

[8] D. Rekioua, E.Matagne, "Modeling of Solar Irradiance and Cells. In: Optimization of Photovoltaic Power Systems," Green Energy and Technology. Springer, London, 2012.

[9] P. N. Krishna, S. R. Gupta, P. V. Shankaranarayanan, S. Sidharth and M. Sirphi, "Fuzzy Logic Based Smart Home Energy Management System," 9th International Conference on Computing, Communication and Networking Technologies, Bengaluru, India, 2018, pp. 1-5

[10] M. B. Smida, A. Sakly, "Fuzzy logic control of a hybrid renewable energy system: A comparative study, "Wind Engineering, Vol.45, no.4, pp.793-806, 2021.

The effect of Covid-19 vaccination on case and mortality rates in Türkiye

Perihan Oya Şengül and Derya Tan

German High School Alumni's Culture and Education Foundation, Alkev Science High School, 34500, İstanbul, Türkiye
E-mail: posengul@gmail.com and derya.tan@alkev.k12.tr

Abstract: The aim is to evaluate the effect of Covid-19 vaccination on case and mortality rates in Turkey. Average case per day before vaccination is 5241. After vaccination, it is 28440. Mortality rate is %1.53 before vaccination, but it is only %0.57 after vaccination. As a result, it can be said that although the huge increase in case numbers because of the mutation of the virus and the increase in the rate of transmission, the mortality number did not increase at the same rate after vaccination. This is the success of the vaccination. If there was no vaccination in Türkiye, and the same mortality rate (%1.53) was valid during the whole dataset period, the total number of mortalities was calculated. In this case, the mortality per day would be 436. In other words, the number of saved people per day due to the vaccination is 273. The total number of saved people during the vaccination period (from 12 February 2021 to 25 April 2022) was 119639. This is a huge number, and this is an enormous success of vaccination.

Keywords: Covid-19, Vaccination, Case rates, Mortality rates, Türkiye

References

[1] Coronavirus disease (COVID-19) – World Health Organization, Who.int., https://www.who.int/emergencies/diseases/novel-coronavirus-2019 [accessed 16 July 2021].

[2] Subasish Das, Anandi Dutta, "Characterizing public emotions and sentiments in COVID-19 environment: A case study of India", Journal of Human Behaviour in the Social Environment, (2021).

[3] WHO Director-General's opening remarks at the media briefing on COVID19 – 11 March 2020, https://reliefweb.int/report/world/who-director-generals-opening-remarks-media-briefing-covid-19-11-march-2020?gclid=Cj0KCQiAwJWdBhCYARIsAJc4idD2 [accessed 23 December 2022].

[4] Ian F. Miller, Alexander D. Becker, Bryan T. Grenfell, Jessica E. Metcalf, "Disease and healthcare burden of COVID-19 in the United States", Nature Medicine, (2020).

[5] Anthony McDonnell, Robert Van Exan, Steve Lloyd, Laura Subramanian, Kalipso Chalkidou et al, "COVID-19 vaccine predictions: using mathematical modelling and expert opinions to estimate timelines and probabilities of success of COVID-19 vaccines", CGD Policy Paper 183. (2020).

[6] T.C. Sağlık Bakanlığı. Genel Koronavirüs Tablosu, (the official web site of the Ministry of Health, Turkey), https://covid19.saglik.gov.tr/TR-66935/genel-koronavirus-tablosu.html [accessed 23 December 2022]

[7] Our World in Data. Coronavirus (COVID-19) Vaccinations, https://ourworldindata.org/covid-vaccinations [accessed 23 December 2022]

Multi-criteria Decision Support for Intelligent Management of Traffic Lights in an Isolated Intersection

F. Rahmoune, S. Larbi and M.S. Radjef

University of Bejaia- Faculty of Exact Sciences- Operational Research Department Research Unit LaMOS- Targa Ouzemmour-Bejaia 06000- Algeria

E-mail: fazia.rahmoune@univ-bejaia.dz, sabiha.larbi@univ-bejaia.dz , mohammedsaid.radjef@univ-bejaia.dz

Abstract: This paper introduces a novel application of two polling systems with non-exhaustive services for traffic light management, namely: the M/M/1 (Binomial Gated Service, Multiple Vacation) and the M/M/1 (Gated Service, Single Vacation). These models are used to simulate traffic signal control at an isolated signalized intersection. The objective of the system controller is to minimize the number of waiting vehicles in each queue for every phase by extending the green light duration for the most congested road. After defining key performance measures for both models, we formulate a corresponding bi-criteria optimization problem for each model to select the most efficient one and determine an optimal traffic light duration plan. To tackle this problem, we employ a genetic algorithm approach, considering various traffic scenarios. This study provides promising insights into smarter and more efficient traffic light management by integrating polling models and multi-objective optimization techniques. These findings contribute to enhancing traffic flow and reducing waiting times at intersections, offering innovative solutions for urban mobility challenges.

Keywords: Polling System, Performance Measures, Multi-objective Optimization, Genetic Algorithm, Smart Traffic Light Management.

References

1. Wang, Y., Zhang, J. and Liu, Y. (2024). “Intelligent Traffic Light Control with Deep Reinforcement Learning for Carbon Emission Reduction.” Journal of Cleaner Production, 334, 130124. 2. Chien, TH and Wei, CC (2024). “Dynamic traffic light control using queuing-based reinforcement learning and game theory.” IEEE Transactions on Intelligent Transportation Systems 3. Li, Y. and Zhang, W. (2023). “Game-theoretic approach to optimize traffic signal control considering waiting times and emissions.” Transportation Research Part C: Emerging Technologies, 139, 103246. 4. Chen, S., Li, L. and Zhou, X. (2023). “Traffic light control based on deep reinforcement learning taking into account environmental factors.” Transportation Research Part C: Emerging Technologies, 137, 103198. 5. Yu, B., Ma, X. and Wang, J. (2022). “A deep learning approach for real-time traffic signal control considering environmental impacts.” Transportation Research, Part D: Transportation and Environment, 104, 102995. 6. Zhang, H. and Mallick, B. (2022). “Queue-based traffic light control with deep reinforcement learning.” Transportation Research Part C: Emerging Technologies, 126, 103273.

Comparison study of two FTCs strategies for double stator induction machines

Toufik Roubache[1,2]

[1]*Msila University, Dept. of Electrical Engineering, 28000, Msila, Algeria LSPIE*
[2]*Batna University, Dept. of Electrical Engineering, 05078, Batna, Algeria*
E-mail: toufik.roubache@univ-msila.dz

Abstract: This study aims to apply the two strategies of active fault tolerant control (FTC) by the sliding mode observer (SMO) and the extended kalman filter (EKF) for direct torque control (DTC) of the double stator induction motor (DSIM) to improve the performance of the machine. To demonstrate the efficacy of the proposed approaches, a comparative analysis was conducted between the two suggested strategies in this paper. Several results prove that the two strategies applied with faults, SMO-FTC and EKF-FTC, improve the robustness and the quality of dynamic responses of the DSIM in closed loop system.

Keywords: Double stator induction motor (DSIM), Direct torque control (DTC), Fault Tolerant Control (FTC), Sliding mode observer (SMO), Extended kalman filter (EKF).

References

[1] S. Guedida, B.Tabbache, K. Nounou, M. Benbouzid, "Direct torque control scheme for less harmonic currents and torque ripples for dual star induction motor", Rev. Roum. Sci. Techn.– Électrotechn. et Énerg. 68(4), pp. 331–338, 2023.

[2] E. Benyoussef, S. Barkat, "Direct torque control based on space vector modulation with balancing strategy of dual star induction motor", Rev. Roum. Sci. Techn.– Électrotechn. et Énerg. 67(1), pp. 15–20, 2022.

[3] A. Gholipour, M. Ghanbari, E. Alibeiki, M. Jannati, "Speed sensorless fault tolerant control of induction motor drives against current sensor fault", Electrical Engineering, 103(4), pp. 1–21, 2021.

[4] Y. Zahraoui, M. Akherraz, S. Elbadaoui, "Improvement of Induction Motor State Observation: Extended Kalman Filter Versus Adaptive Luenberger Observer", WSEAS TRANSACTIONS on SYSTEMS and CONTROL, 15(1), 2020.

[5] A. Azib, D. Ziane, T. Rekioua, A. Tounzi, "Robustness of the direct torque control of double star induction motor in fault condition", Rev. Roum. Sci. Techn.– Électrotechn. et Énerg. 62(1), pp. 147–152, 2016.

[6] A. Raisemche, M. Boukhnifer, C. Larouci, and Demba Diallo,"Two Active Fault-Tolerant Control Schemes of Induction-Motor Drive in EV or HEV", IEEE TRANSACTIONS ON VEHICULAR TECHNOLOGY, 63(1), 2014.

[7] R. Gregor, J. Rodas, "Speed Sensorless Control of Dual Three-Phase Induction Machine based on a Luenberger Observer for Rotor Current Estimation", 38th Annual Conference on IEEE Industrial Electronics Society, Montreal, QC, Canada, pp. 3653-3658, 2012.

Diagnostic of Dual stator winding Induction machine (DSWIM) Based on Mechanical Signatures of Stray Magnetic Flux

Assam Zorig[1], Noureddine. Hamouda[2] ,Khaled Belhouchet[1] Badreddine Babes[2] and Abdelhamid Rabhi[3]

[1] *Laboratory of Electrical Engineering,University of Med Boudiaf M'sila, Algeria.*
[2] *Research Center in Industrial Technologies CRTI, P.O. Box 64, Chéraga 16014 Algiers, Algeria.*
[3] *Laboratory of Modeling, Information and Systems, University of Picardie Jules Verne Amiens, France*
E-mail: assam.zorig@univ-msila.dz

Abstract: Dual stator winding Induction machine (DSWIM) is widely used in industrial and transportation applications which are essential to industrial processes. However, the unreliability and unpredictable life cycles of these machines still present opportunities and challenges for condition monitoring research. A machine breakdown leads to costly repairs and high losses due to downtime. The motivation of this research is to improve the reliability of DSWIM through non-invasive methods for condition monitoring. To monitor and detect these faults at the initial stage, this thesis proposes condition monitoring based on the magnetic stray flux. By studying the interaction between stray flux variations and machine failure, different types of faults can be classified and distinguished through numerical simulation by Finite Element Method simulations (FEM) and Signal Processing Technique (FFT).

Keywords: Induction machine, Finite Element, Stray Flux, DSWIM, FFT, diagnostic.

Multi-coupled circuit modelling to study generator's defects impacts on the power quality in wind energy conversion systems connected to the grid

Radia Abdelli, Ahcene Bouzida, Chafia Serir, Zahra Mokrani, Djamila Rekioua, Talit Belhoul

Université de Bejaia, Faculté de Technologie, Laboratoire de Technologie Industrielle et de l'Information (LTII), 06000 Bejaia, Algérie Department of Electrical Engineering, Faculty of Sciences and Applied Sciences, University of Bouira, Bouira, 10000,Algeria.

E-mail: radia.abdelli@univ-bejaia.dz and a.bouzida@univ-bouira.dz

Abstract: This paper presents a method to study the effect of the broken bars defects of an induction generator used in a wind conversion system. The conventional three-phase model can't be applied to the induction generator's rotor in the case of defect because it can't determine the instantaneous properties of rotor bars. Thus, for introducing the broken information, we apply the Magnetically Coupled Circuits Approach (MCCA) which allows us to show the broken bars effects on the wind conversion performances in order to decide about protecting the system.

Keywords: Induction generator; Broken bars; Rotor defects; Magnetically Coupled Multiple Circuits Approach

References

[1] Fu Q, Yue S, He B, Fu N. Multiple coupled circuit modelling approach for squirrel cage induction machine under single-broken-bar fault with stator winding functions decomposed in d–q rotor reference frame. IET Elect. Power Appl. 2019;13(7):889-900.

[2] Hou Z, Huang J, Liu H, Ye M, Liu Z, Yang J. Diagnosis of broken rotor bar fault in open- and closed-loop controlled wye-connected induction motors using zero-sequence voltage. IET Elect. Power Appl. 2017;11(7):1214-1223.

[3] Martinez J, Belahcen A, Muetze A. Analysis of the vibration magnitude of an induction motor with different numbers of broken bars. IEEE Trans. Ind. Appl. 2017;53(3):2711-2720 .

[4] Climente-Alarcon V, Antonino-Daviu JA, Haavisto A, Arkkio A. Diagnosis of induction motors under varying speed operation by principal slot harmonic tracking. IEEE Trans. Ind. Appl. 2015;51(5):3591-3599.

Mathematical model of a solar photovoltaic system optimized by artificial neural networks

Chafiaa Serir[1], Samia Bensmail[2], Djamila Rekioua[1],Talit Belhoul[3], Zahra Mokrani[1] and Radia Abdelli[1]

[1] *Laboratoire de Technologie, Industrielle et de l'Information, Faculté de Technologie, Université de Bejaia, Bejaia, Algerie*
[2]*Université de Bouira, Faculté de Technologie, Laboratoire LTII, Bouira, Algerie*
[3]*Laboratoire de Génie Électrique, Faculté de Technologie, Université de Bejaia, Bejaia, Algerie*
E-mail: chafiaa.serir@univ-bejaia.dz samia.bensmail@univ-bouira.dz djamila.ziani@univ-bejaia.dz
talit.belhoul@univ-bejaia.dz zahra.mokrani@univ-bejaia.dz radia.abdelli@univ-bejaia.dz

Abstract: Solar energy is a widely used renewable energy source, particularly through photovoltaic (PV) systems for clean electricity generation. This article presents a simplified single-diode mathematical model of photovoltaic cells (PV). This model is built based on nominal specifications provided by manufacturers, such as open-circuit voltage, short-circuit current, as well as voltage and current at the maximum power point. It allows for a more precise representation of the impact of physical variables such as temperature and irradiation. After modeling the photovoltaic panel, the paper explores the application of a robust intelligent technique based on artificial neural networks (ANN) to improve the Maximum Power Point Tracker (MPPT) algorithm of a photovoltaic generator. Simulation results obtained with Matlab/Simulink highlight the importance of this technique in terms of efficiency, robustness, and response time.

Keywords: Galerkin approximation, Photovoltaic, Mathematical Model, MPPT, Artificial Neural Networks.

References

[1] Zheng, Y., Weng, Q., "Modeling the effect of green roof systems and photovoltaic panels for building energysavings to mitigate climate change", Remote Sens, 12-2402, 2020.

[2] Serir, C., Rekioua, D., Mezzai, N., Bacha, S., "Supervisor control and optimization of multi-sources pumping system with battery storage", International Journal of Hydrogen Energy 41(45), 20974-20986, 2016.

[3] Chao, K., H., Rizal, M., N.," A Hybrid MPPT Controller Based on the Genetic Algorithm and Ant Colony Optimization for Photovoltaic Systems under Partially Shaded Conditions", Energies 14-2902, 2021.

[4] Serir, C., Tadjine, K., Bensmail, S., Rekioua, D., Belkaid, A., Hadji, S., Colak, I., "Smart Energy Management Control based on Fuzzy Logic Controller in a Standalone Photovoltaic/Wind System with Battery Storage", Electric Power Components and Systems, ISSN: 1532-5008 print / 1532-5016, https://doi.org/10.1080/15325008.2024.2309631, 2024.

[5] Meghni, B., Ouada, M., Saad, S.," A novel improved variable-step-size P&O MPPT method and effective supervisory controller to extend optimal energy management in hybrid wind turbine", ElectrEng 102, 763–778, 2020.

[6] Serir, C., Rekioua, D., Bensmail, S., Belkaid, A., Tadjine, K., Hadji, S., Colak, I.," Electrification of a Load by a Hybrid Photovoltaic-Wind System with Battery Storage", 2022 11th International Conference on Renewable Energy Research and Application (ICRERA), Istanbul, Turkey, pp. 571-575, 2022.

Eco-friendly synthesis of bi-phase iron oxide nanoparticles: Effect of Geranium Rosat plant extract concentration and their antibacterial activity

Smail Boudjadar[1,2], Leila Boumaza[1], Ouidad Abdelaziz[3]

[1] *Laboratory of Phase transformation, Department of Physics, Faculty of exact sciences, Frères Mentouri University – Constantine 25000, Algeria.*
[2]*Physics mathematics and subatomic physics (PMSP) laboratory, Department of physics, Faculty of exact sciences, Frères Mentouri University – Constantine 25000, Algeria.*
[3]*Department of Microbiology, Faculty of Nature and Life Sciences, Frères Mentouri University – Constantine 25000, Algeria.*
E-mail: boudjadar.smail@umc.edu.dz

Abstract: Iron oxides nanoparticles (IO-Nps) were synthesized through an environmentally friendly and simple process utilizing varying concentrations of Pelargonium graveolens (Geranium rosat) hydrodistilled plant extract as a reducing and capping agent, and iron trichloride hexahydrate as a precursor. The nanoparticles were characterized using X-ray diffraction (XRD), scanning electron microscopy (SEM), energy dispersive X-ray analysis (EDX), Fourier transform infrared spectroscopy (FT-IR), Raman spectroscopy, and ultraviolet-visible analysis (UV-Vis). X-ray diffraction shows the existence of two phases, the stable rhombohedral phase of hematite and the metastable orthorhombic phase of goethite. Heat treatment at 300°C transforms goethite into the more stable hematite phase. The revealed results showed that the crystallite size varied between 12 and 108 nm with an increase in extract plant concentration. Scanning electron microscopy reveals that the nanoparticles exhibit a uniform, agglomerated structure at higher concentrations and a spherical shape at lower concentrations. Quantitative EDX analysis confirms the chemical composition of iron oxide. Chemical analysis using infrared spectroscopy reveals the presence of the Fe-O bond as well as the -OH and C-H bonds of the biomolecules in the extract. Raman spectra show the existence of vibration modes A_1g and E_g of the hematite phase. UV-visible spectroscopy shows two transitions: an indirect one at approximately 1.9 eV and a direct one at around 2.34 eV. The band gap energy is influenced by the size of the grains. The antimicrobial activity was evaluated against Gram-negative (Escherichia coli) and Gram-positive (Staphylococcus aureus) bacteria. The inhibition zone was 16 mm for Escherichia coli and 7 mm for Staphylococcus aureus.

Keywords: Eco-friendly synthesis, geranium rosat, nanoparticles, hematite, goethite, antimicrobial activity.

References

[1] Ramesh Vinayagam, Shraddha Pai, Thivaharan Varadavenkatesan et al, "Structural Characterization of green synthesized α-Fe2O3 nanoparticles using the leaf extract of Spondias dulcis", surfaces and interfaces, 20, 100618, 2020.

[2] Abrar Hussain, Muhammad Yasar et al," Synthesis, characterization, and applications of iron oxide nanoparticles", International Journal of Health Sciences, 17(4), 2023.

[3] P. Adamma Ekwumemgbo, G. A. Shallangwa, I. E. Okon and I. Awodi, "Green Synthesis and Characterization of Iron Oxide Nanoparticles using Prosopis Africana Leaf Extract" Communication in Physical Sciences, 9 (2), pp.125-136, 2023.

Ecological synthesis of copper oxides nanoparticles using Geranium Rosat leaf extract and their antibacterial activity

Leila Boumaza[1], **Ouidad Abdelaziz** [3], **Smail Boudjadar**[1], 2

[1]*Laboratory of Phase transformation, Department of Physics, Faculty of exact sciences, Frères Mentouri University – Constantine 25000, Algeria.*

[2]*Physics mathematics and subatomic physics (PMSP) laboratory, Department of physics, Faculty of exact sciences, Frères Mentouri University – Constantine 25000, Algeria.*

[3]*Department of Microbiology, Faculty of Nature and Life Sciences, Frères Mentouri University – Constantine 25000, Algeria.*

E-mail: boumaza.leila@umc.edu.dz and boudjadar.smail@umc.edu.dz

Abstract: Green synthesis of nanoparticles has become more common in recent years due to its numerous benefits, including simple use, low cost, non-toxic products, friendly to the environment, and easy scaling up for large-scale synthesis. In this study, copper oxide (CuO) NPs were synthesized using a Copper (II) sulfate pentahydrate ($CuSO_4$ $5H_2O$) as a precursor and Geranium Rosat leaves extract as a biosolvent agent. CuO NPs were investigated using several kinds of characterization techniques, including x-ray diffraction (XRD), scanning electron microscopy (SEM), energy-dispersive x-ray spectroscopy (EDX), Raman spectroscopy, Fourier-transform infrared spectroscopy (FTIR) and ultraviolet-visible spectroscopy (UV-Vis). The anti-microbial activity was performed on the gram-positive and gram-negative bacteria. XRD analysis confirms that all biosynthesized copper oxide NPs have a monoclinic crystalline structure of cupric oxide CuO. However, for the very low concentration of plant extract, copper hydroxide Cu(OH)2 appear as a metastable phase. The average crystallite sizes estimated by the Scherrer formula vary between (9.92 and 16.3 nm). In addition, the morphological properties of CuO nanoparticles revealed by SEM characterization shows a flake (like-flakes) and rice (nanorize) shapes. EDX data showed that the product consisted of very pure CuO NPs. The Raman spectra shows the existence of the three optical phonon modes Ag (278 cm-1) and 2Bg (321 and 597.4 cm-1) of the CuO phase. FTIR analysis shows the existence of the Cu-O bond (metal –oxide) additionally to the -OH, aromatic C=C and C-O bonds characteristics of extract biomolecules. The band gap energy changes with the extract concentration variation and has been observed to range between approximately 1.23 and 1.29 eV. The antimicrobial activity of the synthesized nanopowders showed the highest zone of inhibitions for CuO NPs synthesized using 0.025M precursor concentration at 0.1 g/ml leaves extract. The observed values were 1.75 ± 0.01 mm for Gram-negative (Escherichia coli) and 1.5 ± 0.02 mm for Gram-positive (Staphylococcus aureus) bacterial strains.

Keywords: Green synthesis, geranium Rosat, nanoparticles, copper oxides, antibacterial activity.

References

[1] M. Khandelwal, S. Choudhary, Harish, A. Kumawat, K. Prakash Misra, et al, "An Eco-Friendly Synthesis Approach for Enhanced Photocatalytic and Antibacterial Properties of Copper Oxide Nanoparticles Using Coelastrella terrestris Algal Extract", International Journal of Nanomedicine 19, pp, 4137–4162, 2024.

[2] A. Varughese, R. Kaur and P. Singh, "Green Synthesis and Characterization of Copper Oxide Nanoparticles Using Psidium guajava Leaf Extract", IOP Conf. Series: Materials Science and Engineering 961 (012011), 2020.

[3] A. Atri, M. Echabaane, A. Bouzidi, et al, "Green synthesis of copper oxide nanoparticles using Ephedra Alata plant extract and a study of their antifungal, antibacterial activity and photocatalytic performance under sunlight"; Heliyon 9 (2023) e13484.

Generalization of the Method Based on Parameterization Developed for Solving Integer Linear Programming Problems

Kadriye Şimşek Alan

Yildiz Technical University, Dept. of Mathematical Engineering, 34220, Istanbul, Turkey
E-mail: ksimsek@yildiz.edu.tr

Abstract: This study presents the generalization of methods based on parameterization proposed for solving integer programming problems with linear objectives and linear constraints. Initially, the method based on parameterization, proposed for solving 2, 3, and 4-variable integer linear programming problems, is generalized to n-variable integer linear programming problems. The proposed method relies on the parameterization obtained from Diophantine equations. Using this parameterization, the original problem is reformulated as another integer linear programming problem that can be solved more efficiently using simple mathematical programming. The method can be used regardless of the number of constraints of the problem and also provides all alternative solutions to the decision maker. It is demonstrated with some examples that this method provides an efficient algorithm.
This work was supported by Yildiz Technical University Scientific Research Projects Coordination Unit. Project Number: FBA-2021-4032.

References

[1] Gomory, R. E.," Outline of an Algorithm for Integer Solution to Linear Programs", Bulletin of the American Mathematical Society, 64, 275-278, 1958.

[2] Land, A. H.and Doig, A. G An Automatic Method for Solving Discrete Programming problems", Department of Mathematics, Indian Institute of Technology Econnometrica28, 497-520, 1958.

[3] George B. Dantzig G.B." Discrete-variable extremum problems", J. Operations Res. Soc. Amer. Vol.5, no.2 ,1957.

[4] Harry M. Markovitz and Alan S. Manne." On the solution of discrete progming", , Rand Report p-885, June, 1996

[5] A. Schrijver, " Theory of Linear and Integer Programming", John Wiley & Sons Ltd., 1986.

[6] Joseph, A." Parametric formulation of the general integer linear programming problem",22(9), 883-892, 1995.

[7] Pandian, P., Jayalakshmi, M. A.," New Approach for solving a Class of Pure Integer Linear Programming Problems. Journal of Advanced Engineering Technology, 3, 248-251, 2012.

Some Notes on Oscillatory Solutions of Fractional Differential Equations

Aydin Secer[1], Mustafa Bayram[2], Engin Can[3], Hakan Adiguzel[3]

[1] *Yildiz Technical University, Dept. of Mathematical Engineering, 34220, Istanbul, Turkey*
[2] *Biruni University, Dept. of Computer Engineering, 34015, Istanbul, Turkey*
[3] *Sakarya University of Applied Sciences, Dept. of Engineering Fundamental Sciences, 54050, Sakarya, Turkey*
E-mail: asecer@yildiz.edu.tr, mustafabayram@biruni.edu.tr, ecan@subu.edu.tr, hadiguzel@subu.edu.tr

Abstract: This study is dedicated to an investigation of an oscillation problem for the fractional differential equations. For the proposed problem, we construct sufficient conditions for some properties of the solution like positive solutions. Furthermore, through mathematical analysis techniques, we analyze different types of oscillation results. Besides, our main findings are illustrated by some examples.

Keywords: Fractional derivative, Oscillation, Nonoscillation, Differential equations.

Mathematics Subject Classification: 34A08, 34C10

A Novel and Efficient Method for Integer Linear Programming Problems

Kadriye Şimşek Alan

Yildiz Technical University, Dept. of Mathematical Engineering, 34220, Istanbul, Turkey
E-mail: ksimsek@yildiz.edu.tr

Abstract: In this study, an iterative method based on parameterization is developed to solve linear integer programming problems with linear constraints and a linear objective function, and a new efficient and reliable algorithm is presented. There are several methods used for solving LIP problems; however, most of these methods encounter difficulties in terms of computation and timing. In the proposed method, such computational and timing challenges are absent, providing significant advantages for the user. In our method, first, the original LIP problem is transformed into a new LIP problem using parameterization. Then, it is solved sequentially using interval arithmetic, graphical method, and Cartesian product. In this method, which is more better than the branch-and-bound and cutting plane methods, alternative solutions are also defined and presented to the decision-maker.
Numerical examples are provided to demonstrate how the method is implemented and its effectiveness.

References

[1] Alefeld, G., and G. Mayer. “Interval analysis: Theory and applications.”, .” J. Comput. Appl. Math. 121 (1–2): 421–464, 2000.

[2] A. Schrijver, ” Theory of Linear and Integer Programming”, John Wiley & Sons Ltd., 1986.

[3] Bertsimas, D., Perakis., Tayur, G. S “A new algebraic geometry algorithm for integer programming.”, . – Management Science. 46 (7), 999-1008, 2000.

[4] Chen, D. S., Batson, R. G., Dang, Y “.: Applied integer programming: modeling and solution”, John Wiley & Sons, New Jersey, 2011.

[5] Dakin R.J. “A tree search algorithm for mixed integer programming problems. The Computer Journal”;8: 250–255, 1965.

[6] Gomory, R. E.,” Outline of an Algorithm for Integer Solution to Linear Programs”, Bulletin of the American Mathematical Society, 64, 275-278, 1958.

Synthesis, structural analysis of new trans-Pd(O,N)2 complex derived from hydroxo-diazenyl-benzoate azo-ligand

Souheyla Chetioui[1,2,*], **Sihem Menassel**[1,3], **Ilhem Bensehil**[1,4]

[1]*Faculty of Technology. University of M'sila. PO Box 166 Ichebilia, 28000 M'sila, Algeria*// [2]*Research Unit for Chemistry of the Environment and Molecular Structural. University of Constantine 1, Constantine 25000, Algeria* //[3]*Laboratory of Materials and Renewable Energy, Faculty of Sciences, Mohamed Boudiaf University, Algeria*//[4]*Laboratory of Surfaces and Interfaces Studies of Solid Materials, University of Setif 1, Algeria*
E-mail: *Corresponding author: souheyla.chetioui@univ-msila.dz

Abstract: Trans-Pd(O,N)2 with palladium acetate was synthesized by a one-pot procedure using the azo-dye derivative (E)-methyl 2-((2-hydroxynaphthalen-1-yl)diazenyl)benzoate. FT-IR, UV-Vis, and CHN-elemental analysis were used to characterize the complex, which was then modeled using theoretical MEP/MAC/NBA methods. Its structure was determined by x-ray diffraction analysis of a single crystal and further investigated by DFT. Both XRD and DFT show that the deprotonated diazene ligand binds the Pd(II) via the nitrogen atom and the oxygen of the phenolic ionic to form the neutral trans-Pd(O,N)2. The geometry of the trans-Pd(O,N)2 complex is a slightly deformed square-plane. All of the complex's oxygen atoms contribute to hydrogen bonding, resulting in edge-fused rings R22(24) and R22 (12), where chains parallel matrix forms a three-dimensional network. Hirshfeld surface analysis (HSA) revealed several hot points indicating the presence of several nonclassical [C-H....O] hydrogen bonds.

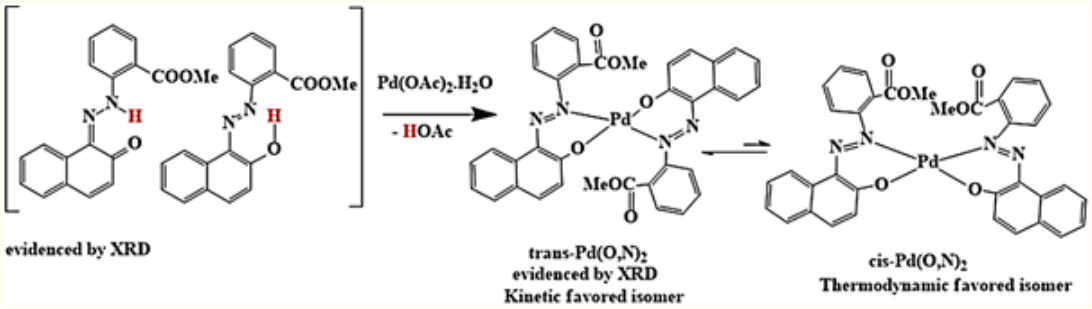

Figure 2: Caption

Keywords: Galerkin approximation, Maple Computer Algebra System, Diferential equations,
Mathematics Subject Classification:12X34, 56Y78

References

[1] S. Wang, S. Shen, H. Xu, D. Gu, J. Yin and X. Tang, Spectroscopic and optical properties of an azo-metal chelate dye as optical recording medium, Mater Sci Eng B. 76 (2000) 69-72.

[2] S. Wang, S. Shen, & H. Xu, Synthesis, spectroscopic and thermal properties of a series of azo metal chelate dyes, Dyes Pigments. 44 (2000) 195-198.

DFT study of (E)-1-(4-Fluorophenyl)-2-(2-oxidonaphthalen-1- yl) diazenium

Nabila Benabila[1,*], Chetioui Souheyla[1,2], Hafida Merouani[3,4]

[1]*Faculty of Science, Department of Chemistry, University of Mohamed Boudiaf Msila, BP 166Ichbilia, 28000 M'sila. Algeria*
[2]*Faculty of Technology, Department of ST , University of Mohamed Boudiaf M'sila, BP 166 Ichbilia, 28000 M'sila. Algeria*
[3]*Laboratoire chimie des matériaux et des vivants : activité, réactivité, university of El-Hadj Lakhdar Batna 1. Algeria*
[4]*Faculty of Technology, Common Core Department, university of Ben Boulaid Batna 2.Algeria*
E-mail: nabila.bennabila@univ-msila.dz

Abstract: The reaction mechanism for the synthesis of (E)-1-(4-Fluorophenyl)-2-(2- oxidonaphthalen-1- yl) diazenium is investigated using the DFT/B3LYP/6–311 ++ G (d, p) method. A theoretical study has been realized to predict the best molecular structure, physico-chemical properties. DFT conceptual reactivity indices analysis allows classification of 4-fluoroaniline and 2-naphthol as strong electrophiles, suggesting a polar process. Besides, Parr functions and Fukui indices predict the most reactive sites for observed experimentally product formation. An extended Topological analysis of the electron localization function (ELF) of the bending point structures along the reaction path indicates that the reaction occurs via a non-concerted several steps mechanism. The analysis of the obtained results of the density functional theory calculations are in good agreement with the exper- imental data.

Keywords: (E)-1-(4-Fluorophenyl)-2-(2-oxidonaphthalen-1- yl) diazenium, DFT, ELF.

Mathematics Subject Classification: 12X34, 56Y78

References

[1] Bruker (2006). APEX2, SAINT and SADABS. Bruker AXS Inc.,Madison, Wisconsin, USA.

[2] Farrugia, L. J. (2012). J. Appl. Cryst. 45, 849–854.

[3] Kennedy, A. R., Kirkhouse, J. B. A., McCarney, K. M., Puissegur, O.,Smith, W. E., Staunton, E., Teat, S. J., Cherryman, J. C. & James, R. (2004). Chem. Eur. J. 10, 4606–4615.

[4] Sheldrick, G. M. (2008). Acta Cryst. A64, 112–122.

Gaussian-Hybrid Numbers Obtained from Jacobsthal and Jacobsthal-Lucas Numbers

Merve Taştan Tekin

Tokat Gaziosmanpaşa University, Dept. of Mathematic, 60400, Tokat, Turkey
E-mail: merve.tastan@gop.edu.tr

Abstract: In the present paper, we first study the Gaussian Jacobsthal hybrid numbers and Gaussian Jacobsthal-Lucas hybrid numbers. We give some new results for the Gaussian Jacobsthal hybrid numbers and Gaussian Jacobsthal-Lucas hybrid numbers, including relations with the Jacobsthal and Jacobsthal-Lucas numbers, and also give some new results for the Gaussian Jacobsthal hybrid numbers and Gaussian Jacobsthal-Lucas hybrid numbers. Moreover, we obtain the recurrence relations, Binet-like formulas, Cassini-like identities for the Gaussian Jacobsthal hybrid numbers and Gaussian Jacobsthal-Lucas hybrid numbers, respectively.

Keywords: Jacobsthal sequence, Jacobsthal-Lucas sequence, Gauss Jacobsthal sequence, Gauss Jacobsthal-Lucas sequence.

Mathematics Subject Classification: A001045, A014551,

References

[1] A.F. Horadam, Jacobsthal representation numbers, Fibonacci Quart. 34(1), 40-54, 1996.

[2] D. Jhala, K. Sisodiya, G.P.S. Rathore, On some identities for k-Jacobsthal numbers, Int. J. Math. Anal. (Ruse) 7(12),551-556, 2013.

[3] FT. Aydın Torunbalcı, Circular-hyperbolic Fibonacci quaternions, Notes Number Theory Discrete Math. 26(2), 167-176, 2020.

[4] M. Özdemir, Introduction to hybrid numbers, Adv. Appl. Clifford Algebr. 28(1), 91-98, 2018.

[5] M. Akar, S. Yüce, S. Şahin, On the dual hyperbolic numbers and the complex hyperbolic numbers, J. Comput Sci. Comp. Math.,8,1-6,2018.

[6] Ş. Uygun, The (s,t)-Jacobsthal and (s,t)-Jacobsthal-Lucas sequences, Appl. Math. Sci. 70(9),3467-3476, 2015.

[7] Ş. Uygun, H. Eldoğan, k-Jacobsthal and k-Jacobsthal Lucas matrix sequences, Int. Math. Forum 11(3), 145-154, 2016.

[8] Y. Soykan, E. Taşdemir, Generalized Tetranacci hybrid numbers, Ann. Mat. Silesiannae, 35(1),113-130, 2021.

Biological effects and chemical characterization of Ilex aquifolium L. extracts: A new source of bioactive constituents

A ldjia Hadroug[1,*] and Rachid Belhattab[2]

[1]*Department of Chemistry, Med Boudiaf University,Algeria*
[2] *Department of Biochemistry, Farhat Abes University, Algeria*
E-mail: aldjia.hadrougue@univ-msila.dz

Abstract: This study gathers information about the effects of methanolic extracts from fruits and aerial parts of Ilex aquifolium L. on selected enzymes (cholinesterases, alpha-amylase and alpha-glucosidase and tyrosinase) as well as their antioxidant capacities in relation with their phenolic composition. The chemical composition was assessed by determining total phenolic and flavonoid content as well as individual phenolic compounds by HPLC-DAD. Moreover, antioxidant abilities of the investigated extracts were tested by using different assays including free radical scavenging (DPPH and ABTS), reducing power (CUPRAC and FRAP), phosphomolybdenum and metal chelating, overall fruits being indicated as a source of antioxidant compounds. Furthermore, interactions between dominant compounds from extracts and selected enzymes were investigated by molecular modeling studies in order to explain at a molecular level the interactions between selected compounds and active sites of the enzyme.

Keywords: Ilex aquifolium L.; bioactive compounds; enzyme inhibition; herbal extracts

A Numerical Study of Forced Vibration Analysis of Sandwich Plates with Viscoelastic Core in the Thermal Environment Subjected to Moving Load

Tekili Sabiha, Mokas Nacer, Karmi Yacine and Khadri Youcef

Laboratory of Advanced Technologies in Mechanical Production Research Laboratory (LRTAPM), Badji Mokhtar-Annaba University, P.o.Box 12, Annaba. 23000, Algeria.

E-mail: tekili.sabiha@gmail.com, nacer.mokas60@gmail.com, yyacine92@hotmail.fr and khadri152000@yahoo.fr

Abstract: The paper focuses on the vibrations responses of sandwich panels constituted of different types of viscoelastic core materials under the effect of a moving load in a thermal environment. The present approach is based on the finite element method using the variationnelle formulation of Hamilton's principle with the virtual displacement principle. However, the complexity of constructing the model basis by solving the eigenvalue problem, mainly due to the frequency dependence of the viscoelastic properties and the stiffness matrix, requires the use of the asymptotic numerical method "ANM" combined with the automatic differentiation "AD" algorithm. This numerical approach presented here is considered a typical approach well suited to solve the vibration problem of sandwich structures with viscoelastic core. First, an evaluation of the state of stress in the different layers constituting the sandwich are discussed. However, the response of sandwich structures with viscoelastic cores considered frequency and temperature dependent under the action of a moving load are deeply investigated. The effect of the variation of the viscoelastic damping and the temperature is very significant on the stress state of the viscoelastic layer and forced vibration responses.

References

[1] Ghafoori E, Ghahremani AR. Dynamic responses of a rectangulaire plate due to a moving oscillator using a semi-analytical method. J Vib Control, submitted for publication.https://doi.org/10.1177/1077546309358957

[2] E. Ghafoori, M. Asghari. Dynamic analysis of laminated composite plates traversed by a moving mass based on a first-order theory. Composite Structures.92 (2010) 1865–1876.https://doi.org/10.1016/j.compstruct.2010.01.011

[3] Zhihui Liu, JunchuanNiu, RuihaoJia, JuncaiGuo. An efficient numerical method for dynamic analysis of polygonal plate under moving loads. Thin-Walled Structures.167, October 2021, 108183.https://doi.org/10.1016/j.tws.2021.108183

[4] H. Ouyang, Moving-load dynamic problems: A tutorial (with a brief overview), Mech. Syst. Signal Process. 25 (2011) 2039–2060.https://doi.org/10.1016/j.ymssp.2010.12.010

[5] I. Esen, A new finite element for transverse vibration of rectangular thin plates under a moving mass, Finite Elem. Anal. Des. 66 (2013) 26–35.https://doi.org/10.1016/j.finel.2012.11.005

[6] H. Arvin, M. Sadighi, A.R. Ohadi. A numerical study of free and forced vibration of composite sandwich beam with viscoelastic core. Composite Structures, 92:996-1008, 2010.https://doi.org/10.1016/j.compstruct.2009.09.047

[7] Y.Karmi, Y.Khadri, S. Tekili, A. Daouadji, E.M.Daya, Effect of Mechanical and geometrical properties on dynamic behavior of asymmetrical composite sandwich beam with viscoelastic core. UPB Scientific Bulletin, Series D: Mechanical Engineering. 83, (2020)

Nonlinear Dynamic Analysis of PCLD Sandwich Beams in the Thermal Environment with Frequency and Temperature Dependent Viscoelastic Cores

Khadri Youcef, Tekili Sabiha, Karmi Yacine and Mokas Nacef

Laboratory of Advanced Technologies in Mechanical Production Research Laboratory (LRTAPM), Badji Mokhtar-Annaba University, P.o.Box 12, Annaba. 23000, Algeria.
E-mail: khadri152000@yahoo.fr, tekili.sabiha@gmail.com, yyacine92@hotmail.fr and nacer.mokas60@gmail.com

Abstract: The aim of this paper is to present a simpliied numerical approach to study the vibro-acoustic responses of structures with PCLD "Passive Constrained Layer Damping" treatment in the thermal environment, taking into account the frequency and temperature dependence of the diferent viscoelastic behavior laws. The modal stability procedure MSP is based on the finite element method in order to discretize and formulate the equation of motion. The asymptotic numerical method "ANM" is applied to approximate the solution of complex eigenvalue problems and construct the modal basis. The variability of the frequency responses is evaluated by a Monte Carlo simulation (MCS) combined with MSP and ANM to evaluate the stochastic behavior of a sandwich beam with random properties. The comparison with the direct frequency responses (DFR) demonstrates that the results are highly satisfactory in terms of the validity of the present MSP approach. A comparative study of viscoelastic behavior models was carried out to evaluate their damping properties provided to the structure. The viscoelastic materials provide signiicant damping particularly for amplitudes corresponding to the high frequencies. This is in contrast to the responses obtained without the viscoelastic layer. The obtained results show the importance of viscoelastic damping, which has a signiicant efect on the vibroacoustic behavior, implying the improvement of the damping of the structure, especially for large frequencies and high temperatures.

References

[1] Rezvani SS, Kiasat MS (2018) Analytical and experimental investigation on the free vibration of a loating composite sandwich plate having viscoelastic core. Arch Civil Mech Eng 18:1241–1258

[2] Kiasat MS, Zhang G, Ernst L, Wisse G (2001) Creep behavior of a molding compound and its effect on packaging process stresses. In: Electronic components and technology conference, pp 931–938

[3] Li X, Kaiping Yu (2015) Vibration and acoustic responses of composite and sandwich panels under thermal environment. J Comput Struct 131:1040–1049

[4] Jeyaraj P, Padmanabhan C, Ganesan N (2008) Vibration and acoustic response of an isotropic plate in a thermal environment. J Vib Acoust. https:// doi. org/ 10. 1115/1. 29483 87

[5] Zhao X, Geng Q, Li Y (2013) Vibration and acoustic response of an orthotropic composite laminated plate in a hygroscopic environment. J Acoust Soc Am 133:1433–1442.

Application of 3D Decision Criteria for the Selection of an Ally

Murat Özkaya[1,2*], Yücel Baştan[3], Burhaneddin İzgi[1***]**

[1] *Deparment of Mathematics, Istanbul Technical University, Istanbul, Türkiye*
[2] *Deparment of Business, Çanakkale Onsekiz Mart University, Çanakkale, Türkiye*
[3] *Deparment of International Relations, Çanakkale Onsekiz Mart University, Çanakkale, Türkiye*
E-mail: *ozkaya16@itu.edu.tr, **yucel.bastan@comu.edu.tr , ***bizgi@itu.edu.tr

Abstract: In this paper, we use the 3-dimensional decision criteria under uncertainty to evaluate potential allies for NATO. In this context, we focus on the recent member of NATO, Finland and Sweden. We investigate Türkiye's behavior towards these countries based on three main factors such as political, economic and military, each with three subfactors. We generate 3D payoff matrix by evaluating the effect of these factors on Türkiye's decision and apply 3D Laplace, 3D Wald, 3D Hurwicz and 3D Savage criteria on the 3D payoff matrix. The findings suggest that Turkey should give priority to approve Finland's accession, in line with Türkiye's current pattern of decision-making.

Keywords: Game theory, 3D decision criteria, 3D matrices, International relations

Mathematics Subject Classification: 91A35, 91A80

References

[1] Özkaya, M., İzgi, B. and Matjaž Perc. "Axioms of decision criteria for 3D matrix games and their applications." Mathematics 10.23 (2022): 4524.

[2] Fishburn, P. 1970, Utility theory for decision making, Newyork, Wiley.

[3] Pataki, B. 1996. A critique of some classical theories of decision under uncertainty. Period. Polytech. Soc. Manag., 4, 79–92.

[4] Diesen, G. 2015. EU and NATO relations with Russia: After the collapse of the Soviet Union, Routledge.

[5] Allan, P. ve Dupont, P. C. 1999. International Relation Theory and Game Theory: Baroque Modeling Choices and Empirical Robustness. International Political Science Review, 20 (1), 23-47

[6] Jeffrey, R. 1990, The logic of decision, 2. Ed. Chicago: Unversity of Chicago Press.

[7] Monaghan, S. (2023) Solving Europe's Defense Dilemma. CSIS Briefs.

[8] Gilboa, I. 2010, Rational choice, Cambridge, MA: MIT Press.

A Matrix Norm-Based Solution for Zero Sum Fuzzy Matrix Games: Fuzzy Matrix Norm Method

Burhaneddin İzgi[1*], Hale Gonce Köçken[2], Murat Özkaya[1,3***],**

[1] *Deparment of Mathematics, Istanbul Technical University, Istanbul, Türkiye*
[2]*Deparment of Mathematical Engineering, Yıldız Technical University, Istanbul, Türkiye*
[3]*Deparment of Business, Çanakkale Onsekiz Mart University, Çanakkale, Türkiye*
E-mail: *bizgi@itu.edu.tr,** hgonce@yildiz.edu.tr, ***ozkaya16@itu.edu.tr

Abstract: This paper introduces novel methodology for addressing two-person zero-sum matrix games with fuzzy payoffs of triangular fuzzy numbers. Apart from traditional approaches, the proposed method aims to directly solve the game by utilizing the norms of the payoff matrix comprehensively, without the need for solving linear programming problems or dealing with sub-games created by considering the components of a fuzzy number individually. Initially, we introduce fuzzy versions of the 1-norm and ∞-norm using a ranking function and then develop the fuzzy matrix norm method to obtain approximate solutions for zero-sum fuzzy matrix games based on the matrix norm (MN) method for matrix games with real values. To demonstrate the effectiveness of the fuzzy matrix norm method, we provide illustrative examples.

Keywords: Game theory, Matrix norm method, Fuzzy matrix games, Zero-sum games

Mathematics Subject Classification: 91AXX, 15B15

References

[1] von Neumann, J. and Morgenstern, O., Theory of games and economic behavior, (1994), Princeton University Press.

[2] Campos, L., Fuzzy linear programming models to solve fuzzy matrix games, Fuzzy sets and systems, 32(3) (1989), 275-289.

[3] Campos, L. and Gonzalez, A., Fuzzy matrix games considering the criteria of the players, Kybernetes, 20(1) (1991), 17-28.

[4] Li, D. F., A fast approach to compute fuzzy values of matrix games with payoffs of triangular fuzzy numbers, European Journal of Operational Research, 223(2) (2012), 421-429.

[5] İzgi, B. and Özkaya, M., A New perspective to the solution and creation of zero sum matrix game with matrix norms, Appl. Math. Comput., 341 (2019), 148-159.

[6] Yager, R.R., A procedure for ordering fuzzy subsets of the unit interval, Information Science, 24 (1981), 143-161.

Statistical modelling of the effect of cutting parameters on the roughness of the machined surface when drilling C22 steel in the annealed and hardened state

Mokas Nacer, Abidi Youcef, Tekili Sabaha

Research Laboratory of Advanced Technology in Mechanical Production, Faculty of Engineering Sciences, Badji Mokhtar University Annaba, Annaba, Algeria
E-mail: nacer.mokas60@gmail.com, abidiyoucef73@gmail.com, tekili.sabah@gmail.com

Abstract: This article is dedicated to the statistical modelling of the effect of cutting parameters on the roughness of the machined surface when drilling C22 steel using HSS twist drills in the annealed and hardened condition. The tests were carried out in accordance with the experimental design methodology (L8). Cutting speed, feed rate and drill diameter are the main elements of the cutting regime representing the input parameters of the test, while the roughness of the machined surface is considered as the response criterion. The results show that the metallurgical aspect of the steel and the cutting parameters have a remarkable influence on the good finish of the machined surface; increasing the cutting speed improves the roughness, while it deteriorates with increasing feed speed and drill diameter. Increasing the feed speed increases the height of asperities on the machined surface, and large diameters require high cutting forces that affect the stability of the machining system. On the other hand, increasing the cutting speed stabilises the system by reducing the cutting forces, which favours chip flow. The roughness obtained after heat treatment is significantly better than that of annealed parts; the steel after quenching has a finer microstructure, which reduces deburring of the material during cutting. The same applies to low rates of elastic deformation, which allow clean, burr-free breakage. In addition, hard materials with fine microstructures mean that chip shear is accompanied by much finer particles being torn off, contributing to improved surface finish. This study has produced predictive mathematical models that correlate well with the experimental results and can be used as tools for industrial applications.

References

[1] Alexandra Lacombe. Influence du procédé de perçage sur l'intégrité de surface et la tenue en fatigue de pièces percées en AA2024-T351. Mécanique des matériaux [physics.class-ph]. Université Paul Sabatier, Toulouse III, Français. P 43-46, 2021

[2] Giasin, K., Hodzic, A., Phadnis, V., & Ayvar-Soberanis, S. 2016. Assessment of cutting forces and hole quality in drilling Al, aluminium alloy: Experimental and finite element study. The International Journal of Advanced Manufacturing Technology, 87, 2041-2061, 2024.

[3] Sun, D., Lemoine, P., Keys, D., Doyle, P., Malinov, S., Zhao, Q., Qin, X., & Jin, Y. 2018. Hole-making processes and their impacts on the microstructure and fatigue response of aircraft alloys. The International Journal of Advanced Manufacturing Technology, 94, 1719-1726

[4] Bordin F. M. and Zeilmann R. P. , "Effect of the cutting edge preparation on the surface integrity after dry drilling, Procedia CIRP, vol. 13, pp.529-542, 2015.

[5] Yu ZHOUa,b, Wei FANGa,b, Lanying SHAOa,b, Yanfei DAIa,b, Jiahuan WANGa,b, Xu WANGa,b, Julong YUANa,b, Weigang GUOc, Binghai LYU, Edge preparation methods for cutting tools, Frontiers of Mechanical Engineering, Vol. 18 Issue (4) : 50, 2023.

[6] B. Gassara & M. Baili & G. Dessein & M. Hbaieb & W. Bouzid Saï, Feed rate modeling in circular–circular interpolation, The International Journal of Advanced Manufacturing Technology, 65:1619–1634, 2013.

Bending and free vibration analysis of functionally graded carbon nanotube-reinforced composite beams by finite element method (FEM)

Sabiha Tekili, Nacer Mokas and Youcef Khadri

Laboratory of Advanced Technologies in Mechanical Production Research Laboratory (LRTAPM), BadjiMokhtar-Annaba University, P.o.Box 12, Annaba. 23000, Algeria.
E-mail: tekili.sabah@gmail.com, nacer.mokas60@gmail.com, khadri152000@yahoo.fr

Abstract: This article presents the bending and free vibration of functionally graded (FG) beams made of carbon nanotube (CNT) reinforced composites. Three distributions of the carbon nanotube are considered; two functionally graded which are FGA-CNT and FGX-CNT and one uniform UD-CNT.The micromechanics properties are determined by using Eshelby-Mori-Tanaka approach. The Hamilton's principle isused fordetermined the motion equations of the functionally graded of carbon nanotube-reinforced composite beams. The motion equations of beams are numericalapproximated by finite element method.We developed a MATLAB code for a parametric study to evaluate the effect of CNT reinforcement on the deflection and frequency of the functionally graded carbon nanotube reinforced composite beams.The results show that the FGX-CNT model gives the minimum dynamic deflection of the beam; therefore, this model has better dynamic resistance.The numerical results also showed that the fraction of CNTs has a significant effect on the deflection and natural frequency of the beam.

References

[1] Enrique García-Macías∗, Luis Rodríguez-Tembleque, Andrés Sáez, Bending and free vibration analysis of functionally graded graphene vs. carbon nanotube reinforced composite plates, Composite Structures 186 (2018) 123–138.

[2] Shuai Zhang, Yulin Lai, Kuanyu Chen, Mostafa Habibi, Masoud Khorami, Zainab Haider Mussa, Influence of MWCNT's waviness and aggregation factors on wave dispersion response of MWCNT-strengthened nanocomposite curved beam, Structures 53 (2023) 1239–1249.

[3] Shengqi Pan, Qiyi Dai, Babak Safaei, Zhaoye Qin, Fulei Chu, Damping characteristics of carbon nanotube reinforced epoxy nanocomposite beams, Thin-Walled Structures 166 (2021) 108127.

[4] T. Vodenitcharova, L.C. Zhang, Bending and local buckling of a nanocomposite beam reinforced by a single-walled carbon nanotube, International Journal of Solids and Structures 43 (2006) 3006–3024.

[5] A Ghorbanpour Arani1 and M H Zamani, Bending analysis of agglomerated carbon nanotube-reinforced beam resting on two parameters modified Vlasov model foundation, Indian J Phys (June 2018) 92(6):767–777

The importance of statistical tools for understanding the smoking behaviour of Algerian smokers: a decision-making aid for the effectiveness of tobacco control measures

Nabila Kendi and Younes Hidra

Laboratory of Medical Informatics (LIMED), Faculty of Economics, Management and Commercial Sciences, University of Bejaia, 06000 Bejaia, Algeria.
E-mail: nabila.kendi@univ-bejaia.dz and younes.hidra@univ-bejaia.dz

Abstract:
Position of the problem: Tobacco control offers sustainable development gains in its economic, social, environmental and health dimensions. Following the globalisation of tobacco control, a convention outlining a coordinated global response has been in place since 2005, under the name of the Framework Convention on Tobacco Control and under the leadership of the WHO. Algeria ratified the Convention in 2006, thereby fulfilling its promise to develop a national tobacco control policy based on its rules, provisions and priorities, by acting to reduce tobacco supply and demand.
Methods: in this work, we carried out two studies. The first was a macroeconomic study in which we analysed the conditions for the effectiveness of the anti-smoking tax policy and its viability by means of an econometric study (multivariate modelling) of the price elasticity of demand for cigarettes, the income elasticity of demand for cigarettes and the elasticity of affordable demand for tobacco. In the second microeconomic study based on individual survey data, our work consisted in analysing, using modelling (an ordinal logistic model), the effectiveness of demand-side tobacco control measures in accordance with the provisions of the FCTC.
Results: The econometric results cast doubt on the effectiveness, in the case of Algeria, of some of the provisions of the WHO FCTC relating to anti-smoking tax policy, the placing of health warning labels on cigarette packets and the ban on the sale of single units of tobacco. Our contribution will prove, in fine, that the results of statistical modelling are essential in order to make effective decisions and guide anti-smoking policies.

References

[1] Becker g.-s., Grossman m., Murphy K.-M, "Rational addiction and the effect of price on consumption", The American Economic Review, 81, 237-241. 1991

[2] Biener L., Siegel M, "Tobacco marketing and adolescent smoking: more support for a causal inference". Am J Public Health, 90(3), 407-411. 2000

[3] Blecher E.-H., Walbeek van C.-P, "An international analysis of cigarette affordability". Tobacco Control, 13, 339–346. 2004.

[4] Blecher EH, Van Walbeek CP, "Cigarette affordability trends: an update and some methodological comments". Tobacco Control;18:167-75. 2009.

[5] Blecher EH, Walbeek van CP, "An international analysis of cigarette affordability". Tobacco Control;13:339-46. 2004.

[6] Bourbonnais, R, "Econométrie, cours et exercices corrigés", 9ème Ed Dunod, 2015.

[7] Calo W.A., Krasny S.E, "Environmental determinants of smoking behaviors: The role of policy and environmental interventions in preventing smoking initiation and supporting cessation", Curr Cardiovasc Risk Rep, 7(6), 446–452. 2013.

[8] Centers For Disease Control And Prevention, "Cigarette Smoking and Tobacco Use Among People of Low Socioeconomic Status". Office on Smoking and Health, National Center for Chronic Disease Prevention and Health Promotion. 2019.

[9] Chaloupka, F.-J, "Rational addictive behavior and cigarette smoking", The Journal of Political Economy 99,722-742. 1991.

[10] Cho Y.J. et AL. "Does Adding Information on Toxic Constituents to Cigarette Pack Warnings Increase Smokers' Perceptions About the Health Risks of Smoking? A Longitudinal Study in Australia, Canada, Mexico, and the United States", Health Education & Behavior, 45 (1) 32 – 42. 2018.

[11] Djaouda M, "L'analyse statistique fondamentale avec SPSS" 2 ème éd. Darwael, Oman, 2009.

[12] Dupilet C., Grignon M. et Pierrard B, "Modèles économiques et politiques de lutte contre le tabagisme", éd. CREDES, Paris, juin 2002.

[13] Ellen J., Hahn E.-J. "Smokefree legislation: a review of health and economic outcomes research. Am J Prev Med"., 39(6 Suppl 1):S66-76. 2010.

[14] Etilé F. "L'analyse économique des politiques publiques du tabagisme. Psychotropes", 12(1), 25-55. 2006.

[15] Hu TW, Mao Z. "Economics Analysis of Tobacco and Options for Tobacco Control", China Case Study. Economics of Tobacco Control, Dec;3:10. 2002.

[16] Hu Y, Shang C, Chaloupka FJ. "The association between cigarette affordability and consumption": An update. PLoS ONE. 13 (12): e0200665. 2018.

[17] John RM, Rao RK, Rao MG, Moore J, Deshpande RS, Sengupta J et al. "The Economics of Tobacco and Tobacco Taxation in India". Paris: International Union Against Tuberculosis and Lung Disease; 2010.

[18] KENDI N. "Essai d'analyse de la politique de lutte contre le tabagisme en Algérie". Mémoire de Magister en Sciences Economiques, Université de Bejaia. 2012.

[19] Kendi N. "Analyse de la politique de lutte contre le tabagisme en Algérie : régulation du marché et opportunités de lute" Thèse de Doctorat en Sciences Economiques, option : Économie de la santé et Développement Durable. Université de Bejaia ; 2019.

[20] Kendi N., Hidra Y. & Kaïd-Tlilane N, "Analyse macroéconomique de l'efficacité de la politique fiscale antitabac en Algérie". Santé publique., 34 (1), pp 141-155, 2022.

[21] Kendi N., Hidra Y., Kaïd-Tlilane N. "La réduction de la pauvreté par la lutte antitabac : analyse des impacts socioéconomiques du tabagisme sur les familles pauvres en Algérie", Les Cahiers du MECAS, 14 (1), 116-125. 2018.

[22] Kendi N., Kaïd Tlilane N, "Quelle politique de prévention du tabagisme juvénile en Algérie ? Cas de la wilaya de Béjaïa". Les Cahiers du CEDIMES, 13 (04), 47-58. 2019.

[23] Longo D.R., Johnson J.C., Brownson R.C. "A prospective investigation of the impact of smoking bans on tobacco cessation and relapse", Tobacco Control 10(3), 267-72. 2001.

[24] Osman A., Thrasher J.F., Yong H.H., Arillo-Santillan E., Hammond D. "Disparagement of health warning labels on cigarette packages and cessation attempts: results from four countries". Health Education Research, 32(6): 524–536. 2017.

[25] Pampel F. "National Income, Inequality and Global Patterns of Cigarette Use", Soc Forces, 86(2): 445–466. 2007.

[26] Reid J.L., Mutti-Packer S., Gupta P.C., Li Q., Yuan J., Nargis N., Ghulam Hussain A.K.M. & Hammond D. "Influence of HealthWarnings on Beliefs about the Health Effects of Cigarette Smoking, in the Context of an Experimental Study in Four Asian Countries", Int. J. Environ. Res. Public Health, 14(8), 868; 2017.

[27] Rijo M.-J. "Price Elasticity Estimates for Tobacco Products in India", Health Policy Plan, 23(3), 200–209. 2008.

[28] Sighe Z., Hailemariam S., Fesshaye H. "Price elasticity of demand for tobacco consumption in Eritrea : an exploratory study". MOJ Public Health, 5(6), 208–213. 2017.

[29] Stafford J.et Bodson P. "L'analyse multivariée avec SPSS". Ed Presses de l'Université du Québec. 2006.

[30] Swayampakala K., Thrasher J.F., Yong H.-H., Nagelhout G.E., Li L., Borland R., Hammond D., O'Connor R.J., Hardin J.W. "Over-Time Impacts of Pictorial Health Warning Labels and their Differences across Smoker Subgroups: Results from Adult Smokers in Canada and Australia". Nicotine & Tobacco Research, 20(7), 888–896. 2018.

[31] Warner K.-E., Ernster V.-L., Holbrook J.-H., et al. "Promotion of tobacco products: issues and policy options". J Health Polit Policy Law, 11, 367–392. 1986.

[32] World Bank. "Curbing the epidemic. Governments and the economics of tobacco control". Washington: the international Bank for reconstruction and development/ The World Bank. 1999.

[33] Xu X., Chaloupka F.-J. "The Effects of Prices on Alcohol Use and its Consequences Alcohol research & health", the journal of the National Institute on Alcohol Abuse and Alcoholism, 34(2), 236-245. 2011.

Extraction Process of Algerian Rosmarinus Officinalis L. Essential Oil by Hydrodistillation-Statistical Approach

Sarra Guilane, Ouarda Moumeni, Chaima Labadlia and Mohamed Hichem Ben Zaim

Badji Mokhtar—Annaba University, Laboratory of Environmental Engineering, Process Engineering Department, Faculty of Engineering P.O. Box 12, Annaba 23000, Algeria
E-mail: Sara.guilane@univ-annaba.dz

Abstract: The medicinal plants represent a very important source of active compounds; they are used in several fields: in cosmetics, in food and especially in the pharmaceutical field. These active compounds can be extracted by different extraction techniques, Among these plants, Rosmarinus officinalis L. This medicinal herb contains an essential oil to which it owes its interesting properties. The oil possesses tonic stimulating qualities, it is used as a pulmonary antiseptic, a choleretic, and a colagoguic, and also has stomachic, antidiarrheal, and antirheumatic characteristics [1]in addition to being a natural effective antioxidant [2]. The improvement of the essential oil yield becomes a main priority. Hence, the application of statistical techniques such as design of experiments makes this improvement increasingly possible. These methods optimize the operating conditions to achieve the maximum possible result with a minimum number of experiments [3]. Numerous researchers have referred to the application of experimental designs in the analysis and optimization of the extraction essential oil method. Others have passed directly to the optimization by employing the response surface approach, while others have applied other types of designs including the complete factorial design [4-6]. A study by surface response plan type Box Behnken was conducted; after an appropriate choice of three variables: Ratio (Volume/Plant matter), Heating temperature, and Extracting time. The effects of all factors examined and the statistical values of Student's t-test and the observed probability (p value) are employed to establish the significance of the coefficients of each parameter. The statistical mathematical model that represents the response in terms of the most influential variables according to the results of the minitab 13 software is: $Y = 0,80333 - 0,10500X_1$ˇ$0,13000X_2 + 0,19000X_3 - 0,19000X_1X_3 + 0,08500X_2X_3$. According to the postulated and validated mathematical model, the yield depends on the linear terms relating to the ratio factors (v/m); the heating temperature and the hydrodistillation time, respectively; and the interaction terms which relate to the heating temperature/hydrodistillation time interactions; and the ratio (v/m)/hydrodistillation time interactions. The statistical compilation establishes, in an interdependent way, the behavior of our system with respect to several variables. Indeed, the mathematical correlation deduced shows that the mass yield of essential oil is proportional to the extraction time and the heating temperature and inversely proportional to the ratio (v/m). A very good agreement between the model and the experimental results was observed with a correlation factor of $R^2 = 0.9761$. The results of this study demonstrated the high efficiency of employing the experiment design method to optimize the operational factors impacting the extraction yield.

Keywords: Extraction yield; Algerian Rosmarinus officinalis; Box Behnken Desig; Design of experiments; Essential Oil

References

[1] M. Lahlou and R. Berrada, "Fractional distillation effect on the chemical composition of Moroccan myrtle (Myrtus communis L.) essential oils", Flavour Fragr. J., vol. 18, pp 124–127, 2003.

[2] N. Erkan, G. Ayranci and E. Ayranci, "Antioxidant activities of rosemary (Rosmarinus officinalis L.) extract, blackseed (Nigella sativa L.) essential oil, carnosic acid, rosmarinic acid and sesamol", Food Chem., vol. 110, pp 76–82, 2008.

[3] G. Pintore, M. Usai, P. Bradesi, C. Juliano, G. Boatto, F. Tomi, M. Chessa, R. Cerri and J. Casanova, "Chemical composition and antimicrobial activity of Rosmarinus officinalis L. oils from Sardinia and Corsica", Flavour Fragr. J, vol. 17,pp 15–19,2002.

[4] M. S. Galadima, A. S. Ahmed, A. S. Olawale and I. M. Bugaje, "Optimization of Steam Distillation of Essential Oil of Eucalyptus tereticornis by Response Surface Methodology", Nig. J. Basic Appl. Sci. vol. 20, pp 368–372, 2012.

[5] Y.Ez zoubi, M. Fadil, D. Bousta,A. Lalami, M. Lachkar , and A. Farah, Ultrasound-Assisted Extraction of Phenolic Compounds from Moroccan Lavandula stoechas L.: Optimization Using Response Surface Methodology, Journal of Chemistry, 2021, 11 (2021).

Contribution to the Application of Condition Maintenance for Followed and Diagnostic Of a Rotating Machine

Tamaloussi Naima, Benzaid Lamia, Azzez Zina, Bouzaouit Azzedine

University of Skikda, Faculty of Technology, Department of Mechanical Engineering, Skikda, Algeria.1
E-mail: naimatamaloussi@yahoo.com

Abstract: The appropriate type of maintenance (corrective, preventive or predictive) is chosen for each rotating machine based on certain criteria, including: the cost of replacing equipment and the frequency of breakdowns, is one of the main causes of machine breakdown rotating. Which are monitored and diagnosed in real time to increase their lifespan and ensure their suitability.The objective of this work is to study bearing fault diagnosis tools. We carried out precise and reliable machine condition measurements, based on vibration analysis, wear index tracking and thermal imaging, to discover faults and find suitable solutions to ensure. the proper functioning of the machine.

References

[1] Jean Héng : «Industrial management series» , paris 2002.

[2] François Monchy : « Maintenance methods and organization», Industrial management series, 2000 paris.

[3] R. Bigret J.L.Feron : « Diagnosis of rotating machines », 2001paris.

[4] www.flirsysteme.com

[5] www.bkvibro.com

[6] J. Ayle, Lubricant – Additives with chemical action, engineering technique.

[7] https://www.products.pcc.eu/fr/blog/les-huiles-de-base-en-tant-que-composant- principal- des-lubr.

[8] http://tpmattitude.fr/lubrification.html.

[9] jacques Dénis jean Briantjean-Claudehipeau« physico-chemistry of lubricants», 1997, P 386-388.

Using Calculus of Variations to Mathematically Model a Durable Tent Design

Using Calculus of Variations to Mathematically Model a Durable Tent Design

FMV Erenköy Işık Science High School, Istanbul, Türkiye Mathematics and Science Education Department, Bogazici University, Istanbul, Türkiye
E-mail: basriozanguven123@gmail.com and fatma.tutak@bogazici.edu.tr

Abstract:
Natural disasters and emergencies cause many people in our country and around the world to be homeless and forced to live in tents. Especially in earthquake-prone regions like Turkey, it is imperative to find fast and safe solutions in emergencies. In the February 6 earthquake in Turkey, many people lost their homes and in this process, there was an urgent need for shelter and therefore a large number of tents were needed. In this presentation, the authors will share a tent model, namely the CaTent

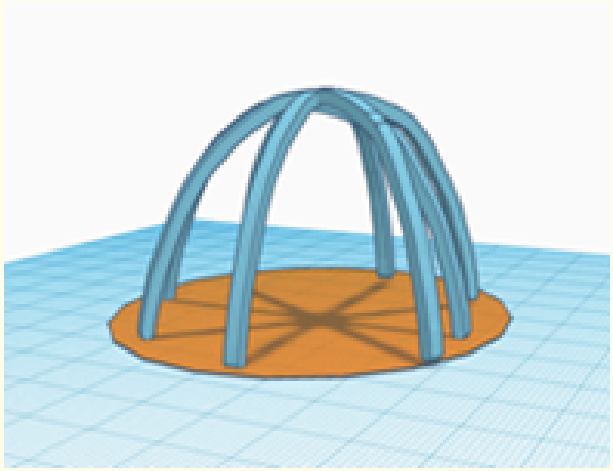

Figure 3: CaTent Design

(Figure 1) that is designed to provide fast, safe and sustainable shelter for people who have lost their homes during natural disasters and emergencies. Mathematical modeling and biomimicry principles are used in the process. In addition, by using physics and mathematics disciplines together, it is aimed to design the tent in a way that is far from aesthetic concerns and suitable for different climatic and living conditions. The main component of a tent is the poles which are designed based on calculus of variations, specifically by using the Euler-Lagrange equation.

$$\frac{\partial f}{\partial y} - \frac{d}{dx}\left(\frac{\partial f}{\partial y'}\right) = 0$$

The following Functional is used for solving the Euler-Lagrange equation:

$$f = 2\pi y\sqrt{1 + (y')^2}$$

The result is as follows:

$$y = K\cosh\left(\frac{x - C}{K}\right)$$

$$y = 3.8752 - 1.3252\cosh\left(\frac{x}{1.3252}\right)$$

By using this equation the authors determined the length of a pole. The length of a pole is found to be 7.2832 meters. Considering the biomimicry approach in the research, the tent was designed in harmony with nature. Thus, a sustainable and environmentally friendly solution was presented. As a result, this research combines mathematical modeling and biomimicry

principles to design an effective, fast and safe tent for emergency situations. This tent is more practical than the traditional earthquake tent and requires fewer people to set up. It is also an example of how mathematical modeling can be applied to tent design.

Keywords: Catenary Curve, Calculus of Variation, Mathematical Modelling, Biomimicry

Mathematics Subject Classification: 49-01

Comparison of software tools for calculating maximum tsunami wave heights

Mikhail Lavrentiev[1,2] and Andrey Marchuk[1,3] and Konstantin Oblaukhov[1] and Mikhail Shadrin[1]

[1] *Institute of Automation and Electrometry SB RAS, 630090, Novosibirsk, Russia*
[2] *Novosibirsk State University, Faculty of Information Technologies, 630090, Novosibirsk, Russia*
[3] *Institute of Computational Mathematics and Mathematical Geophysics SB RAS, 630090, Novosibirsk, Russia*
E-mail: mmlavrentiev@gmail.com and mag@omzg.sscc.ru and oblaukhov@sl.iae.nsk.su and mikesha@sl.iae.nsk.su

Abstract: Destructive tsunami flood waves still pose a significant hazard both for the population of a number of coastal territories and for the corresponding industrial and infrastructural facilities. Correct determination of the distribution of the expected maximum wave heights along the coast before tsunami arrival can save lives, minimize the consequences for engineering structures, and avoid costly evacuation measures if they are not necessary. The paper compares the maximum tsunami wave amplitude values obtained by different numerical methods [1]. It is shown that the methods used to solve the wave propagation problem for model source give similar values of maximum heights practically in the entire computational domain except for points close to the boundary. This can be explained by different ways of realizing the conditions of total reflection from the boundary. However, the discussed methods have different performance, which differs by orders of magnitude. In order to obtaining results faster, it is recommended to use hardware acceleration of the calculations [2]. The results will be useful for warning services in decision making.

Keywords: Tsunami wave propagation, Maximal heights, Numerical Scheme

Mathematics Subject Classification: 65N06, 76D33

References

[1] Lavrentiev, M. and Lysakov, K. and Marchuk, An. and Oblaukhov, K. and Shadrin, M., "Hardware/Software Solution for Low Power Evaluation of Tsunami Danger", Journal Low Power Electr. and Appl., 12(6), 2022. doi: 10.3390/jlpea12010006

[2] Lavrentiev, M. and Lysakov, K. and Marchuk, An. and Oblaukhov, K., "Fundamentals of Fast Tsunami Wave Parameter Determination Technology for Hazard Mitigation", Sensors, 22, 7630. https://doi.org/10.3390/s22197630

Transoceanic tsunami modeling on a 1-minute grid

Mikhail Lavrentiev[1,2] and Konstantin Lysakov[1,3] and Andrey Marchuk[1,4] and Konstantin Oblaukhov[1,3]

[1] *Institute of Automation and Electrometry SB RAS, 630090, Novosibirsk, Russia*
[2] *Sobolev Institute of Mathematics SB RAS, 630090, Novosibirsk, Russia*
[3] *Novosibirsk State University, Faculty of Information Technologies, 630090, Novosibirsk, Russia*
[4] *Institute of Computational Mathematics and Mathematical Geophysics SB RAS, 630090, Novosibirsk, Russia*
E-mail: mmlavrentiev@gmail.com and lysakov@sl.iae.nsk.su and mag@omzg.sscc.ru and oblaukhov@sl.iae.nsk.su

Abstract: Tsunami waves can propagate over a distance of several thousand kilometers without losing their destructive power. For modeling the process of transoceanic wave propagation, it is customary to use the resources of supercomputers. In order to limit the processing time by 1-2 hours, grids with a step of 3-4 geographic minutes are used for such calculations. The use of more detailed grids requires even more significant computational costs. Due to the use of hardware acceleration (previously proposed [1]co-processor based on Field Programmable Gates Array - FPGA), a personal computer can also be used for calculations, which can significantly increase the number of studies in the field of tsunami warning. Obtained precision is the same then using alternative simulation tools, while performance is similar to those of supercomputers [2]. The paper presents the results of numerical solution of the system of shallow water equations modeling the propagation of a tsunami wave across the Pacific Ocean water area using a computational grid with a resolution of 1 minute. It is shown that due to the achieved fast performance it is possible to adjust the source parameters as new information on the amplitude and profile of the wave passing over deep-sea pressure sensors becomes available.

Keywords: Transoceanic tsunami wave propagation, Hardware acceleration

Mathematics Subject Classification: 65N06, 76D33

References

[1] Lavrentiev, M. and Lysakov, K. and Marchuk, An. and Oblaukhov, K., "Fundamentals of Fast Tsunami Wave Parameter Determination Technology for Hazard Mitigation", Sensors, 22, 7630. https://doi.org/10.3390/s22197630

[2] Lavrentiev, M. and Lysakov, K. and Marchuk, An. and Oblaukhov, K. and Shadrin, M., "Hardware Acceleration of Tsunami Wave Propagation Modeling in the Southern Part of Japan", Appl. Sci., 10(12), 4159, 2020. https://doi.org/10.3390/app10124159

Realizing Multiple Optical Bifurcation using a Micoring Resonator with Triple-Coupler

Mahdi Bahadoran[1*], Faezeh Pakfetrat[1], Ahmad Fakhrurrazi Ahmad Noorden[2]

[1]*Department of Physics, Shiraz University of Technology, 31371555, Shiraz, Fars, Iran.*
[2] *Center for Advanced Optoelectronics research (CAPTOR), Kulliyyah of Science, International Islamic University Malaysia, 25200 Kuantan, Pahang, Malaysia.*
E-mail: bahadoran@sutech.ac.ir , pakfetrat.f@gmail.com and fakhrurrazi@iium.edu.my

Abstract: In this study, a novel triple-coupler add-drop microring resonator (TCADMR) was presented and the nonlinear behavior of light through a system of GaAsInP core waveguide on a substrate layer of InP was investigated. The light behavior via TCADMR system was studied using optical transfer matrix and coupled-mode theory. Three sets of optical bright solitons with an increasing amplitude ratio were simultaneously entered in to the TCADMR and multiple bifurcate areas were realized. A nonlinear ultra-fast on-off switching time with a minimum threshold input power was realized that makes the TCADMR as a promising device for study of cell signaling networks, quantum systems, classical analogues, and analysis impacts areas systems like hamiltonian and stochastic systems.

References

[1] Zhao, C.Y. and W.H. Tan, Transmission performance of one waveguide and double micro-ring resonator using 3× 3 optical fiber coupler. Journal of Modern Optics, 2016. 63(17): p. 1726-1733.

[2] Lynch, S., A. Steele, and J. Hoad, Stability analysis of nonlinear optical resonators. Chaos, Solitons & Fractals, 1998. 9(6): p. 935-946.

[3] Sirawattananon, C., et al., Analytical Vernier effects of a PANDA ring resonator for microforce sensing application. Ieee Transactions on Nanotechnology, 2012. 11(4): p. 707-712.

[4] Bahadoran, M., J. Ali, and P.P. Yupapin, Ultrafast all-optical switching using signal flow graph for PANDA resonator. Applied Optics, 2013. 52(12): p. 2866-2873.

[5] Bahadoran, M. and P. Yupapin, All-optical notch filters for ultra-wideband chaotic communications. The European Physical Journal Plus, 2018. 133(11): p. 487.

[6] Li, Y., et al., A memristive chaotic map with only one bifurcation parameter. Nonlinear Dynamics, 2024. 112(5): p. 3869-3886

[7] Wu, H., et al., Bifurcation analysis in liquid crystal elastomer spring self-oscillators under linear light fields. Chaos, Solitons & Fractals, 2024. 181: p. 114587

Modelling and optimisation of the maximum power of a wind turbine using fuzzy logic

Samia Bensmail[1] and Chafiaa Serir[2] and Djamila Rekioua[3]

[1] *Bouira University,Dept. of Electrical Engineering, Bouira, Algeria*
[2] *Béjaïa University, Laboratory LTII, Dept. of Electrical Engineering, Béjaïa , Algeria*
E-mail: samia.bensmail@univ-bouira.dz chafiaa.serir@univ-bejaia.dz, djamila.ziani@univ-bejaia.dz

Abstract: In this article we will apply a method based on artificial intelligence (fuzzy logic), with the aim of tracking and extracting the maximum power produced by the wind turbine. To do this we first modelled our system using mathematical equations, then developed an algorithm based on fuzzy logic which consists of finding an optimal operating relationship corresponding to dv/dp=0, this method has the advantage of being able to be integrated without any knowledge of the characteristics of the canopy. The results obtained show the effectiveness and robustness of fuzzy MPPT. The performance validity of this proposed technique is confirmed by simulation on MATLAB. Simulink, and compared with other classical methods such as P&O, TCR... etc.

Keywords: Turbine, MPPT, Wind, Fuzzy Logic

References

[1] Y. A. Kaplan, “overview of wind energy in the world and assessment of current wind energy policies in Turkey “, Renewable and sustainable energy reviews, vo. 43, pp562-568,(2015).

[2] K. E. Johnson, L. Y. PAO, M. J. Balais, and L. J. Fingers, “control of variable-speed wind turbines:standard and adaptive techniques for maximising energy capture”, IEEE Control syst, vol. 26, no. 3,pp70-81,june. 2006.

[3] H. Othmani, “Optimisation de la technique de perturbation et observation par la logique floue “, international journal of scientific research and engineering technology (IJSET), 2015.

[4] J. Hossain and M. K. Michra, “adaptive maximum power points taking control algorithm for wind energy conversion systems “, IEE Transactions on energy conversion, vol. 31,no. 2,June 2016.

[5] Djamila Rekioua, Samia Bensmail, Chafiaa Serir, Toufik Rekioua (March 2023) .Power supervision of an autonomous photovoltaic/wind turbine/battery system with MPPT using adaptative fuzzy logic controller. International Journal of Applied Power Engineering (IJAPE) Vol. 12, No. 1

[6] S.M.EL-Sadek, M.A. Elsharkawi, A.A. Elrefaie, “Acomprehensive review of hybrid wind-hydrogen systems for electricity generation”, renewable and sustainable energy reviews, vol.34, pp. 821-837.

[7] A.khalil Nejad. (2014).A hybrid wind-PV system performance investigation for the purpose of maximum hydrogen production and storage using advanced alkaline electrolyzer. Energy Conversion and Management, Vol 80, Pages 398-406.

[8] R. Kot, M. Rolak, M. Malinowski” Comparison of maximum peak power tracking algorithms for a small wind turbine”, Mathematics and Computers in Simulation 91 (2013) 29–40.

[9] M. Ermis, H. B. Ertan, E. Akpinar, and F. Uigut, "Autonomous wind energy conversion systems with a simple controller for maximum-power transfer," Proc. Inst. Elect. Eng. B, vol. 139, pp. 421-428, Sept. 1992.

[10] S.J.Park, Y.J.Cho, and Y.S. Lee. (2020). A real-time energy management strategy for hybrid wind-fuel cell systems. IEEE Transactions on sustainable energy,.

Bound state solutions of the Dirac equation with the Eckart potential including Coulomb-like tensor potential by Feynman path integral

Assia Amrouche[1], Ahmed Diaf[2]

[1]*Laboratoire de Physique des Techniques Expérimentales et ses Applications. University Yahia Fares –Medea, Algeria*
[2]*Laboratoire de l'énergie et des systèmes intelligents, Khemis Miliana University, Algeria*
E-mail: amroucheassia@gmail.com

Abstract: We solve the Dirac equation with the Eckart potential including a Coulomb-like tensor interaction under pseudospin symmetry condition with arbitrary spin-orbit coupling quantum number κ by using the Feynman path integral method. We calculated the wave function and energy eigenvalues and compared our results with other data.

References

[1] A. N. Ikot, E. Maghsoodi, S. Zarrinkamar and H. Hassanabadi, Journal of Theoretical and Applied Physics 7 53 (2013).

[2] D. C. Khandekar, S. V. Lawande et K. V. Bhagwat, "Path Integral Methods and Their Applications", World Sientific, Singapore, (1986).

[3] M. Hamzavi · H. Hassanabadi · A.A. Rajabi, Int J Theor Phys 50: 454–464 (2011).

[4] D. C. Khandekar, S. V. Lawande et K. V. Bhagwat, "Path Integral Methods and Their Applications", World Sientific, Singapore, (1986).

[5] A. Frank and K.B. Wolf, J. Math. Phys. 26 973–83 (1985).

[6] C. Grosche, J. Phys. A: Math. Gen. 22 5073–87 (1989).

On Generalized Metric Spaces and their Topological and Fixed Point Theoretic Applications

Tadesse Bekeshie Gerbaba

Ethiopia
E-mail: tadesse.bekeshie@aau.edu.et

Abstract: This is a survey on the genesis and development of one of the most important notions in mathematical analysis, namely the notion of metric space and mainly for its own sake. It also surveys the topological properties and fixed point theoretic applications of notable metric space variants, as its subsidiary general goal. In particular, the survey article attempts to accomplish the following three specific objectives. Firstly, it attempts to uncover a moderately comprehensive list of generalizations or extensions of metric space that exist in the contemporary literature and classify them into logical categories that could be pedagogically significant. Secondly, it assesses the impacts of selected variants of metric spaces in the realm of fixed point theory vis-a-vis the motivations that necessitated their introduction into fixed point theory: Are fixed point theorems obtained via metric space generalizations genuine generalizations of existing results, as per their claims, or are they mere duplications of previous results? Lastly, the article explores some basic topological properties of selected "generalized" metric spaces and generalized metric characterizations of some topologies.

Generation of Multiple Nonlinear Optical Bistability using GaAsInP Microring Resonator with Three Input Port

Mahdi Bahadoran[1*], Faezeh Pakfetrat[1], Ahmad Fakhrurrazi Ahmad Noorden[2] Zahra Tohidinia[1]

[1]*Department of Physics, Shiraz University of Technology, 31371555, Shiraz, Fars, Iran.*
[2] *Center for Advanced Optoelectronics research (CAPTOR), Kulliyyah of Science, International Islamic University Malaysia, 25200 Kuantan, Pahang, Malaysia.*
E-mail: bahadoran@sutech.ac.ir, pakfetrat.f@gmail.com and fakhrurrazi@iium.edu.my

Abstract: A novel triple-coupler add-drop GaAsInP microring resonator (TCADMR) was introduced and the nonlinear behavior of light through this system was investigated. The optical transfer matrix was derived for a 2×2 asymmetric waveguide coupler using coupled-mode theory. Then the relationships between the light fields propagating inside the ring are calculated. Three sets of optical bright solitons with an increasing amplitude ratio were simultaneously entered in to the TCADMR and a nonlinear ultra-fast on-off switching time of 14.4 ps was realized for a minimum threshold input power as small as 0.37 μW. Achieving a pico-scale optical switching time via a microscale optical track beside, realizing nonlinearity in a microscale input power make the TCADMR as a promising device for future low cost and compact optical switches applicable in biological and photonics systems.

References

[1] Zhao, C.Y. and W.H. Tan, Transmission performance of one waveguide and double micro-ring resonator using 3× 3 optical fiber coupler. Journal of Modern Optics, 2016. 63(17): p. 1726-1733.

[2] Lynch, S., A. Steele, and J. Hoad, Stability analysis of nonlinear optical resonators. Chaos, Solitons & Fractals, 1998. 9(6): p. 935-946.

[3] Sirawattananon, C., et al., Analytical Vernier effects of a PANDA ring resonator for microforce sensing application. Ieee Transactions on Nanotechnology, 2012. 11(4): p. 707-712.

[4] Bahadoran, M., J. Ali, and P.P. Yupapin, Ultrafast all-optical switching using signal flow graph for PANDA resonator. Applied Optics, 2013. 52(12): p. 2866-2873.

[5] Bahadoran, M. and P. Yupapin, All-optical notch filters for ultra-wideband chaotic communications. The European Physical Journal Plus, 2018. 133(11): p. 487.

[6] Li, Y., et al., A memristive chaotic map with only one bifurcation parameter. Nonlinear Dynamics, 2024. 112(5): p. 3869-3886

[7] Wu, H., et al., Bifurcation analysis in liquid crystal elastomer spring self-oscillators under linear light fields. Chaos, Solitons & Fractals, 2024. 181: p. 114587

Load and distance-based sink movement algorithm for network performance improvement in mobile wireless sensor networks with a mobile sink

Louiza Belkhiri-Brahmi[1], Samira Yessad[1] and Fouzi Semchedine[1,2]

[1]*Research Unit LaMOS (Modeling and Optimization of Systems), Faculty of Exact Sciences, Bejaia University, 06000, Bejaia, Algeria;*

[2] *Mechatronics Laboratory (LMETR) - E1764200 Optics and Precision Mechanics Institute, Ferhat Abbas University Setif 1, 19000, Setif, Algeria*

E-mail: louiza.belkhiri@univ-bejaia.dz, samira.yessad@univ-bejaia.dz and fouzi.semcheddine@univ-setif.dz

Abstract: Using sink mobility in wireless sensor networks significantly improves network performance by dynamically adjusting the position of the sink to optimize data collection. By strategically moving the sink according to specific objectives, the network can reduce latency, balance the load, and extend the lifetime of sensor nodes, resulting in more efficient and reliable data transmission. In this work, we propose a load and distance-based sink movement algorithm to determine the trajectory of the sink in a wireless sensor network with a mobile sink. The proposed algorithm uses a matrix distance to guide it to the nearest sojourning points from the most loaded nodes, then uses a function to determine the optimal visiting order between sojourning points. Indeed, our algorithm aims to minimize the hop distance between heavily loaded nodes and the sink, minimize the geometric distance between sojourning points, and prioritize visiting nodes with high packet numbers to deliver. By reducing the number of hops between the burdened nodes and the sink, the energy consumed in transmitting data packets is reduced, the risk of error is minimized, and the probability of successful transmission is maximized. The simulation results show that our algorithm significantly outperforms comparative approaches in terms of network lifetime and packet delivery ratio.

Keywords: 68M10, 94A05, 78M40.

Mathematics Subject Classification: Mobile wireless sensor networks (MWSN), controlled mobility, sink trajectory optimization, load balancing, energy efficiency.

References

[1] Basagni, S.and Carosi, A. and Melachrinoudis, E. and Petrioli, C., and Wang, Z. M. “Controlled sink mobility for prolonging wireless sensor networks lifetime”. Wire. Netw., 14, pp. 831-858, 2008.

[2] Koc M. and Korpeoglu I. , ”Traffic-and energy-load-based sink mobility algorithms for wireless sensor networks”. Int J Sens Netw, 23(4), pp.211–221, 2017.

[3] Mehto A, Verma RK. and Jain S. , ”Efficient trajectory planning and route adjustment strategy for mobile sink in WSN-assisted IoT”. In: 2022 IEEE Region 10 Symposium (TENSYMP), Mumbai, India, 2022.

[4] Wu Z. and Wan G, ”An enhanced ACO-based mobile sink path determination for data gathering in wireless sensor networks”. EURASIP J Wirel Commun Netw, 1, pp. 1–13, 2022.

[5] Belkhiri-Brahmi, L.and Yessad, S. and Semchedine, F. ”Congestion control-based sink MOBility pattern for data gathering optimization in WSN". J Supercomput, 80, pp. 3441–3479, 2024.

Solution of Markov Reward Games Using Convolutional Neural Networks

Murat Özkaya[1,2*] **, Burhaneddin İzgi**[1**]

[1] *Deparment of Mathematical Engineering, Istanbul Technical University, Istanbul, Türkiye*
[2] *Deparment of Business, Çanakkale Onsekiz Mart University, Çanakkale, Türkiye*
E-mail: ozkaya16@itu.edu.tr*, bizgi@itu.edu.tr**

Abstract: In this paper, we present a convolutional neural network architecture designed to solve Markov reward games. This architecture takes the rewards and transition matrix as inputs and provides the optimal strategy for the game. The proposed neural network architecture is trained using 80% of 3000 and 5000 Markov reward games, each featuring 3 actions and 3 states, and is tested utilizing 20% of 3000 and 5000 Markov reward games. The results reveal that the developed architecture can achieve errors of less than 3% in terms of mean square error in the final rewards

Keywords: Game theory; Markov reward games; Artificial neural network; Convolutional neural network

Mathematics Subject Classification: 91Axx, 91A80, 97R40

References

[1] Bellman, R. (1957). A Markovian decision process. Journal of Mathematics and Mechanics, 6(5), 679-684.

[2] Bochenek, B. and Ustrnul, Z. (2022). Machine learning in weather prediction and climate analyses-applications and perspectives. Atmosphere, 13(2), 180.

[3] Chen, S. and He, H. (2018). Stock prediction using convolutional neural network. In IOP Conference series: materials science and engineering 435, 012026).

[4] Chollet, F. (2018) Deep learning with Pyhton. Manning Publications.

[5] Delakis, M. and Garcia, C. (2008, January). Text detection with convolutional neural networks. In International Conference on Computer Vision Theory and Applications, 2, 290-294. SCITEPRESS.

[6] Dynkin, E. B. and Dynkin, E. B. (1965). Markov processes. Springer Berlin Heidelberg.

[7] Fan, J., Xu, W., Wu, Y. and Gong, Y. (2010). Human tracking using convolutional neural networks. IEEE transactions on Neural Networks, 21(10), 1610-1623.

[8] Ghosh, A., Sufian, A., Sultana, F., Chakrabarti, A. and De, D. (2020). Fundamental concepts of convolutional neural network. Recent trends and advances in artificial intelligence and Internet of Things, 519-567.

[9] Goodfellow, I., Bengio, Y. and Courville, A. (2016). Deep learning. MIT press.

[10] Krizhevsky, A., Sutskever, I., & Hinton, G. E. (2012). Imagenet classification with deep convolutional neural networks. Advances in neural information processing systems, 25, 1097-1105.

[11] Guo, T., Dong, J., Li, H. and Gao, Y. (2017). Simple convolutional neural network on image classification. In 2017 IEEE 2nd [1]International Conference on Big Data Analysis (ICBDA) 721-724. IEEE.

[12] Howard, R. A. (1960). Dynamic Programming and Markov Processes. MIT Press & John Wiley and Sons Inc.

[13] İzgi, B., Özkaya, M., Üre, N. K. and Perc, M. (2023). Machine learning driven extended matrix norm method for the solution of large-scale zero-sum matrix games. Journal of Computational Science, 68, 101997.

[14] Ketkar, N., Moolayil, J., Ketkar, N. and Moolayil, J. (2021). Convolutional neural networks. Deep Learning with Python: Learn Best Practices of Deep Learning Models with PyTorch, 197-242.

[15] Lakhani P. and Sundaram B (2017) Deep learning at chest radiography: automated classification of pulmonary tuberculosis by using convolutional neural networks. Radiology 284:574–582

[16] Lawrence, S., Giles, C. L., Tsoi, A. C. and Back, A. D. (1997). Face recognition: A convolutional neural-network approach. IEEE transactions on neural networks, 8(1), 98-113.

[17] Li, Q., Cai, W., Wang, X., Zhou, Y., Feng, D. D. and Chen, M. (2014, December). Medical image classification with convolutional neural network. In 2014 13th international conference on control automation robotics & vision (ICARCV), 844-848. IEEE.

[18] Maes, C. (2015). An introduction to the theory of Markov processes. Mostly for Physics Students, 37.

[19] Meena, G., Mohbey, K. K., Indian, A., Khan, M. Z. and Kumar, S. (2024). Identifying emotions from facial expressions using a deep convolutional neural network-based approach. Multimedia Tools and Applications, 83(6), 15711-15732.

[20] Puterman, M. L. (2014). Markov Decision Processes: Discrete Stochastic Dynamic Programming. John Wiley & Sons.

[21] Rawat, W. and Wang, Z. (2017). Deep convolutional neural networks for image classification: A comprehensive review. Neural computation, 29(9), 2352-2449.

[22] Szarvas, M., Yoshizawa, A., Yamamoto, M. and Ogata, J. (2005). Pedestrian detection with convolutional neural networks. In IEEE Proceedings. Intelligent Vehicles Symposium, 2005, 224-229. IEEE.

[23] Ting, F. F., Tan, Y. J. and Sim, K. S. (2019). Convolutional neural network improvement for breast cancer classification. Expert Systems with Applications, 120, 103-115.

[24] Traore, B. B., Kamsu-Foguem, B. and Tangara, F. (2018). Deep convolution neural network for image recognition. Ecological informatics, 48, 257-268.

[25] Wang, W., Yang, Y., Wang, X., Wang, W. and Li, J. (2019). Development of convolutional neural network and its application in image classification: a survey. Optical Engineering, 58(4), 040901-040901.

[26] Wu, J. and Zhao, Y. (2019). Machine learning technology in the application of genome analysis: A systematic review. Gene, 705, 149-156.

Statistical Proprieties and Modeling of Lifetime Data under Exponential Geometric Pareto Distribution

Lallouche Abdallah

Department of mathematics, University of SKIKDA, ALGERIA
E-mail: a.lallouche@univ-skikda.dz

Abstract: Statistical distributions plays a vital role in modeling lifetime data that arise in different fields of science such as in Survival analysis, Economics, Biology, Engineering, and in some other applied field of sciences. There are many lifetime probability distributions that can be used to model the data under exponential family distributions, for example, Exponential-Geometric –Pareto distribution are among others. The main objective of this work is to achieve maximum flexibility while modeling the lifetime data. We firstly evaluate the Akaike and Bayesian information criteria for our distributions and different statistical properties. The maximum-likelihood estimators of the models parameters are obtained. Then we will try to apply our proposed distributions to real data sets for comparative study.

Keywords: Exponential- Poisson -Weibull distribution, Bayesian information criteria, maximum likelihood, lifetime data.

References

[1] Zakerzadeh, H. and Dolati, A. (2009): Generalized Lindley distribution, Journal of Mathematical extension, 3 (2), 13 – 25.

[2] Shanker, R. and Mishra, A. (2013): A Quasi Lindley Distribution, African Journal of Mathematics and Computer Science Research (AJMCSR), 6 (4), 64 – 71.

[3] Gupta, R.D. and Kundu, D. (1999): Generalized Exponential Distribution, Austalian & New Zealand Journal of Statistics, 41(2), 173 – 188.

[4] Shanker, R. and Mishra, A. (2016): A quasi Poisson-Lindley distribution, Journal of Indian Statistical Association, 54 (1&2), 113 – 125.

Nonlocal and Nonclassical Properties of a System of Four-Level Atom Interacting with Parity Deformed field

Sayed Abdel-Khalek[1,2], M. Algarni [3], K. Berrada[4]

[1] *Department of Mathematics and Statistics, College of Science, Taif University, PO Box 11099, Taif 21944, Saudi Arabia; sabotalb@tu.edu.sa*

[2] *Department of Mathematics, Faculty of Science, Sohag University, 82524 Sohag, Egypt; sayedquantum@yahoo.co.uk*

[3] *Department of Mathematical Sciences, College of Science, Princess Nourah bint Abdulrahman University, P.O. Box 84428, Riyadh, 11671, Saudi Arabia*

[4] *Department of Physics, College of Science, Imam Mohammad Ibn Saud Islamic University (IMSIU), Riyadh, Saudi Arabia*

E-mail: sabotalb@tu.edu.sa, sayedquantum@yahoo.co.uk

Abstract: In this article, we present a model of a four-level atom (F–LA) interacting with a field mode initially defined in a parity deformed field (PD-F). We consider for-level atom initially in the upper states and display the quantum dynamics of the mathematical system with the solution of the motion equation. We display the dynamical behavior of fundamental quantum resources that are considered in different tasks of quantum optics and information including the atomic population inversion, F–LA with PD-F entanglement, P–BF photon statistics with respect to the parameter values of the proposed model. In this context, we show how the quantum resources are influenced by the different parameters of the PD-F and time-dependent coupling. Finally, we illustrate the dynamical relationship among the quantum resources of the quantum mathematical system.

Keywords: Four-Level Atom, Parity Deformed field, Quantum properties, Entanglement, Photon Statistics.

References

[1] S Abdel-Khalek, AA Mousa, TA Nofal, Dynamic properties of Wehrl information entropy and Wehrl phase distribution for a moving four-level atom. Journal of Russian Laser Research 33, 547-558 (2012)

[2] M Algarni, K Berrada, S Abdel-Khalek, H Eleuch. Parity deformed tavis-cummings model: Entanglement, parameter estimation and statistical properties. Mathematics 10 (17), 3051 (2022)

[3] S Abdel-Khalek, EM Khalil, AB Alruqi, MA Althomali. Evolution of the entanglement, photon statistics and quantum fisher information of a single qubit parity deformed JCM, Optical and Quantum Electronics 55 (2), 161 (2023)

[4] S Almalki, K Berrada, S Abdel-Khalek, H Eleuch. Interaction of a four-level atom with a quantized field in the presence of a nonlinear Kerr medium. Scientific Reports 14 (1), 1141 (2024)

Using Machine Learning Intelligence for analyzing Insights in Blood diseases Medical Data

Azhari Mohamed

Saudi Arabia
E-mail: azharielhagn@gmail.com

Abstract: The objective of this research is to examine the notable challenges related to the profiling of Blood diseases, a globally prevalent disease with substantial health consequences. The relevance of the problem we are addressing becomes more apparent when considering the limitations of current diagnostic methods, which often suffer from deficiencies in terms of accuracy, speed, and customization. Given the aforementioned knowledge, there is a reconsideration of the Blood disease profiling process, aided by the utilization of a machine learning approach called artificial intelligence. The objective of our study is to have a significant impact on the diagnosis of Blood diseases, the selection of treatment modalities, and the delivery of patient care. In order to accomplish this objective, our approach entails leveraging diverse and extensive datasets, employing computational techniques, and scrutinizing intricate patterns. The importance of this program extends beyond the realm of Blood diseases research, with broader implications for healthcare methodology, patient well-being, and the utilization of advanced technologies to tackle pressing healthcare concerns. With the aim of showcasing a strong commitment to enhancing healthcare and the quantifiable influence it exerts on those affected by Blood diseases.The objective of this research endeavor is to establish the foundation for a prospective future wherein innovative technical advancements facilitate a transformative change in the domain of Blood diseases research, ultimately resulting in enhanced patient outcomes.

Keywords: Blood diseases, analyzing, Medical Data, Machine Learning, enhancing healthcare,scrutinizing intricate patterns.

ISBN: 978-605-69181-8-6