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FOREWORD & ACKNOWLEDGEMENTS

It is with immense pleasure and profound honor that we extend our warmest welcome to all participants, esteemed colleagues, and distinguished guests to the 6th Edition of the **International Conference on Research in Applied Mathematics and Computer Science** (ICRAMCS 2024). Hosted by the Laboratory of Mathematics and Population Dynamics (LMPD) at the Faculty of Sciences Semlalia-Marrakech (FSSM), Cadi Ayyad University, Morocco, this conference stands as a testament to the enduring commitment of our institution to foster excellence in interdisciplinary research and scholarly collaboration.

We express our deepest gratitude to all those who have contributed to the realization of this momentous event. Firstly, we extend our heartfelt appreciation to the organizing committee whose dedication, diligence, and unwavering commitment have been instrumental in shaping this conference into a resounding success. Their tireless efforts in curating a stimulating program and ensuring seamless logistical arrangements reflect their profound passion for advancing the frontiers of knowledge in applied mathematics and computer science.

Furthermore, we extend our sincere thanks to our esteemed keynote speakers, Prof. Mohamed Amine KHAMSI, Prof. Abdelaziz RHANDI, and Prof. Abdessamad TRIDANE, whose expertise, insights, and scholarly contributions enrich the academic discourse and inspire our community of researchers and scholars.

We are also deeply indebted to the scientific committee for their rigorous review and selection of papers, ensuring the highest standards of academic excellence and scholarly rigor. The opportunity for selected papers to be published in journals indexed by Scopus and/or Web of Science underscores the significance and impact of the research presented at ICRAMCS 2024, further solidifying its reputation as a premier international forum for intellectual exchange and collaboration.

Moreover, we extend our gratitude to our esteemed partners and sponsors for their generous support and invaluable contributions, without which this conference would not have been possible. Their unwavering commitment to promoting academic excellence and fostering international collaboration underscores the transformative power of collective endeavor in advancing scientific inquiry and innovation.

Last but not least, we express our heartfelt appreciation to all participants, both in person and virtually, for their active engagement, scholarly contributions, and unwavering enthusiasm. Your presence and participation enrich the conference experience, facilitating vibrant discussions, interdisciplinary dialogue, and the exchange of novel ideas and perspectives.

In conclusion, we extend our warmest wishes for a fruitful and enriching conference experience. May ICRAMCS 2024 serve as a catalyst for new collaborations, groundbreaking discoveries, and transformative insights, furthering our collective endeavor to harness the potential of applied mathematics and computer science in addressing the complex challenges of our time.

Sincerely,

On behalf of the Organizing Committee of ICRAMCS 2024
Prof. Youssef EL FOUTAYENI
LMDP Laboratory
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April 25-26-27, 2024 | Marrakech, Morocco

Systemic Risk Transmission within the Moroccan Banking Sector

Communication Info

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Keywords:
(1) Systemic risk
(2) Contagion effects
(3) Morocco's banking system

Abstract

With successive financial crises, the banking sector's vulnerability to systemic risk has become increasingly apparent. This study utilizes the Conditional Value at Risk (CoVaR) [1], calibrated through the application of Quantile Regression Neural Network (QRNN) [2], to examine the evolution of systemic risk within Morocco's banking industry. The research reveals a significant surge in systemic risk during the Subprime and Covid-19 crises. Furthermore, this investigation identifies key Global Systemically Important Banks (G-SIBs) within the Moroccan banking system. These findings provide valuable insights for regulators tasked with formulating policies to effectively mitigate systemic risk in Morocco's banking sector.

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Inference statistic for periodic regression mode

Communication Info

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Keywords:
(1) Periodic multiple regression model
(2) adaptive estimation method
(3) uniform local asymptotic normality

Abstract

Two main problems will be examined in this article: Firstly, testing the absence of periodicity of parameters in short panels of the multiple regression model by proposing locally and asymptotically optimal parametric and non-parametric tests. Secondly, we estimate the periodic multiple regression parameters using the adaptive estimation method. The construction of the locally asymptotically minimax estimator allows us to derive the adaptive estimator of the periodic multiple regression model. The simulation results show that all tests are appropriate, the Gaussian test is not valid under asymmetric density, and the adaptive method outperforms the least square method. We applied the periodic multiple regression model to real data. For all these data, the periodic regression model outperforms the classical regression and random regression models.

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Asian option pricing by Monte Carlo methods

Communication Info

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Keywords:
(1) Control variables
(2) Financial option
(3) Monte Carlo methods

Abstract

Monte Carlo methods have been experimentally proved to be useful in many different kinds of high-dimensional mathematical and physical problems. Their importance can be seen in financial mathematics, especially for option pricing. There are many different variance reduction approaches, such as quasi-Monte Carlo, stratification methods. In this paper we discuss the control variable method for calculating the call asian option and compare the results with the classical Monte carlo methods, we use the geometric averaging as control variable to estimate Asian call option under the arithmetic averaging, the confidence interval will be significantly reduced after using this method, we conclude that the Asian call option under geometric averaging is less than one using arithmetic averaging.

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Inflation et Taux Directeur : À la Recherche d'une Relation Existe-t-elle?"

Communication Info

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Keywords:
(1) Taux directeur
(2) L'inflation

Abstract

Cette recherche cherche à déterminer si une relation significative existe entre l'inflation et le taux directeur, en intégrant des approches théoriques et empiriques.
[1] volet a évalué l'association entre les taux d'intérêt et l'inflation dans le cas du Ghana entre 2007 et 2013, en utilisant des données mensuelles et trimestrielles, [2] a exploré la relation à long terme, montrant que le taux de croissance de l'inflation, et non l'écart entre les taux réel et naturel, joue un rôle déterminant, tout en calculant le taux naturel moyen.
Les conclusions visent à enrichir notre compréhension de la dynamique entre ces deux variables clés, avec des implications potentielles pour les marchés financiers.

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Pricing and hedging game options in an imperfect market with default: A doubly reflected BSDEs approach

Communication Info

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Keywords:
(1) Doubly reflected BSDEs
(2) Game options
(2) Default time
(3) Stochastic Lipchitz coefficient
(4) Imperfect markets with default

Abstract

Game options, also known as game contingent claims, constitute a type of Dynkin game in finance, initially introduced by Kifer [1] in the context of a perfect market, where the author provided fair pricing for the option as well as hedging strategies for the issuer, considering both Cox-Ross-Rubinstein and a Black-Scholes models for discrete and continuous time, respectively. Following this work, several studies have explored this area of research, drawing upon the theory of doubly reflected backward stochastic differential equations (DRBSDEs) to address pricing and hedging problems in financial derivatives [2, 3, 4, 5].

This communication aims to present the connection between a class of DRBSDEs with two completely separated barriers under a stochastic Lipschitz coefficient and the pricing and hedging problems associated with generalized game options in an imperfect market model with default risk. In this model, market noise is driven by a standard Brownian motion and a random time τ, referred to as a default time. The criterion for the game is expressed in terms of a non-linear expectation.

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A TOPSIS based framework for ethical performance calculation of (SRI) portfolios

Communication Info

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Keywords:
SRI
Closeness coefficient
g-TOPSIS

Abstract

This work explores the integration of ethical performance in the decision making process for the optimization of socially responsible investment portfolios (SRI). It aims to develop a framework based on the TOPSIS method to calculate the ethical performance of given portfolios.
By using the concept of closeness coefficient related to the TOPSIS method, the proposed framework considers it as the ethical score and especially as a function of separation measures.
Numerical simulations with different functions have been run on the basis of data of companies quoted on the Moroccan stock market. We conclude with a discussion and comparison with other methods.

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The Contribution of Stochastic Modeling to Applied Economics: A Review and Application

Communication Info

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Keywords:
(1) Economic models
(2) Stochastic Differential Equations (SDEs)
(3) CRRA preferences
(4) Stability analysis

Abstract

This study aims to review some of recent works showing the contribution of continuous-time stochastic models to the development of economic theory [4].
By extending traditional economic models, researchers introduce the notion of random diffusion to rely on unexpected observations [1].
As an illustrative example, we investigate the quantitative properties and stability of stochastic economic growth models driven by Gaussian-diffusion processes (see for instance [3, 5]).
In our production model, by assuming a Constant Relative Risk Aversion (CRRA) type utility function [2], the uncertainty is driven by a Geometric Brownian motion. The resulting closed-form solution optimizes the utility of the agent's intertemporal consumption, leading to a balanced growth path.

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Computational analysis in non-homogeneous Vasicek diffusion process: application

Communication Info

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Keywords:
(1) Non-homogeneous Vasicek diffusion process
(2) Statistical inference
(3)CO2 emission in Arab world

Abstract

In this paper, we study a new stochastic model, based on a Vasicek non-homogeneous diffusion process, which is used in various contexts. We first establish the probabilistic characteristics of the model, such as the analytical expression solution to Itô stochastic differential equation, after which we determine the trend functions (conditioned and non-conditioned), the maximum likelihood estimators of the parameters of the model and the computational of the statistical inference that may arise. Finally, to evaluate the capability of this process for modeling real data, we applied the stochastic Vasicek non-homogeneous diffusion process to study the emissions of CO2 in Arab world.

The Vasicek non-homogeneous model considered is the one dimensional process $\{x(t), t \in [t_1, T]\}$ that has values in$\mathbb{R}$.

$$dx(t) = \left(a - \frac{h\acute{(t)}}{h(t)}x(t)\right) \; dt + \sigma dw(t) \; dt$$

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Outliers and GARCH models in financial data

Communication Info

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Keywords:
(1) GARCH
(2) Volatily
(3) Extreme value
(1) Outliers
(1) Machine learning

Abstract

The presence of extreme observations, or outliers, poses a significant challenge to traditional statistical methods due to their potential distortion on model estimation and forecasting accuracy [6]. To address these concerns, we propose a new approach that maintains the flexibility and predictive power of the GARCH model while incorporating robust techniques to identify and handle outliers [1].

Our methodology involves two main components. Firstly, we use different outlier detection algorithms such as Local Outlier Factor, One-Class SVM, and LSTM autoencoder, suitable to handle complex and large-scale datasets [5]. Secondly, we develop a hybrid GARCH framework by integrating robust estimators such as BM-estimator [4] and the detection-correction method using complex distributions with the standard GARCH specifications [3]. This combination allows us to capture the inherently dynamic volatility structure in financial markets while mitigating the impact of outlying events [2].

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Intuitionistic fuzzy evolution problem with non-local condition

Communication Info

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Keywords:
(1) Generalized intuitionistic fuzzy Caputo derivative
(2) Intuitionistic fuzzy fractional evolution problem
(3) Intuitionistic fuzzy semi-group
(4) Mean-square calculus

Abstract

In this manuscript, we will study the existence and uniqueness of the solution of the intuitionistic fuzzy evolution problem with non-local conditions under a generalized derivative of Caputo of order $0 < q < 1$, using the intuitionistic fuzzy semi-group and the notion of the contraction of application.

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Dynamic Portfolio Optimization Using Graph Theory

Communication Info

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Keywords:
(1) Dynamic portfolio optimization
(2) Morrocan stock exchange market
(3) Graph theory

Abstract

The Portfolio optimization is a pertinent topic that requires significant attention in financial literature. During the portfolio construction, an investor faces two crucial steps: portfolio selection and portfolio allocation [1]. This article aims to investigate dynamic portfolio optimization based on the Triangulated Maximally Filtered Graph (TMFG) method applied to the Moroccan All Shares Index (MASI) historical stock log-returns, covering the period from January 2, 2013, to October 27, 2022, allowing the construction of the TMFG-Portfolio [2]. Portfolio selection for the TMFG-Portfolio was conducted using the Degree Centrality (DC) measure, and portfolio allocation was carried out through the use of the Inverse Degree Centrality Portfolio (IDCP). The obtained portfolios were compared with the Minimum Variance Portfolio (MV Portfolio) and Equal Weighting Portfolio (EW Portfolio) using centrality measures, diversification, and backtesting [3] [4]. According to the indicators used in the analysis, the TMFG-Portfolio is the most performing and robust portfolio, demonstrating good performance even during the Covid-19 crisis and ensuring a high level of diversification. The findings suggest that the proposed method can enhance portfolio performance, providing valuable insights for investors or active managers when optimizing their portfolios [5].

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Common fixed point for a pair of multi-valued mappings satisfying an implicit relation in extended b−metric spaces with application to an integral equation.

Communication Info

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Keywords:
(1) Fixed point
(2) Extended b-metric space
(3) Implicit relation
(4) Integral equation

Abstract

Our objective is to prove a general fixed point theorem for a pair of multi-valued mappings satisfying a new type of implicit relation in extended b−metric spaces. The results in this paper generalize the results obtained in [1], [2] and to obtain other particular results with application to an integral equation.

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Impact of Wind Speed and Temperature on Fishermen's Profit Maximization

Communication Info

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Keywords:
(1) Profit maximization
(2) Markov chain

Abstract

In this study, we explore the impact of wind speed [3] and temperature [1] on profit optimization within the dual-fishermen exploitation of tritrophic prey-predator fish ecosystems. Recognizing both wind speed and temperature as influential external parameters, our bioeconomic model emphasizes their combined effects on profit maximization for two distinct fishing actors. Grounded in the Nash Equilibrium framework [2], we propose that optimal outcomes arise when each participant steadfastly adheres to their respective strategies. Employing a Python-driven Markov chain methodology, we anticipate future wind and temperature states based on current conditions and inherent transition probabilities. Preliminary findings indicate a significant correlation between variations in wind speed and temperature and the economic viability of fishing ventures. This research advocates for the integration of advanced computational methodologies, such as Python and Markov chains, in fisheries management.

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Analyse du risque crédit : Les ratios déterminants à la prise de décision

Communication Info

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Keywords:
Défaillance
Risque crédit
Ratios
Scoring

Abstract

Cette étude se concentre sur l'étude des facteurs qui influencent le refus de crédit par les banques, dans le but d'améliorer la compréhension des mécanismes de prise de décision en matière d'octroi de crédit.
Le refus de crédit est une mesure adoptée par les banques pour réduire le risque en évitant d'accorder des prêts à des clients qui présentent un risque élevé de non-remboursement.
L'évaluation du risque de crédit implique une classification précise des clients en bons et mauvais débiteurs.
Cette étude vise à identifier les facteurs les plus influents sur la solvabilité des entreprises tout en éliminant les facteurs redondants, en utilisant l'analyse discriminante sur une base de données de 60 entreprises au Maroc, dont 20 sont financièrement saines et 40 rencontrent des difficultés, l'objectif est d'évaluer et de prédire le risque de défaut de crédit.

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Review on freedom concept, and Mathematical aspects of comparing sets.

Communication Info

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Keywords:
(1) Market freedom
(2) Economic freedom
(3) Comparing sets

Abstract

Freedom is one of the most important human concepts; After life there is freedom. Therefore, we cannot exclude its intrinsic value to classify and evaluate one situation as better than another. This paper is concerned on freedom definition from various aspects, and mathematical concepts of comparing two sets including the axioms that have been proposed in the literature on measuring freedom. We start by defining freedom in the most widespread religions, UDHR, philosophy, economics, Amartya Sen perspective of individual freedom, especially the opportunity aspect. Then, we work in axiomatic examination that have been proposed in the literature on 'measuring freedom' through examples. Finally, we discuss to add some conditions to strengthen some axioms, and end by judging on the ideal axiom for us to compare two sets under freedom concept.

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ICRAMCS 2024

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QML estimation for near integrated stochastic volatility models

Communication Info

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Keywords:
(1) SV
(2) Kalman filter
(3) QML

Abstract

Stochastic volatility (SV) models are an alternative approach for financial modeling. In the so-called SV models, the volatility of financial returns is treated as a latent autoregressive process.
The SV model literature refers to various approaches that have been developed for estimating SV model parameters. These include the Generalized method of moments (GMM) [6,1,2], Bayesian MCMC methods [4,5] and the Quasi-Maximum likelihood (QML) [3]. This last one is combined with the Kalman filter under the condition of stationarity of the volatility and proves to be computationally efficient. However, the volatility of many economic and financial time series displays persistent changes and possible non-stationarity. In this case, we speak of a "near-integrated process". Consequently, the Kalman filter is no longer applicable, as the initial conditions do not hold. We therefore propose an improvement and extension of QML estimation using a diffuse Kalman filter in order to estimate near-integrated SV models in presence of hight volatiliy persistence.

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L'impact de la COVID-19 sur les transferts des MRE : une approche ARIMA.

Communication Info

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Mots-clés :
(1) ARIMA
(2) Propriétés cycliques
(3) Transferts de fonds
(4) Covid-19
(5) MRE
(6) Enquête HCP

Résumé

La crise de la COVID-19 se distingue par sa nature. Initialement émergée en tant que crise sanitaire, elle a rapidement évolué vers une crise économique qui impacte les flux financiers. Dans ce contexte, tous les pays ont adopté différentes initiatives pour atténuer ces conséquences. Le Maroc, loin d'être une exception, a pris toutes les mesures nécessaires pour protéger son économie et renforcer sa résilience. En outre les transferts d'argent effectués par les marocain résidant à l'étranger (MRE) ont fait preuve d'une résilience remarquable, même face à une récession mondiale sans précédent déclenchée par la pandémie. L'objectif de cette communication est de dresser un bilan en se fondant sur les données d'une enquête menée par le HCP, puis d'examiner les propriétés cycliques des transferts de fonds vers le Maroc et analyser la dynamique des envois de fonds à travers le cycle économique et leur capacité à agir comme un stabilisateur pendant les périodes de volatilité économique accrue. Ensuite nous examinerons l'impact potentiel de la crise sanitaire sur les transferts en utilisant une modélisation économétrique prédictive basée sur des données allant de 2004 à 2019.

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Analyse du comportement de valeur liquidative des OPCVM monétaires

Communication Info

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Keywords:
(1) OPCVM MONETAIRE 1
(2) MEDAF 2
(3) VALEUR LIQUIDATIF 3

Abstract

Dans cette étude, nous analysons le comportement de la valeur liquidative des fonds communs de placement du marché monétaire à l'aide du modèle de marché et du modèle de tarification des actifs financiers (MEDAF). Grâce à un traitement approfondi de la base de données, nous appliquons L'équation du CAPM est donnée par :

$$E(R_i)=R_f+\beta_i\times(E(R_m)-R_f)$$

Pour estimer les rendements attendus des fonds communs de placement monétaires, en tenant compte à la fois du risque systématique et du risque spécifique de chaque actif. De plus, nous utilisons des ratios financiers tels que le ratio de Sharpe, le ratio de Treynor et le coefficient de variation moyen (MCV) pour évaluer la performance relative des fonds communs de placement du marché monétaire.

Nos résultats donnent le possible de classer les fonds communs de placement monétaire en fonction de leur attractivité en tant qu'investissements, ce qui permet de repérer les fonds qui offrent les meilleures opportunités de rendement adaptées au risque. Les investisseurs qui souhaitent répartir de manière optimale leurs fonds au sein des fonds communs de placement du marché monétaire peuvent bénéficier de cette analyse précieuse.

Cette étude apporte une contribution à la recherche sur la gestion de portefeuille en offrant des données quantitatives sur le comportement des fonds communs de placement sur le marché monétaire et en mettant en évidence l'adéquation des modèles financiers traditionnels dans ce contexte particulier.

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ICRAMCS 2024

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

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Modeling the adoption of Artificial Intelligence by Gompertz diffusion process

Communication Info

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Keywords:
(1) Gompertz diffusion model
(2) Metaheuristic method
(3) AI adoption

Abstract

This study introduces a stochastic Gompertz diffusion model [3]. To begin with, we establish the probabilistic properties of this model, including solving the stochastic differential equation (SDE), determining the probability transition density function and its distribution, as well as defining moment functions. Next, we address the parameter estimation problem using the maximum likelihood method, resulting in a nonlinear equation solvable through a metaheuristic method namely the crow search algorithm [1]. Finally, we conduct simulation studies to assess the performance of the proposed approach. Then we fit the model to the adoption of Artificial intelligence (AI) applications [2].

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Mathematical modelling of image registration problems using Nash game approach

Communication Info

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Keywords:
(1) Image Registration
(2) Inverse Problem
(3) Nash Game theory

Abstract

In medical imaging, the image registration problem is an essential tool in diagnosis and surgery planning, which seeks to find pointwise correspondences between two or more images. This paper addresses the problem of image registration solved in the Nash game approach. The problem is formulated as a two-player static game of complete information.
the first player is associated with the sum of squared differences (SSD) as the similarity measures while the other one is with the normalized gradient differences (NGD) as a second similarity measure. In the numerical simulations, we prove the efficiency of the proposed model, compared with some well-known models in literature.

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Forecasting the volatility of time series using machine learning algorithms

Communication Info

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Keywords:
(1) Volatility Forecasting
(2) Machine Learning
(3) GARCH models

Abstract

Volatility forecasting is a crucial tool used across diverse fields, including finance, logistics and economic planning. It enables informed decision-making, risk reduction, and resource optimization, significantly impacting financial performance, economic stability, and public safety.
Volatility is not an easy phenomenon to predict or forecast. Volatility plays a crucial role in determining the risk and potential return of an investment, making it a key factor in financial decision making.
This study compares classical volatility forecasting models (ARCH, GARCH, EGARCH, GJR GARCH) for S&P500, Nasdaq and Bitcoin using Yahoo Finance data (Jan 2012 – Jan2023). The research enhances understanding of volatility dynamics, offering insights for investors and analysts, and informing decision-making in volatile markets.

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Physics-informed neural networks framework for solving economic growth models

Communication Info

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Keywords:
(1) Physics-Informed Neural Networks (PINNs)
(2) Deep learning
(3) Solow Growth Model
(4) Partial Differential Equations (PDEs)

Abstract

Physics-informed neural networks (PINNs) [2,3] are a novel deep learning paradigm primed for solving forward and inverse problems of nonlinear partial differential equations (PDEs). By embedding physical information delineated by PDEs in feedforward neural networks, PINNs are trained as surrogate models for approximate solutions to the PDEs without the need of label data.

Our goal is to use the PINN method to solve the Solow (RCK model) economic growth model represented by a system of two differential equations. The Solow model [4] tries to explain the dynamics of long-term growth of an economy [1], as a result of changes in capital accumulation, labor growth, and technological progress. Our algorithm is based on PINNs, which embed different types of partial differential equations into a loss function using automatic differentiation, and then the neural networks are trained by minimizing this loss. Numerical results for different control parameters.

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New Predictive Modeling in Financial Markets using Nonlinear Time Series and Deep Learning Models

Communication Info

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Keywords:
(1) Financial markets
(2) Predictive modeling
(3) Bilinear models
(4) ARIMA
(5) LSTM networks

Abstract

This work presents a comparative study of predictive modeling techniques in the context of financial markets, with a focus on the Moroccan market. The study aims to assess the performance of three different approaches: Bilinear models, linear ARIMA, and Long Short-Term Memory (LSTM) networks. Predictive modeling plays a crucial role in understanding and forecasting market behavior, enabling informed decision-making for investors, policymakers, and financial institutions.
In this research, we utilize historical financial data spanning post-COVID to train and evaluate the predictive models. The Bilinear model, a relatively novel approach in financial forecasting time series, is compared against the traditional linear ARIMA model and the advanced LSTM neural network. Our methodology involves preprocessing the data, which includes normalization and feature engineering, to ensure compatibility with each modeling technique. We then train the models using historical market data and evaluate their performance using various metrics such as Mean Absolute Error (MAE), Root Mean Square Error (RMSE), and the accuracy of directional forecasts, etc. The results provide insights into the effectiveness of each approach in capturing the dynamics of the Moroccan financial market. We discuss the strengths and limitations of each model, highlighting areas where specific techniques outperform others. This research contributes to the growing body of knowledge on predictive modeling in financial markets, offering valuable insights for practitioners and researchers. The findings have implications for portfolio management, risk assessment, and decision support systems in the context of the Moroccan financial ecosystem.

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THE SIXTH EDITION OF THE INTERNATIONAL CONFERENCE ON RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
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Etude de l'impact des événements internationaux sur un ensemble d'actifs financiers

Communication Info

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Keywords:
(1) Evénement
(2) Impact
(3) Actif Financier
(4) Efficience du marché
(5) Estimation

Abstract

Cet article présente une méthodologie d'étude d'événements en finance pour mesurer l'impact sur le marché des actions et évaluer les réactions des entreprises. Le projet applique cette méthodologie à un portefeuille incluant JP Morgan Chase, NIKE, FedEx, Walmart, Coca-Cola, et Renault en lien avec la guerre en Ukraine, en utilisant des concepts de Borusyak et al. [1]. Les fondements théoriques s'appuient sur des travaux de référence tels que Campbell et al. [2] en économétrie des marchés financiers, la thèse de Bacmann [3] sur l'analyse d'événements, et les contributions de Lo [4] sur l'estimation par maximum de vraisemblance de processus stochastiques. Cette recherche s'intègre dans la finance d'entreprise, ancrée dans le Handbook of Corporate Finance [5], fournissant une perspective approfondie sur les mécanismes des réactions du marché aux événements.

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Hybrid and Singular Approaches for Modeling Moroccan index: A Fusion of Statistical and Machine Learning Methods

Communication Info

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Keywords:
(1) Stock Market
(2) Modeling
(3) Forecasting
(4) Hybrid models
(5) Classical models
(6) Machine learning
(7) Deep Learning

Abstract

Investors, traders, and decision-makers in the financial market are increasingly utilizing modern digital technologies to refine their strategies. Despite these advancements, the stock market faces challenges due to external factors that impact its fluctuations. Various approaches, ranging from traditional statistical methods to advanced machine learning (ML) techniques, are used for predicting stock prices. This study aims to develop models specifically for forecasting the daily price of the Moroccan all-share index (MASI). Our methodology involves the introduction of novel hybrid models for the stock market, such as SVR-XGBoost, MLP-XGBoost, and LSTM-XGBoost. In this study, the sector index is included as an endogenous variable. In the comparative analysis, we compare our proposed models with classical ARIMAX models and established ML models, including Support Vector Regression (SVR), XGBoost, backtesting XGBoost, as well as deep learning models like Multilayer Perceptron (MLP) and Long Short-Term Memory (LSTM). Additionally, we utilize backtesting and the bootstrap interval of the forecast. The results demonstrate that the hybrid model achieves the highest accuracy.

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Application of machine learning to improve numerical solutions of Black-Scholes equation

Communication Info

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Keywords:
Black-Scholes
Machine learning
Numerical solution

Abstract

Artificial intelligence, and in particular machine learning, have recently made it possible to improve the performance of numerical solutions of complex differential equations.
The algorithms we are working on are based on the development of neural networks, and are implemented in the Python language.
Various methods of solving with machine learning exist, and we have studied two of them: using a black-box differential equation solver [1] and Laguerre polynomials approximation [2]. The results obtained are a significant improvement in accuracy and computation speed.
This new approach is important because it marks a turning point in the approach to solving complex differential equations, and the results offer promising prospects for applications. Particularly for the numerical solutions of the Black-Scholes equation which presents many challenges.

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ICRAMCS 2024

THE SIXTH EDITION OF THE INTERNATIONAL CONFERENCE ON RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
April 25-26-27, 2024 | Marrakech, Morocco

Reinforcement learning application in portfolio optimization: A Comprehensive Literature

Communication Info

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Keywords:
(1) Reinforcement Learning
(2) Deep Learning
(3) Finance
(4) Artificial Intelligence
(5) Portfolio Optimization

Abstract

Portfolio optimization has been studied roughly with the emergence of artificial intelligence and data. Traditionally, financial market researchers have used modern portfolio theory to optimize portfolios. However, with the recent development of artificial intelligence, attempts to optimize portfolios with machine learning and especially deep learning and reinforcement learning are increasing. Many studies have been undertaken to create reinforcement learning and deep reinforcement learning algorithms for portfolio optimization. In fact, many researchers have successfully used reinforcement learning to train an intelligent agent that learns profitable trading strategies from financial market data. In this paper, our aim is to review the research advances made in the application of reinforcement learning and deep reinforcement learning in information-based decision-making in financial industries and specifically in portfolio optimization. Therefore, it is crucial to understand the major components of a reinforcement learning algorithm as well as the variety of methods and their related terminology. First, we will tackle briefly the terminologies used in the field of portfolio optimization and reinforcement learning. Then, we provide an overview of the current research methods used for portfolio optimization while analyzing their results and their limitations. This overview will give perspective for future research.

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April 25-26-27, 2024 | Marrakech, Morocco

Application of Artificial Intelligence in Banking Industry Services

Communication Info

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Keywords:
(1) Artificial Intelligence,
(2) Risk Management
(3) Capital Markets

Abstract

This paper discusses to what extent the artificial intelligence is used in the capital markets industry services, more specifically in risk management units[1] [2], and how this technology has impacted the operational performance of these banking departments [3] by emphasizing examples of business cases. It also reviews the current use of GenAI technology across the banking industry. The paper highlights as well the need for research in robustness, interpretability, the quantitative capabilities [4], and ethical considerations to ensure responsible use of GenAI technology in finance [5].

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Numerical methods and algorithms in pricing options: application to the de-Americanization of options with Neural Network (NN) approach.

Communication Info

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Keywords:
(1) American-style options
(2) fast calibration
(3) Neural network
(4) Volatility models

Abstract

De-Americanization of American options is a method used in finance industry to simplify the calibration of derivative models. The main benefits of this approach are reduction of computational cost, relative ease of Implementation and Accuracy in delivering pseudo-European option prices from American option market prices. There are several methods for calibrating American options, each with its own strengths and weaknesses. Among these methods, we can cite Free-Boundary Partial Differential Equation (PDE) Methods, Tree Methods, Least-Squares Monte Carlo (LSMC) Methods, Neural Network De-Americanization, and Local Volatility Models. In this work, we will focus on the Neural network (NN) de-Americanization recent approach. De-Americanization of American options is a process that involves Simplification, Transformation, Calibration and Determination of Model Parameters: The calibrated model parameters are then used to price other derivative products.

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Study of long memory and asymmetric volatility in a GARCH model with time-varying transition probability: ARFIMA-TVTP-MSGARCH model.

Communication Info

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Keywords:
(1) Leverage effect
(2) long memory
(3) Volatility,
(4) Switching regime
(5) Time varing transition probabilities

Abstract

The financial market is an ecosystem characterized by great complexity reflecting the dynamic interactions between various economic actors and factors. In this context, the study of the dynamics of return and volatility is of great importance in clarifying the decision-making process of investors and speculators. The objective of this study is to capture the non-linear nature of financial market behavior by exploring the phenomena of persistence of information at the level of return [1], [2] and the asymmetry of shocks on volatility. The second level of nonlinearity is to carry out this exploration in a Markovian regime change model [3] while allowing the transition probabilities to vary over time[4]. To be able to take into account this non-linearity and its stylized facts, we adopt an ARFIMA-TVTP-MSGARCH model [5] to demonstrate informational inefficiency and leverage in different market states.

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Optimal investment model of pension funds applied to the Moroccan pension

Communication Info

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Keywords:
(1) pension fund
(2) modeling
(3) macroeconomic

Abstract

The pension fund is a social and economic problem, the political decision is based on a strategic choice to respond to social and demographic evolution stability. In this paper, we have provided a nonlinear model of macroeconomic optimization adapted to Pay-As-You-Go pension funds[1][2] [3], and we present a quantitative analysis of the capital and reform effects of Moroccan pension fund[4], we have proposed an analytical resolution then a finite difference numerical approach. Simulation results show that our approach has been successful in controlling investments at every moment of the time horizon[5].

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Mathematical models for financial distress

Communication Info

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Keywords:
(1) Logistic regression
(2) Neural networks
(3) financial distress prediction

Abstract

In the face of rising defaults and limited studies on the prediction of financial distress in Morocco, this article aims to determine the most relevant predictors of financial distress and identify its optimal prediction models in a normal Moroccan economic context over two years. To achieve these objectives, logistic regression and neural networks are used based on financial ratios selected by lasso and stepwise techniques. Our empirical results highlight the significant role of predictors, namely interest to sales and return on assets in predicting financial distress. The results show that logistic regression models obtained by stepwise selection outperform the other models with an overall accuracy of 93.33% two years before financial distress and 95.00% one year prior to financial distress. Results also show that our models classify distressed SMEs better than healthy SMEs with type I errors lower than type II errors.

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The impact of surface temperature on a delayed tri-trophic marine species system with Allee Effect

Communication Info

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Keywords:
(1) Marine species
(2) Allee effect
(3) Surface temperature

Abstract

In this research, we delve into the dynamics of a tritrophic system encompassing three species: prey, predator, and super predator. We introduce the concept that both prey and predator populations are subject to the Allee effect.
To bring our study closer to real-world scenarios, we introduce two discrete delays into the model to represent the reaction time of super predators. We establish conditions for the local stability of the positive interior equilibrium and identify the existence of Hopf bifurcations in relation to threshold parameters. We develop a Lyapunov function to investigate the overall stability of the positive interior equilibrium. Additionally, we assess the sensitivity of the state variables to minor variations in the Allee parameters.
Our numerical simulations serve to illustrate the practical implications of our theoretical findings, underscoring the significance of incorporating surface temperature into our study.

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An optimal control approach for estimating Purkinje/Myocardium gap junctions conductance parameters

Communication Info

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Keywords:
(1)inverse boundary value problem
(2) semilinear parabolic equation
(3) cardiac electrophysiology

Abstract

We formulate an optimal control problem associated with a coupled 1D-3D system that models the electrical activity in the human heart. Our objective is to estimate the diffusion parameters that appear in the coupling zones. We use a gradient method to solve the obtained optimization problem. The gradient is calculated by solving the dual problem. We then develop numerical tests that confirm the success of our approach in identifying the parameters approach in the presence of noise.

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Optimal Harvesting of Predator-Prey Model with Allee Effect and Fear Effect

Communication Info

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Keywords:
(1) Predator-Prey model;
(2) Allee Effect;
(3) Fear Effect;
(4) Optimal Harvesting;
(5) Stability analysis.

Abstract

The Allee [1] and Fear [2] effects are incorporated into the predator-prey model, which constitutes the primary focus of this study. This investigation sheds light on the influence of fishing activities on both species and underscores the pivotal roles played by the Allee and Fear effects in shaping the dynamics of the system. To ensure the presence and limitations of populations, the analysis commences by examining the positivity and boundedness of the solutions. The interior equilibrium point, indicative of a state where both predator and prey populations reach equilibrium, is employed to assess the system's stability [3]. Additionally, the study delves into identifying an optimal fishing [4] approach that maximizes dynamic profit for the species while upholding sustainability. Lastly, Matlab software is used to perform numerical simulations that show the theoretical outcomes.

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Dynamical Behavior Analysis of a Stochastic prey-predator model with Holling II Functional Response under Lévy noise

Communication Info

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Keywords:
(1) SDEs;
(2) Itô's formula; stochastic predator-prey model;
(3) Brownian motion and Levy noise

Abstract

In this work, mathematical and numerical investigations of the following stochastic prey-predator model with Holling II functional response under both and Levy noise [1,2]:

$$\begin{cases} \frac{dx(t)}{dt} = r_1 x(t) - b_1 x^2(t) - \frac{c_1 x(t)}{1+x(t)} y(t) + \sigma_1 x(t) dB_1(t) + \int_Y \gamma_1(u) x(t^-) \tilde{N}(dt,du) \\ \frac{dy(t)}{dt} = -r_2 y(t) - b_2 y^2(t) + \frac{c_2 x(t)}{1+x(t)} y(t) + \sigma_2 y(t) dB_2(t) + \int_Y \gamma_2(u) y(t^-) \tilde{N}(dt,du) \end{cases}$$

where $x(t)$ and $y(t)$ represent the size of prey predator populations at time $\boldsymbol{t}$, respectively. The parameter $\boldsymbol{r_1}$ denotes the intrinsic growth rate of the prey population, and $\boldsymbol{r_2}$ denotes the death of the predator population. The parameters $\boldsymbol{b_1}$ and $\boldsymbol{b_2}$ are the density-dependent coefficients of the prey and predator populations, respectively while $\boldsymbol{c_1}$ and $\boldsymbol{c_2}$ represent the capturing rate of the predator and the rate of conversion of nutrients into the reproduction for the predator, respectively. $\boldsymbol{B_1(t)}$ and $\boldsymbol{B_2(t)}$ are independent Brownian motions and σ_i^2 denotes the intensity of the white noise. Firstly, we prove that there exists a unique positive solution of the system with a positive initial value [3]. Then, we study the path-wise properties and ultimately bounded in mean of the system. Finally, numerical procedure and some examples are elaborated to illustrate our main results.

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A generalized form of Newton's cooling law under a variable ambient temperature with application to Pharmacokinetics

Communication Info

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Keywords:
(1) Fractional Newton's law of cooling.
(2) Ψ-Caputo fractional derivative.
(3) Modelling nature
(4) delay
(5) Pharmacokinetics

Abstract

In this work, we introduce a new fractional model involving Ψ-Caputo derivative of order α in $(0, 1)$; a fractional Newton's law of cooling under a variable ambient temperature with two heat transfer coefficients with delay. In light of the Banach fixed point theorem, we prove the existence and uniqueness results - under a condition on both heat transfer coefficients - by converting the main problem to a general delayed Volterra integral equation of the second kind. Furthermore, we derive a condition for finite-time stability (FTS) by means of a general version of the delayed Gronwall inequality.
Finally, to show the efficacy and precision of our model, we look into a pharmacokinetics clinical trial. Our delayed fractional model anticipates values of drug concentration in plasma as close as possible to the ones observed in experimental data.

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Exploring the impact of light pollution on the bioeconomic dynamics of fisheries.

Communication Info

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Keywords:
(1) Bioeconomic model
(2) Light pollution
(3) Linear complementarity problem
(4) Nash equilibrium
(5) Fish population

Abstract

This study aims to illustrate the impact of light pollution on fishing activities, including catch rates and fishermen's profits [1]. Specifically, we investigate how light pollution influences the fishing dynamics of sardines and anchovies in the Casablanca-Rabat region of Morocco, employing a bioeconomic framework focusing on these two marine populations [2]. We begin by establishing the validity of our model through an analysis of its positivity and boundedness, followed by demonstrating the local stability of the interior equilibrium point [3]. Subsequently, we proceed to determine the optimal fishing effort that maximizes both fishermen's profits and catches while considering the constraints posed by the influence of light pollution on the sustained viability of the sardine and anchovy populations [4]. Utilizing data provided by the National Fisheries Research Institute (INRH), our numerical simulations yield detailed insights into the outcomes.

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Analysing the Effect of Trastuzumab Treatment on Breast Cancer Stages and Cardiac Function: A Mathematical modeling and numerical simulation

Communication Info

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Keywords:
(1) Breast Cancer
(2) Cardiotoxicity
(3) Cancer Stage
(4) Trastuzumab
(5) Mathematical model
(6) Numerical simulation

Abstract

Breast cancer is the second most common cause of death among women worldwide. Trastuzumab is the first humanized monoclonal antibody against HER2-positive metastatic breast cancer. However, the most serious side effect of trastuzumab is cardiotoxicity, which has become a limiting factor in the drug's safe use. In this study, we investigated the effect of trastuzumab treatment on breast cancer stages and cardiac function. Therefore, we constructed a mathematical model based on breast cancer patients. The model was created using a system of differential equations, and equilibrium point and stability analyses were employed to study the associated temporal dynamics. The stability of the equilibrium point was analyzed using the Routh-Hurwitz criteria, which identified an asymptotically stable equilibrium point. To validate these findings, numerical simulations were performed, demonstrating that the equilibrium point is always stable regardless of the initial conditions. Finally, our results suggest that the five sub-populations of patients will reach a stable state upon reaching the equilibrium point.

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Mathematical Modeling of Fisheries Sustainability: Insights from Guitarfish and Plaice Populations in Agadir

Communication Info

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Keywords:
(1) Bioeconomic modeling
(2) Conservation strategies
(3) Population dynamics
(4) Economic sustainability
(5) Fisheries of Morocco
(6) Preserving the Environment

Abstract

This study investigates the economic and ecological importance of Guitarfish and Plaice in Agadir's coastal waters, highlighting their crucial roles in the local economy and marine ecosystem. Through a mathematical model, it analyzes the stability and dynamics of their populations, considering factors like growth rates, carrying capacities, and predation rates. By predicting equilibrium points and assessing stability thresholds, the research provides insights into the species' long-term survival. Additionally, it utilizes Lagrange interpolation to estimate Plaice production and revenue for 2023, aiding in future planning and decision-making. This interdisciplinary approach bridges mathematical modeling with economic analysis, offering valuable tools for fisheries management and conservation strategies in Agadir and beyond.

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Bioeconomic modeling for Fishing in Morocco

Communication Info

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Keywords:
(1) Bioeconomic modeling
(2) Optimization Techniques
(3) Biological equilibrium

Abstract

This study aims to deepen the understanding and optimize fishing activity in Morocco by holistically integrating biological and economic aspects. On the biological front, we examine the rivalry between three marine species: Sardine, Mackerel, and Tuna, and the need to preserve the balance of their biomass. On the economic side, we focus on maximizing fishermen's profits.

We develop a biological equilibrium model for fishermen operating in the Atlantic region, where the three species coexist. These competing species exhibit their natural growth represented by logistic curves. We propose a mathematical model that takes into account the density and competition between species to explain population dynamics. Integrating human intervention adds a realistic dimension to our modeling. Fishermen specifically target all three species, thereby influencing population dynamics based on their fishing activities. This approach allows us to explore the effects of human-nature interaction on the biological equilibrium of sardine equilibrium of sardine, mackerel, and tuna populations.

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Dynamics of Time Fractional Gray-Scott Model with Anomalous Diffusion

Communication Info

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Keywords:
(1) Pattern formation
(2) Fractional Laplacian
(3) Fractional derivative
(3) Turing instability
(5) Numerical methods

Abstract

In this study, we propose a new generalization of the Gray-Scott model [1] with both a fractional time derivative and anomalous diffusion. The given system integrates Caputo's fractional derivative for the coordinate of the time to take into account the memory effect [2], while the diffusion is formulated by the fractional Laplacian operator to consider the effects of anomalous diffusion on the pattern formation [3]. In order to approach the solution numerically, we use a combined method of the finite difference scheme for temporal discretization [4], and the matrix transfer technique (MTT) for spatial discretization [5]. Furthermore, the Turing instability conditions are rigorously established in an appropriate steady state of the model. In addition, we illustrate the results by an application in the numerical simulations section.

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Stacked Ensemble and Feature Selection for Early Diabetes Diagnosis

Communication Info

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Keywords:
(1) Machine Learning
(2) Classification
(3) Ensemble Technique
(4) Causal Inference
(5) Bayesian Networks
(6) Diabetes Diagnosis

Abstract

Background: This study explores the application of causal inference methods combined with Machine Learning to enhance early diagnosis and management of diabetes [1,2].
Method: We employed causal analysis methods [3,4], including Bayesian networks, created new features, and optimized hyperparameters. Data preprocessing involved the removal of variables, imputation of missing values, elimination of outliers, and data balancing. Models such as Random Forest Classifier, XGBClassifier, and the ensemble Stacking approach were used for analyzing significant variables and predicting diabetes.
Results: After the creation of new variables with weighting and interaction among causal variables, the results showed a significant improvement, shifting from an accuracy of 0.70 and an AUC of 0.7744 to an accuracy of 0.73 and an AUC of 0.7984.
Conclusions: The integrated methods demonstrated substantial efficacy in predicting and managing diabetes, highlighting the importance of causal analysis in the medical field.

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Optimal Control of Marine Parasitic Disease

Communication Info

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Keywords:
(1) aquatic
(2) Anisakis
(3) Optimal control

Abstract

In aquatic epidemiology, Anisakis, a widely distributed parasitic nematode, poses a growing threat to global health and food sources[2]. Its complex life cycle involves marine hosts, and human infection occurs through consumption of raw seafood[4]. Mathematical models are crucial for understanding and predicting the dynamics of Anisakis[1][4]. This study formulates an optimal control problem focusing on public health education and aquaculture/fishing practices to reduce susceptible humans and infected fish[5].

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THE SIXTH EDITION OF THE INTERNATIONAL CONFERENCE ON RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
April 25-26-27, 2024 | Marrakech, Morocco

Stability and Hopf bifurcation of an HIV model with latent reservoir, macrophages and

Communication Info

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Keywords:
(1) HIV
(2) CTL immune response
(3) Hopf Bifurcation.

Abstract

In this work, we propose an in-host model describing the dynamics of HIV and its interaction with both CD4+T and macrophage cells. This model incorporates CD4+T latent reservoir and delayed CTL immune response as well. Using Lyapunov functionals and LaSalle's invariance principle, it is shown that the disease-free equilibrium is globally asymptotically stable when the basic reproduction ratio is less than unity. Additionally, we provide sufficient conditions for the global stability of the endemic equilibria. By choosing time delay, τ, as a bifurcation parameter and analyzing the corresponding characteristic equation of the model, we establish the existence of Hopf bifurcation at the immunity-infection equilibria. To comprehensively explore the influence of model parameters on system dynamics and investigate the possibility of the occurrence of the Hopf bifurcation, a sensitivity analysis is performed using PRCC method and the LHS. Finally, numerical simulations are carried out to illustrate the corresponding theoretical results.

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Modeling and Analysis of a Stochastic Epidemic Model involving immigration and vaccination

Communication Info

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Keywords:
(1) Stochastic model;
(2) White noise;
(3) Immigration; Vaccination;
(4) Extinction; Persistence.

Abstract

We present in this paper a stochastic SIR model with general incidence function involving immigration and vaccination, perturbed by Gaussian white noise. The global existence and positivity of the solution is showed. The extinction of the disease is established in the terms of a threshold value R_ {0} ^{S}. Moreover, we prove that the number of infected individuals I(t) is always persistent in the mean. Also, the sensitivity analysis is used to discover parameters that have impact on the threshold value R_ {0} ^{S}. We introduce some numerical simulation graphics to illustrate the theoretical results.

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On the extension of spatiotemporal epidemic models to the stochastic case with discontinuous noise

Communication Info

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Keywords:
(1) Epidemic model
(2) Stochastic partial differential equations
(3) Pure-jump Lévy noise
(3) Numerical simulations

Abstract

Lately, a remarkable progress has been made in the investigation of the dynamics of epidemics through mathematical models governed by stochastic differential equations with globally and/or locally Lipschitz coefficients. Based on the so-called Lyapunov method and the stopping-time technique, the mathematical well-posedness and biological feasibility of such models has been achieved for different types of stochastic noise. However, such a method cannot be used in the case of epidemic models governed by stochastic partial differential equations with Gaussian or Lévy noise due to the lack of local strong solutions. In this talk, we develop a first approach allowing to address the well-posedness and biological feasibility of such models in the case of pure-jump Lévy noise. Our developed approach is based on semi-group theory, Banach fixed-point theorem and an approximation technique.

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April 25-26-27, 2024 | Marrakech, Morocco

Mathematical Review : Pre-Processing Techniques in Medical Image Analysis

Communication Info

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Keywords:
(1) Medical image
(2) Discretization
(3) Interpolation
(4) Histogram

Abstract

The inception of X-ray tomography, ultrasound, positron emission, and magnetic resonance imaging has notably revolutionized medical practice. Three key concepts basically discretization, interpolation and histogram are important for a concise diagnosis. A grayscale medical image can be defined as a function $f : \mathrm{E} \rightarrow \mathrm{V}$ where $\mathrm{E} \subseteq \mathbb{R}^2$ and $\mathrm{V} \subseteq \mathbb{R}_+$. Moreover, colored medical images are a prolongation of this representation to include multiple channels in the RGB color space. Digital medical images are captured and stored through discretization [1]. To ensure a smooth reconstruction during operations such resizing, cropping and zooming, Interpolation techniques are applied [2]. Among these techniques, bicubic interpolation is regularly selected for its capacity to safeguard image integrity [3]. Histogram analysis is pivotal for segmentation, enhancement and feature extraction [4, 5]. For grayscale images, within a specified interval $[e_i, e_{i+1}]$, the frequency of intensity values is obtained through the formula: $h_f[i] = \sum_{x \in E}[e_i \leq f(x) \leq e_{i+1}]$. The incremented frequencies are then presented in a univariate histogram, while multivariate histograms are offering insights into the distribution of color values across multiple channels.

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April 25-26-27, 2024 | Marrakech, Morocco

Stability and Periodic Oscillations in a Virotherapy Model with Time Delay

Communication Info

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Keywords:
(1) Virotherapy
(2) Stability
(3) Hopf bifurcation
(4) Center manifold
(5) Normal form

Abstract

In this paper, we propose a delayed mathematical model which models the virotherapy treatment of a cancer dynamics with logistic growth. The total cancer population is divided into two types of cells: uninfected and infected cells. Considering time delay as a parameter, we establish the positivity and boundedness of solutions and the stability of the possible equilibria. We prove that, time delay can lead to periodic oscillations with small amplitude called "Jeff's phenomenon" which observed in laboratory and causes oscillations in cancer size via Hopf bifurcation theory. We give an algorithm determining the direction of Hopf bifurcation via center manifold and normal form theories. We end with some numerical simulations illustrating our obtained results.

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MATHEMATICAL MODEL ANALYSIS OF HEPATITIS C WITH CARDIAC SIDE EFFECTS OF DAA TREATMENT

Communication Info

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Keywords:
(1) Hepatitis C
(2) mathematical model
(3) stability

Abstract

Hepatitis C virus (HCV) is a blood-borne infection that can lead to liver failure, cirrhosis, hepatocellular carcinoma, and death. Direct-acting antivirals (DAAs) are a relatively new therapeutic approach, the safest and most effective for treating hepatitis C. However, DAAs can have divergent effects on heart health. The side effects of DAAs on the heart are called cardiotoxicity. Therefore, we built a mathematical model based on hepatitis C patients, we show the positivity and boundedness of the system solution, and we have determined the equilibrium point and its stability by using the Routh Hurwitz criteria, which identified an asymptotically stable equilibrium point. Finally, we performed numerical simulations to evaluate these results.

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Dynamic Compexity of a Delayed Spatiotemporal Predator-Prey Model

Communication Info

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Keywords:
(1) Predator-Prey
(2) Diffusion
(3) Hopf bifurcation

Abstract

In this paper, we focus our attention on a delayed spatiotemporal predator-prey system, the feature of this model is that the prey undergoes simultaneously the Allee effect and the fear effect, and the predation is modeled by the Holling II function with cooperative Hunting behavior, toxicity affects directly the prey following consumption of the environmental resources and indirectly affects the predators by prey predation, moreover, nonlinear fishing applied to the prey due to their aggregative behavior, and linear fishing to the predators. The objective of this study is to find the coexistence equilibrium of the two species and understand their dynamics around this equilibrium in time and space using parabolic and elliptic partial differential equations theories, eigenvalues analysis, and Hopf bifurcation properties, which allows to identify conditions of stability, instability and Turing instability. Finally, we present a numerical simulation to validate the theoretical results findings.

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Modeling the spread of infectious diseases with spatio-temporal equations using fractional derivatives and a saturated incidence function

Communication Info

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Keywords:
(1) Global stability
(2) Spatiotemporal SIR model
(3) epidemic model,
(4) Time-fractional reaction diffusion systems.

Abstract

The work proposes and examines the comprehensive analysis of a spatio-temporal fractional-order SIR infection model with a saturated incidence function. The infection dynamics are described by three partial differential equations, each incorporating a fractional-order temporal derivative. The model equations describe the evolution of susceptible, infected, and recovered individuals while accounting for spatial diffusion for each compartment. A saturated incidence rate is chosen to capture the nonlinear propagation of the infection. Initially, we establish the well-posedness of our proposed model in terms of the existence and uniqueness of the solution. Additionally, in this context, we establish the boundedness and positivity of the solutions. Next, we provide the expressions for the disease-free equilibrium and the endemic equilibrium. It has been demonstrated that the global stability of each equilibrium mainly depends on the basic reproduction number R0. Finally, numerical simulations are conducted to validate the theoretical results and demonstrate the effect of vaccination in reducing infection stability. It was found that the order of the fractional derivative has no effect on the stability of the equilibria but only influences the convergence rate to equilibrium states. Furthermore, vaccination has been observed as one of the effective strategies for controlling disease spread.

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THE SIXTH EDITION OF THE INTERNATIONAL CONFERENCE ON RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
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Analysis of paratyphoid transmission mathematical model with strategies of optimal control

Communication Info

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Keywords:
(1) Epidemiological modeling,
(2) Optimal control,
(3) Paratyphoid,

Abstract

This research looks at different methods of controlling the environment to get rid of Salmonella germs and limit the spread of typhoid fever in Taiwan.

To do this, we use Pontryagin's maximum principle to find the most efficient control measures by iteratively solving the optimality system. To validate our theoretical study, we run numerical simulations using MATLAB.

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Analyzing the Mathematical Stability of a Cholera Disease Model

Communication Info

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Keywords:

(1) mathematical modeling; stability;

(2) Disease cholera ,Lyapunov function.

(3) sensitivity; optimal control;

Abstract

Cholera, a rapidly spreading gastrointestinal infection associated with water contamination,
continues to be a prominent global health challenge in developing nations. Our research focuses
on constructing a dynamic model using mortality data sourced from the World Health Organization (WHO) and real-time information on the epidemic's spread. By applying the Routh-Hurwitz criteria and developing Lyapunov functions, we assess the local and global stability of both diseasefree and disease-equilibrium states within the model. Furthermore, we conduct sensitivity analyses on model parameters to identify those exerting significant influence on the reproduction number R0. To validate our theoretical findings, we carry out numerical simulations using Matlab.

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Mathematical Model Analysis of Cervical Cancer Stages

Communication Info

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Keywords:
(1) Cervical cancer
(2) chemotherapy
(3) hematologic toxicity

Abstract

Cervical cancer is the most common cancer which affects women next to breast cancer in the worldwide. Cancer treatment is used to kill cancer cells, remove cancer cells through surgery, or prevent cancer from getting the signal needed for cell division, cancer treatment does not necessarily have a good effect on patients, cervical cancer treatment has an effect on red and white blood cells and plasma, side effects of chemotherapy is called hematologic toxicity, therefore we have constructed a mathematical model from the cervical cancer patient population in the hospital. A population is divided into five sub-populations; the model is constructed by using a differential equation system. The equilibrium point and stability analysis are used to study the dynamics associated with time. We verified the results of analysis numerical simulation.

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Mathematical Characterization of Nutrient Influence on Tumor Growth

Communication Info

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Keywords:
(1) Tumor Growth
(2) Gompertz-Malthus Model
(3) Mathematical modeling
(4) nutrient limitation

Abstract

Tumor growth is a complex phenomenon influenced by various factors, including the availability of essential nutrients. Mathematical modeling serves as a powerful tool to investigate these intricate relationships and gain insights into tumor progression, while a singular, universally recognized model named "Gompertz-Malthus Model with Nutrient Parameter" might not be present, established frameworks effectively capture the impact of nutrients on tumor growth. while unveiling the intricate interplay between nutrient constraints and tumor growth necessitates the development of robust mathematical frameworks. This investigation delves into the current landscape of mathematical modeling approaches employed to characterize the influence of nutrient availability on tumor progression.

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Mathematical Modeling of Wheat Diseases

Communication Info

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Keywords:
(1) Plant diseases
(2) Mathematical model
(3) Control Optimal

Abstract

Wheat is one of the most important cultivated food crops across the globe. Out of the 200 diseases affecting wheat, approximately 50 cause significant economic losses and are widely distributed. Annually, around 20% of wheat is lost due to these diseases, which greatly impact both yield and cause mortality of the plants. The aim of this study is to develop a mathematical system of ordinary differential equations to model the transmission dynamics of specific wheat diseases and investigate the effectiveness of certain control strategies in limiting their spread.
We utilize the tools of optimal control theory, particularly Pontryagin's maximum principle, to characterize these optimal controls.
Finally, numerical simulations are conducted to validate the theoretical analysis using MATLAB.

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Multiple Positive Solutions for a Critical Fractional P-laplacian System with Concave Nonlinearities

Communication Info

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Keywords:
(1) fractional p-Laplacian
(2) critical elliptic sysytem
(3) multiplicity

Abstract

The aim of this paper is to study the following nonlinear fractional p-Laplacian system with critical exponent

$$\begin{cases} (-\Delta)_s^p u + |u|^{p-2}u = \lambda g(x)|u|^{q-2}u + \dfrac{\alpha}{\alpha+\beta} f(x)|u|^{\alpha-2}u|v|^{\beta}, & in\ \Omega, \\ (-\Delta)_s^p v + |v|^{p-2}v = \lambda h(x)|v|^{q-2}v + \dfrac{\alpha}{\alpha+\beta} f(x)|v|^{\alpha-2}v|u|^{\beta}, & in\ \Omega, \\ u = v = 0, & in\ \Omega, \end{cases}$$

where Ω is a smooth bounded set in $\mathbb{R}^N$, $0 < s < 1$, $\lambda, \mu > 0$, are two parameters, $1 < q < p < p_s^*$, $N > ps$, $\alpha, \beta > 1$ satisfy $\alpha + \beta = p_s^*$ with p_s^* is the fractional Sobolev critical exponent and $(-\Delta)_s^p$ is the fractional p-Laplacian operator. Using the Nehari manifold and Ljusternik-Schnirelmann category, we study the topology of the global maximum set Θ of $f(x)$ and show that the system has at least at least $Cat_{\Theta_\delta}(\Theta) + 1$ distinct positive solutions.

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New advances in the qualitative theory of integro-differential equations

Communication Info

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Keywords:
(1) System of integro-delay differential equations
(2) Boundedness
(3) LKF

Abstract

Asymptotic stability, uniform stability, integrability, and boundedness are among the qualitative behaviors of solutions to some unperturbed and perturbed systems of nonlinear integro-delay differential equations that are covered in this study. Four theorems are demonstrated here on by applying the Lyapunov–Krasovskii functional approach to these features of solutions. Additionally, an example is provided to show how the findings of this research might be applied.

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Transition to chaos in five-dimensional porous model for low Prandtl number

Communication Info

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Keywords:
(1) Chaos
(2) Spectral method
(3) Homoclinic explosion

Abstract

In this paper, we investigated the transition to chaos in a five-dimensional model for low Prandtl number in a porous medium. The mathematical model includes the heat equation coupled with the equations of motion under the Boussinesq-Darcy approximation. A system of five ordinary differential equations is obtained using a spectral method. This system is solved numerically by using the fourth-order Runge-Kutta method. The results showed that from a subcritical value of the Rayleigh number, a transition from steady convection to chaos via a Hopf bifurcation produced a limit cycle which can be associated with a homoclinic explosion. Also, we proved that for a certain value of Rayleigh number and shape parameter, the transition from periodic oscillatory convection to chaotic convection can occur via a period-doubling.

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Existence of solutions to non-local uncertain differential equations under The ψ-Caputo fractional derivative

Communication Info

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Keywords:
(1) Uncertain Differential Equations Fractional,
(2) Schaüder fixed point theorem
(3) Krasnosel'skii fixed point theorem
(4) Fuzzy metric spaces
(5) Semilinear space

Abstract

Dans cette étude, nous explorons l'existence et l'unicité de solutions pour une catégorie d'équations différentielles non local incertaines impliquant des dérivées fractionnaires de type ψ-Caputo. Rappelons que le principe d'incertitude est crucial en physique quantique [1]. Agarwal et al. [2] ont introduit le concept de solutions pour ces équations en 2010. Ici, notre méthode repose sur le théorème du point fixe de Krasnosel'skii ainsi que sur le théorème du point fixe de Schauder applicable aux espaces métriques flous. Ces théorèmes suggèrent que le sujet en question possède une solution floue définie sur un intervalle spécifique. Notre approche nécessite l'examen d'un problème intégral associé où les outils mentionnés trouvent application. Des extensions des résultats de points fixes peuvent être trouvées dans [3]. Dans ce travail, nous examinons une classe d'équations différentielles non linéaires avec incertitude et dérivées non locales, qui englobe une classe plus large que [4]. L'objectif est d'offrir une découverte généralisant les résultats de [5] à la situation des équations différentielles incertaines. En guise de conclusion, nous apportons une incitation d'ordre physique.

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Stability analysis of a spatio-temporel epidemic model

Communication Info

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Keywords:
(1) SIR epidemic model
(2 Age structured model
(3) Stability analysis

Abstract

The main idea of our work is to present and study the asymptotic behavior of an epidemic SIR model taking into account the age variable. Firstly, we started by presenting our age-structured mathematical model in the form of a system of partial differential equations. Also, we have proved the existence of the solution of this model. Secondly, we calculated the equilibrium points of the model and we have developed theoretical results for their local and global stability. Finally, the method of nite differences of characteristics is used to present the numerical results of the suggested age-structured epidemic model and the numerical simulations are carried out using MATLAB.

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A priori error analysis and finite element approximations for a coupled model under nonlinear slip boundary conditions

Communication Info

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Keywords:
Stokes equations, Navier-Stokes equations, convection-diffusion equations, finite element discretization, nonlinear slip boundary conditions, variational inequality

Abstract

We present in this work the unsteady Stokes and Navier-Stokes equations coupled with the heat equation and provided with nonlinear slip boundary conditions of the Tresca type. Where both the viscosity and the diffusion coefficients depend on the temperature. We use an implicit Euler diagram in time and we discretize the problem in space by the finite element method. We demonstrate optimal error estimates between the continuous solution and the discrete solution. And we confirm the interest of this approach by some numerical experiments.

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EXPLORING EXISTENCE AND REGULARITY IN THE PERTURBED COUPLED SYSTEM MODELING THE THERMISTOR

Communication Info

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Keywords:
(1) Thermistor problem
(2) Perturbed coulpled system
(3) Capacity solutions

Abstract

This study focuses on exploring the existence and regularity of a capacity solution for a perturbed coupled parabolic-elliptic system, that characterizes the evolution of temperature (u), and electric potential (φ) in semiconductor materials. The system can be viewed as an expanded form of the well-known thermistor problem. These equations involve the Leray-Lions operator critical in the Orlicz–Sobolev W^1_0 L_M(Q_T), alongside a nonlinearity denoted as H, a constraint related to the spread of φ, and specific boundary and initial conditions. The model based on time describes the temperature behavior in a thermistor device affected by electrical resistivity (H), presenting strong nonlinearity where there are no strict rules on how it grows, only certain conditions about its behavior.

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Solving the Fractional Schrödinger Equation with Singular Potential by Means of the Fourier Transform

Communication Info

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Keywords:
(1) Colombeau algebra
(2) Schrödinger equation
(3) Fourier transform
(4) Singular potential

Abstract

The algebras of Colombeau are constructed by J. F. Colombeau [5][6], as factor algebras of infinite powers of the space C^∞ modulo a particular class of ideals. Elements of these algebras are classes of nets of smooth functions. This theory was been used for solving the linear and nonlinear partial differential equations with singularities [1], for example M. Oberguggenberger and Y.G. Wang, studied the Delta-waves for semi linear hyperbolic Cauchy problems [7].

In this communication, we are interested to study the fractional Schrödinger's equations with singular potential and initial data, which have both time fractional and space-fractional components. We employ the Fourier transform to prove the existence-uniqueness theorems. Additionally, we give the association with the classical solution.

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Numerical investigation of nanofluid flow with gold nanoparticles injected inside a stenotic artery

Communication Info

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Keywords:
(1) Magnetohydrodynamics
(2) Porous medium
(3) Couple stress
(4) The Akbari Ganji Method

Abstract

The Casson fluid flow with porous material in magnetohydrodynamics is examined in this work. Additional semi-analytical results are investigated using the Silver-Water nanofluid. The Akbari-Ganji Method (AGM) is used to solve the semi-analytical Cattaneo-Christov heat flux model after taking thermal radiation into account. With the use of appropriate parameters, such as the relaxation time parameter, Prandtl number, radiation parameter, magnetic parameter, and so on, the normalized shear stress atthe wall, temperature profile, and rate of heat flux may be examined. This issue has numerous industrial applications and technical procedures, such as the extrusion of rubber sheets and the manufacture of glass fiber. The main physical application is thediscovery that a rise in the thermal relaxation parameter and Prandtl number maintains a constant fluid temperature.

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THE SIXTH EDITION OF THE INTERNATIONAL CONFERENCE ON RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
April 25-26-27, 2024 | Marrakech, Morocco

Lattice Boltzmann modeling of natural convection of nanofluid in enclosure with fins

Communication Info

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Keywords:
(1) Nanofluids
(2) Natural convection
(3) Lattice Boltzmann method
(4) Heat Transfer
(5) Fins

Abstract

This study, which done based on the first and second laws of thermodynamics and via Boltzmann equations, determines the amount of heat transfer of water/Cu nanofluid inside an enclosure cavity with horizontal's fins attached to its hot wall. The effect of fins length and their position is also given attention. Lattice Boltzmann method [1] has been implemented to compute for streamlines, isotherms, and velocity fields. The code was validated by comparing our results with those of other authors [2]. A parametric study has been carried out by considering the following parameters: the nanoparticles volume fraction $\varphi = 0 - 4\%$, the Rayleigh number Ra= 10^3-10^5, the length ($L_f = 0.25 - 0.75$) and the position ($H_f = 0.25 - 0.75$) of fins. The results demonstrates that the horizontals fins have a negative effect on the enhancement of heat transfer and reduce the natural convection. On the contrary, an increase in the volume fraction of nanoparticles and Rayleigh number enhances heat transfer and make the natural convection dominates [3-5].

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Nonexistence of Radial Positive Solutions of Nonpositone Problems in a Ball

Communication Info

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Keywords:
(1) Nonlinear boundary value problem
(2) radial positive solution
(3) nonpositone problem

Abstract

During the last years many efforts has been devoted to the study of nonlinear diffusion equations. A typical example is the following

$$\begin{cases} -\Delta u = \lambda f(u) & \text{in } \Omega, \\ u = 0 & \text{on } \partial\Omega, \end{cases} \qquad (P)$$

where Ω is a smooth bounded domain in R^N for $N \geq 2$, λ is a parameter and f is sufficiently smooth function.

In this paper, we study the nonexistence of radial positive solutions for the problem (P) in a ball when the nonlinearity f has more than one zero and negative at the origin. More precisely, we assume that the function $f : [0, +\infty) \to R$ satisfies the following hypotheses

H1/ $f \in C^1(R^+, R)$ such that f has three zeros $\beta 1 < \beta 2 < \beta 3$ and *increasing* on $(0, \beta 1)$

H2/ $\exists \alpha > 1$ such that $\liminf_{u \to +\infty} (f(u)/u^\alpha) > 0$

H3/ $f(0) < 0$.

Under the above conditions, we will prove the following main result in this work

Theorem : *There exists* $\bar{\lambda}$ *such that if* $\lambda > \bar{\lambda}$, *then the problem* (P) *has no radial positive solution.*

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THE SIXTH EDITION OF THE INTERNATIONAL CONFERENCE ON RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
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An accurate compact finite difference scheme for solving nonlinear tempered Ψ-Caputo fractional partial integro-differential equations

Communication Info

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Keywords:
(1) Ψ-fractional integral
(2) Ψ-Caputo fractional derivative
(3) Compact finite difference scheme

Abstract

This paper presents a novel approach to constructing a fourth-order compact difference scheme for the nonlinear tempered Ψ-Caputo time fractional integro-differential equation. The scheme is developed based on a nonlinear fourth-order operator and a method of order reduction. To handle the terms involving fractional derivatives, we employ the L1-discretization formula. The nonlinear convection term is discretized using a nonlinear compact difference operator, while the integral term with memory in time is approximated using a second-order finite difference method. Furthermore, we establish a fully discrete compact difference scheme by approximating the spatial second-order derivative with a classic compact difference formula. The convergence and stability of the scheme are rigorously proven in the L∞-norm using the energy argument and mathematical induction. Additionally, several numerical examples are conducted to validate the theoretical analysis.

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FAVARD SPACES AND ADMISSIBILITY FOR ANALYTIC RESOLVENT FAMILIES

Communication Info

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Keywords:
(1) Volterra equation
(2) Analytic resolvent family
(3) Favard spaces
(4) Admissibility

Abstract

The notion of admissible control operators for Volterra systems is well studied in [3,2].
The notion of analytic resolvent family of Volterra systems is well studied in [4,5].
In this communication, we are concerned with a class of scalar Volterra equations. In order we present some new results concerning the Favard spaces of the analytic resolvent for a Volterra system with infinite dimension generalizing some results in [1] and finally we establish some relationship between the Favard spaces and the admissibility of unbounded control operators for linear Volterra systems in Banach spaces generalizing some results in [6].

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THE SIXTH EDITION OF THE INTERNATIONAL CONFERENCE ON RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
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On the notion of generalized solution for the fractional parabolic p-Laplace operator

Communication Info

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Keywords:
(1) Fractional p-Laplace operator
(2) Generalized solutions
(3) Measure data

Abstract

We prove existence of renormalized solution for the fractional parabolic p-Laplace operator

$$\begin{cases} u_t + (-\Delta)_p^s u = \mu \ \ in\ Q := (0,T) \times \Omega, \\ u(0,x) = u_0(x)\ in\ \Omega, \quad u(t,x) = 0\ on\ (0,T) \times \partial\Omega, \end{cases}$$

where Ω is a bounded domain in $\mathbb{R}^N$ $(N \geq 2)$ with Lipschitz boundary $\partial\Omega$ and T is a positive number, $(-\Delta)_p^s u$ is the fractional p-Laplace operator $(ps < N, 0 < s < 1)$, $\mathrm{p} > 2 - \frac{\mathrm{s}}{\mathrm{N}}$, $\mathrm{u}_0 \in \mathrm{L}^1(\Omega)$ and $\mu \in M(Q)$ the vector space of Radon measures in Q. We characterize the fractional order Sobolev spaces and we give different properties of the fractional capacity, see [4,6], in connection with Radon measures, see [2,3], under which the existence result of renormalized solutions holds.

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

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Existence and averaging principle results for partial functional differential equations with infinite delay using the α-norm in the case of non-Lipschitz condition

Communication Info

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Keywords:
(1) Partial functional differential equations
(2) Alpha-norm
(3) Infinite delay
(4) Non-Lipschitz condition

Abstract

In our paper we establish an existence and uniqueness result of mild solution for the following partial functional differential equation

$$\begin{cases} x'(t) = -Ax(t) + f(t, x_t), & t \geq 0 \\ x_0 = \varphi \in \beta \end{cases}$$

in the case of infinite delay [1] and using the α-norm [2]. The space β is an abstract phase space [3] the unbounded linear part A generates an analytic semigroup and the nonlinear part f satisfies a condition which is weaker than the ordinary Lipschitz condition with respect to the second argument.

Once the existence result is proven we go on to establish an averaging principle [4] of the following equation with a small parameter $\varepsilon > 0$,

$$\begin{cases} x'(t) = -Ax(t) + f(t/\varepsilon, x_t), & 0 \leq t \leq T, \\ x_0 = \varphi \in \beta. \end{cases}$$

Under some conditions we prove that the solution of the previous system converges to the solution of the following autonomous problem

$$\begin{cases} x'(t) = -Ax(t) + f_0(x_t), & 0 \leq t \leq T, \\ x_0 = \varphi \in \beta. \end{cases}$$

And we finish by an application.

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Generalized solution of fractional Burger equation

Communication Info

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Keywords:
(1) Generalised solution 1
(2) Burger fractional equation 2
(3) Granwal's lemma 3
(4) Distributions 4
(5) associations 5

Abstract

The aim of this article is to study the existence and uniqueness of the generalised solution of the Burger fractional equation using Granwal's lemma. The solution is found in certain algebras of new generalized functions containing spaces of distributions. Then we study the associations with the classical solution.

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THE SIXTH EDITION OF THE INTERNATIONAL CONFERENCE ON RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
April 25-26-27, 2024 | Marrakech, Morocco

Numerical Analysis of 2D Heat Transfer Equation Applied in Solar panel

Communication Info

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Keywords:
(1) **2D finite difference**
(2) **Heat transfer**
(3) **PV module**

Abstract

In this talk, we employ the finite difference method to simulate and analyze the temperature distribution across the various layers of a photovoltaic (PV) module. Our study focuses on the propagation of temperature within the complete module by solving the conductive heat transfer equation. By investigating the temperature spread, we aim to gain insights into the thermal behavior and performance of the PV module. We begin by examining the layered structure of a typical solar panel. It consists of various components, including a top glass cover, semiconductor layers, substrate material, and a backsheet. Each layer has distinct thermal properties that impact the temperature distribution within the panel. Finally, to validate our model, we will compare the temperatures obtained on the last layer by finite difference with those measured on the back of the panel for different irradiance values.

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April 25-26-27, 2024 | Marrakech, Morocco

Local and Global Solvability for a Nonlinear Diffusion Model with Fractional Laplacian Operators

Communication Info

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Keywords:
(1) Nonlinear diffusion
(2) Fractional Laplacian operators
(3) Local and global well-posedness
(4) Homogeneous Besov-spaces

Abstract

This paper considers a nonlinear diffusion model with fractional Laplacian operators in homogeneous Besov spaces. By using the smoothing effect of the heat semigroup and the Littlewood-Paley theory, we obtain with a sufficient condition, the local solution of this model. Moreover, we get the global solution for small initial data in the critical Besov spaces $\dot{B}^{-2\alpha+\frac{n}{p}}_{p,\infty}(\mathbb{R}^n)$ with $1 \leq p < \infty$.

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Existence results in weighted Sobolev space for quasilinear degenerate p(z)-elliptic problems

Communication Info
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Keywords:
(1) Nonlinear elliptic equations
(2) Entropy solutions
(4) Weighted variable exponent Sobolev space

Abstract
In this study, we investigate a class of degenerate nonlinear elliptic problems involving p(x)-growth conditions and $\mathbf{L^1}$ -data, coupled with a Hardy potential. By means of weighted Sobolev spaces with variable exponents, we show the existence of entropy solutions to the considered problem.

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Weak Solution for Nonlinear Fractional p(.)-Laplacian problem with Variable Order via Rothe's Time-Discretization Method

Communication Info

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Keywords:
(1) weak solution
(2) p(.)-Laplacian operator
(3) variable order

Abstract

Let $\Omega \subset \mathbb{R}^d$, $(d \geqslant 2)$ be an open bounded domain with a connected Lipschitz boundary $\partial\Omega$ and T be a fixed positive real number. Our aim of this communication is to prove the existence and uniqueness results of weak solutions for the nonlinear fractional parabolic problem

$$\begin{cases} \frac{\partial u}{\partial t} + (-\Delta)^{s(.)}_{p(.)} u = f(x,t) \ \ in \ \ Q_T := \Omega \times]0, T[, \\ u = 0 \ \ on \ \ \Sigma_T := \partial\Omega \times]0, T[, \\ u(.,0) = u_0 \ \ in \ \ \Omega, \end{cases} \tag{1}$$

where $(-\Delta)^{s(.)}_{p(.)}$ is the fractional $p(x)$-Laplacian operator with variable order which can be defined as

$$(-\Delta)^{s(.)}_{p(.)} u(x) = P \cdot V \cdot \int_\Omega \frac{|u(x) - u(y)|^{p(x,y)-2}(u(x) - u(y))}{|x - y|^{d+s(x,y)p(x,y)}} dy, \ for \ all \ x \in \Omega,$$

and $P.V.$ is a commonly used abbreviation in the principal value sense. $p(.)$ and $s(.)$ are two continuous variable exponents with $s(x,y)p(x,y) < d$ for any $(x,y) \in \overline{\Omega} \times \overline{\Omega}$ verifying the following hypotheses :

$$1 < p^- = \min_{(x,y)\in\overline{\Omega}\times\overline{\Omega}} p(x,y) \leqslant p(x,y) \leqslant p^+ = \max_{(x,y)\in\overline{\Omega}\times\overline{\Omega}} p(x,y) < +\infty, \tag{2}$$

$$0 < s^- = \min_{(x,y)\in\overline{\Omega}\times\overline{\Omega}} s(x,y) \leqslant s(x,y) < s^+ = \max_{(x,y)\in\overline{\Omega}\times\overline{\Omega}} s(x,y) < 1, \tag{3}$$

$$0 < s^- < s^+ < 1 < p^- \leqslant p^+. \tag{4}$$

$$p \text{ and } s \text{ are symmetric, that is, } p(x,y) = p(y,x) \text{ and } s(x,y) = s(y,x) \tag{5}$$

for all $(x,y) \in \overline{\Omega} \times \overline{\Omega}$.
f and u_0 are regular data.

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Differential History-Dependent Variational-Hemivariational Inequality with Application to a Dynamic Contact Problem

Communication Info

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Keywords:
(1) Variational-Hemivariational inequality
(2) History-dependent
(3) Rothe method
(4) Viscoelastic
(5) Wear
(6) Nonlinear equation

Abstract

This paper is dedicated to the discussion of a new dynamical system involving a historydependent variational-hemivariational inequality coupled with a non-linear evolution equation. The existence and uniqueness of the solution to this problem are established using the Rothe method and a surjectivity result for a pseudo-monotone perturbation of a maximal operator. Additionally, we derive the regularity solution for such a history-dependent variational-hemivariational inequality. Furthermore, the main results obtained in this study are applied to investigate the unique solvability of a dynamical viscoelastic frictional contact problem with long memory and wear.

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Partition of Unity Finite Element Method for Nonlinear Anisotropic Diffusion in

Communication Info

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Keywords:
Anisotropic diffusion -
partition of unity method
Finite element method
Heterogeneous media.

Abstract

This work presents the partition of unity finite element method PUFEM for solving non-linear anisotropic transient diffusion problems. The suggested approach includes a new anisotropic enrichment created especially for this category of problems. The enrichment makes use of previous knowledge about the anisotropic nature of the problem and consists of exponential functions with gradients that vary with rotation. The suggested partition of unity method outperforms even the traditional partition of unity method in terms of efficiency when compared to standard methods. This efficiency improvement comes from two sources: first, by using solutions on coarse meshes with few elements and keeping accuracy on meshes with hundreds or thousands of elements comparable to the classic finite element method. Second, the suggested enrichment permits mesh selection to be largely independent of the anisotropy of the problem, enabling constant mesh use even in the case of anisotropic conditions changing. This accomplishment preserves every benefit of the conventional approach to managing heterogeneous domains. A fully implicit method employing a linearization approach handles nonlinearity in temporal discretization. We continuously show, through extensive numerical tests, the efficacy of the method in obtaining the requisite accuracy levels while retaining its efficiency.

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ICRAMCS 2024
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A mesh-free technique for the numerical solution of a type of VIE of the third kind

Communication Info

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Keywords:
(1) RBF
(2) Mesh-free method
(3) Third kind VIEs

Abstract

In this paper, we use a method based on RBFs collocation method for the numerical solution of a class of VIEs of the third kind. The principal benefit of this scheme is that it does not require any discretization and so it is independent of the geometry of the domain and can thus be applied to the solution of various kinds of VIEs. The construction of the suggested technique has been introduced. The convergence analysis of the presented method is investigated. Finally, certain numerical examples are included to show the accuracy and efficiency of the new technique.

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On a nonlinear system involving the (p(x), q(x))-Kirchhoff-Laplace operator

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Keywords:
(1) Dirichlet boundary conditions
(2) nonlinear system
(3) topological degree methods
(4) (p(x),q(x))-Kirchhoff-Laplace operator

In this work, a nonlinear system of Kirchhoff-type involving the $(p(x),q(x))$-Laplacian operator under Dirichlet boundary conditions is considered. These types of problems have many implications in scientific and engineering disciplines such as elastic mechanics, image processing (see [6]), electrorheological fluids [2,7], probability, electrical networks, etc.

Based on a topological degree argument on the generalized Sobolev space and under suitable assumptions regarding the nonlinear terms and the Kirchhoff functions, we establish the existence of at least one nontrivial solutions for this problem on the product space $W_0^{1,p(x)}(\Omega)\times W_0^{1,q(x)}(\Omega)$.

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Existence results for nonlinear fractional pantograph differential equations via measure of noncompactness

Communication Info

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Keywords:
(1) pantograph differential equations
(2) measures of noncompactness

Abstract

The aim of this manuscript is to study the existence and uniqueness of solutions for a certain type of nonlinear Caputo fractional pantograph differential equations with nonlocal conditions. The proofs are based on some results of topological degree theory for condensing maps combined with the technique of measures of noncompactness and certain fundamental fractional calculus tools. As an application, a nontrivial example is given to illustrate our theoretical results.

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On a class of nonlinear singular elliptic problem with p(x)-Laplacian operator

Communication Info

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Keywords:
(1) Singular elliptic problems
(2) p(x)-Laplacian operator
(3) Mountain Pass Theorem

Abstract

In this paper, we study a class of nonlinear singular elliptic problems involving the p(x)-Laplacian operator in a bounded domain of R^N. Some of these problems come from different areas of applied mathematics and physics such as Micro Electro-Mechanical systems, modeling of Electrorheological Fluids, Surface Diffusion on Solids or Image Processing and Restoration.

Using the Mountain Pass Theorem, we prove the existence of a non-trivial weak solution for the problem considered in the context of Sobolev spaces with variable exponents under certain appropriate assumptions on nonlinearities.

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Operator splitting method for Rosenau-Burgers equation

Communication Info

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Keywords:
(1) Rosenau-Burgers equation.
(2) Operator splitting method.
(3) Finite difference Schemes.

Abstract

In this paper, we introduce the operator splitting method for solving PDEs, focusing on the Rosenau-Burgers equation. This technique has been successfully applied to complex problems over many years, yielding highly satisfactory results. Obtaining analytical solutions for the Rosenau-Burgers equation is generally challenging.

Firstly, we derive the exact solution of the ODE obtained from the original PDE using central finite difference discretization in the spatial direction. Subsequently, we explore the exponential Lie-Trotter and Strang splitting methods for the Rosenau-Burgers equation. We then compare the errors between the Lie-Trotter and Strang methods and determine the convergence rates for both techniques. We also demonstrate the consistency and stability of both methods. The proposed approaches offer the advantages of a simple structure and high accuracy.

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Unconditional Optimal Error Estimates of a BDF scheme for a nonlocal parabolic problem

Communication Info

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Keywords:
(1) Error estimate
(2) Finite element method
(3) BDF scheme

Abstract

The study of nonlocal parabolic problems has recently received significant attention (see [1,2] and the references therein). Many authors [3,4] studied such problem using the Crank–Nicolson Galerkin finite element method. The paper presented the exponential decay and vanishing of solutions in finite time using the Crank-Nicolson Galerkin finite element method.

This research focuses on a nonlocal nonlinear parabolic problem and the unconditionally optimal error estimates of a linearized second-order scheme. The scheme involves two steps, the first based on the Crank-Nicholson method and the second on the second-order BDF method. Through a rigorous error analysis and the use of the error splitting technique, optimal L^2 error estimates are derived. Finally, numerical simulations are presented to confirm the theoretical analysis. The implementation of the simulations is done using Matlab.

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The effectiveness of contact tracing in controlling the COVID-19 epidemic: A modelling study

Communication Info

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Keywords:
(1) Mathematical Modelling
(2) Discrete systems
(3) Infectious diseases

Abstract

We develop a mathematical model to investigate the effect of the contact tracing intervention on the epidemic dynamics of COVID-19 during its early emergence.
We propose a discrete time epidemic model structured by disease-age that includes general features of contact tracing. The model is fitted to data reported for the early spread of COVID-19 in South Korea, Brazil, and Venezuela. The three countries were known to differ in contact tracing performance, where South Korea stood out as an exemplar country for a better use of the intervention in response to the pandemic during its early emergence [1], while Venezuela was known for its precarious contact tracing system [2].
Using the fitted values of model parameters, we estimate the effective reproduction number R_e after the incorporation of contact tracing in the three countries. We then compare it to the basic reproduction number R_0 in the absence of contact tracing by calculating the relative change.

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Resolution of Navier-Lamé system with web-spline finite element method

Communication Info

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Keywords:
(1) Web-spline fem
(2) MATLAB
(3) Abaqus

Abstract

This communication taken into consideration the two-dimensional linear elasticity equation of Navier–Lamé with the Dirichlet boundary condition. This examine have evolved blended finite element; approach the use of the Web (weighted extended B-spline)-spline space. These offer an actual implementation of the homogeneous; Dirichlet boundary conditions.
We showed the existence and the uniqueness of the weak solution, in addition to the convergence of the numerical solution for the quadratic case are proved. The weighted extended B-spline; technique have end up a far extra workmanlike solution.

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Existence of entropy solution for a nonlinear parabolic problem in weighted Sobolev space via optimization method

Communication Info

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Keywords:
(1) Nonlinear degenerate parabolic problem.
(2) entropy solutions.
(3) Weighted Sobolev space

Abstract

Let $\Omega \subset \mathbb{R}^N$ ($N \geq 2$) be a bounded open set, T is a fixed positive number and p be a real number such that $1 < p < \infty$. Our aim in this work is to study the existence and uniqueness for weak solution in weighted Sobolev spaces of the nonlinear degenerate parabolic problem

$$\begin{cases} \frac{\partial u}{\partial t} - div\,(\omega|\nabla u|^{p-2}\nabla u) + |u|^{p-2}u = f & in\ \ Q :=]0;T[\times \\ u = 0 & on\ \ \Gamma :=]0;T[\times\,\partial\Omega, \\ u(.,0) = u_0 & in\ \Omega, \end{cases}$$

where ω is a measurable positive and a.e finite function defined in $\mathbb{R}^N$, α is real function satisfying the following assumptions:

(H_1) $\omega \in L^1_{loc}(\Omega)$and $\omega^{\frac{-1}{p-1}} \in L^1_{loc}(\Omega)$.

(H_2) $\omega^{-s} \in L^1(\Omega)$ where $s \in \left(\frac{N}{P},\infty\right) \cap \left(\frac{1}{p-1},\infty\right]$.

(H_3) $f \in L^1(Q)$.

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Renormalized solutions for strongly nonlinear elliptic problems with lower order terms And L^1-data in Musielak-Orlicz space

Communication Info

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Keywords:
(1) Musielak-Orlicz-Sobolev Spaces
(2) Renormalized solutions
(3) Poincaré inequality

Abstract

In this research we prove an existence result of renormalized solutions in Musielak-Orlicz spaces for a class of nonlinear elliptic equations with two lower order terms and L1-data.

In this paper we deal with a nonlinear and non coercive divergence equation containing lower order terms. Precisely we consider the following problem:

A(u) − div(Φ(x, u)) + g(x, u, ∇u) = f in Ω (1)

where Ω is a bounded Lipchitz open subset of R^N (N≥ 2) which satisfies the segment propriety and A(u) = −diva(x, u, ∇u) is a Leray-Lions operator defined on A : D(A) ⊂ $W_0^1 L_\varphi(\Omega) \rightarrow W^{-1}L_\psi(\Omega)$ where φ and ψ are two complementary Musielak-Orlicz functions. The lower order term Φ is a Carathéodory function which is not coercive, g is a nonlinearity term which satisfies some growth and sign conditions. The right-hand side f is assumed to belong to L1(Ω).

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Existence and multiplicity of solutions of a bi- non local problem without Ambrosetti-Rabinowitz condition on compact Riemannian manifolds

Communication Info

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Keywords:
(1) Compact Riemannian manifolds
(2) Non-local terms
(3) Mountain Pass Theorem
(4) Fountain and Dual Fountain Theorem.

Abstract

This paper deals with existence and multiplicity results for a bi-non-local problem without the Ambrosetti-Rabinwitz condition, in the context of variable exponents of Sobolev spaces over compact Riemannian manifolds. Using the mountain pass theorem, we obtain that our problem admits at least weak non-trivial solutions. Also using Fountain's theorem and Dual Fountain's theorem, we obtain the existence of infinitely many non-trivial solutions.

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Absolutely convergent Fourier–Jacobi series and generalized Lipschitz classes

Communication Info

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Keywords:
(1) Fourier–Jacobi series;
(2) Fourier–Jacobi transform;
(3) Boas theorems

Abstract

In this paper, we give necessary and sufficient conditions in terms of Fourier–Jacobi coefficients of a function *f*, to ensure that *f* belongs either to one of the generalized Lipschitz classes. Also a condition for generalized Jacobi differentiability of a function on interval $[0, \pi]$ is proved.

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Fractional Physics-Informed Neural Networks For The Fractional Gray-Scott Model

Communication Info

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Keywords:
(1) Physics-Informed Neural Networks
(2) Fractional Gray-Scott model
(3) Fractional Laplacian

Abstract

Physics-informed neural networks (PINNs), introduced in [1], are effective in solving integer order partial differential equations (PDEs) based on scattered and noisy data. PINNs employ standard feedforward neural networks (NNs) with the PDEs explicitly encoded into the NN using automatic differentiation, while the sum of the mean-squared PDE residuals and the mean squared error in initial-boundary conditions is minimized with respect to the NN parameters. In this work, we will use an extension of PINNs called fractional physics informed neural networks (fPINNs) [2] to solve one dimensional space-time fractional reaction-diffusion Gray-Scott model [3].

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On a critical fourth order Leray-Lions p(x)-Kirchhoff type problem with no-flux boundary condition

Communication Info

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Keywords:
(1) Leray-Lions type operator
(2) Critical variable exponent
(3) No flux boundary condition

Abstract

Using variational methods combined with the genus theory, we investigate in this work, the existence of nontrivial weak solutions for a class of fourth order critical $p(x)$-Kirchhoff type problem involving the Leray-Lions type operators with indefinite weight and no flux boundary condition. Accurately, we show the existence of at least k pairs of nontrivial weak solutions for the given problem.

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Quadratically perturbed fractional differential equations with variable order derivative

Communication Info

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Keywords:
(1) Hybrid equations
(2) Variable order derivative
(3) Krasnoselskii fixed point theorem.

Abstract

The theory of fractional differential equations has emerged as an interesting area to explore in recent years. The thing that caught our attention thinking about using the order of the fractional derivatives as a function, where we find some works ([1], [2], [3], [4], and [5]), in which the order of the fractional derivative has been used as a function that changes with concentration, time, space, or other independent quantities. Motivated by these works in this paper, we studied the existence of solutions for a hybrid fractional differential equation with variable order derivative by using the Krasnoselskii fixed point theorem. Further, an example is provided to illustrate our results.

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

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On the conservation Laws of the Time-Fractional Regularized Long-Wave Equation

Communication Info

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Keywords:
(1) Lie Symmetry
(2) Riemann-Liouville fractional derivative
(3) Regularized Long-Wave Equation
(4) Conservation Laws.

Abstract

Building upon our prior research, this paper represents a continuation of our previous work [4], where we explored the time-fractional Regularized Long-Wave Equation for its solutions through the application of Lie point symmetry analysis. In our previous study, we showcased the effectiveness of the Lie symmetry method in deriving similarity reductions and explicit solutions for the nonlinear time-fractional Regularized Long-Wave Equation.

In this paper, we extend our investigation by employing a new conservation theorem. We construct new conserved vectors for the governing equation and provide a detailed derivation of these vectors. This further enhances our understanding of the dynamics and behavior of the system under consideration, contributing to the broader body of knowledge in the field of mathematical physics.

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Numerical Simulation of Pollutant Transport in the Oualidia lagoon (Morocco)

Communication Info

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Keywords:
(1) Lattice Boltzmann Method
(2) Shallow Water Equation
(3) Oualidia Lagoon

Abstract

This paper introduces the lattice Boltzmann method (LBM) and its application in analyzing fluid dynamics described by the shallow water equations (SWE). Derived from statistical physics principles, LBM is gaining traction as a serious alternative to traditional methods (finite difference, finite element and finite volume) [1]. LBM has been utilized in industrial flows governed by the Navier-Stokes equations; its adaptation to coastal fluid dynamics typically described by the SWE is also explored [2]. This work aims to test and validate our developed model on a variety of flow problems used in hydraulic engineering. We will present a numerical simulation of wind-driven flow in a circular basin. The second simulation involves the application of LBM to model pollutant transport in the lagoon of Oualidia. In this instance, we simplified the boundaries and initially approached the study area with a constant bathymetry. On the other hand, we used real values of boundary conditions (water depth and velocities of M_2tidal wave) taken from the TPXO global database. The results are presented using different scenarios of tidal and wind-induced flow fields in the lagoon. The results obtained by our code applied to the Oualidia lagoon are in good agreement with the various results published in the literature on the lagoon [3].

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The thermal buckling analysis of Functionally Graded Plates

Communication Info

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Keywords:
(1) Thermal buckling
(2) Fifth order shear deformation theory
(3) Functionally Graded Material (FGM) plate

Abstract

This research delves into thermal buckling of simply supported Functionally Graded Material (FGM) plates based on a fifth-order shear deformation theory. The developed theory takes into account the effects of transverse stresses and uses higher-order variations of in-plane displacements. The FGM plate's material properties and coefficient of thermal expansion exhibit thickness-dependent variations, following a power law distribution based on the volume fractions of its constituents. To formulate the stability equations of motion the principle of minimum total potential energy is used. Solutions for simply supported FGM plates are obtained using Navier's solution technique, while considering different temperature distributions inside the plate. including non-linear, linear, and uniform. The proposed theory has been compared numerically with some established theories, these comparisons show improved accuracy of thermal buckling load prediction when using the proposed theory instead of others.

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Solutions in Sense of Distributions for Elliptic Problem with L^m −data and Fourier Boundary Condition

Communication Info

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Keywords:
(1) Sobolev spaces with variable exponents
(2) Fourier boundary-value
(3) Solutions in sense of distributions

Abstract

We study the existence of solutions in the sense of distributions for the following non-coercive quasilinear $p(x)$ −elliptic equation with Fourier boundary-value

$$\begin{cases} -div\big(a(x,u,\nabla u)\big) + |u|^{p(x)-2}u = f(x,u) - div\big(\phi(x,u)\big) & in\ \Omega, \\ \big(a(x,u,\nabla u) - \phi(x,u)\big)\eta + \kappa u = g(x) & in\ \partial\Omega, \end{cases}$$

where Ω is an open bounded subset in R^N (N≥ 2) with Lipschitz boundary $\partial\Omega$, and η is the outer unit normal vector on $\partial\Omega$. Where the right-hand side $f(x,u)$and $\phi(x,s)$ are Carathéodory functions satisfying some growth conditions.

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Numerical Analysis of a Thermoelastic Unilateral Contact Problem

Communication Info

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Keywords:
(1) Thermal contact
(2) Penalty and augmented Lagrangian methods
(3) Numerical simulations

Abstract

We study a frictionless contact problem between a thermoelastic body and a rigid foundation. The contact is described with Signorini's condition and a thermal contact condition when the heat exchange coefficient depends on the contact pressure, see [1]. We aim to present a detailed description of the numerical modeling of the problem. On this end, we use a penalty method to approximate the constraints, see [2, 3] for details. Finally, we provide numerical simulations to study a two-dimensional example and compare the penalty problem with the Lagrangian one.

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Existence results for nonlinear elliptic equations with Neumann boundary condition

Communication Info

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Keywords:
(1) Nonlinear elliptic equations
(2) Berkovits' topological degree

Abstract

In this paper, we will employ Berkovits' topological degree to establish the existence of weak solutions for a Neumann boundary value problem of nonlinear elliptic equations .

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On the almost periodicity for some nonautonomous evolutions equations

Communication Info

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Keywords:
(1) Nonautonomous evolution equation
(2) Essential spectral radius
(3)Almost periodicity

Abstract

In this work, our aim is to investigate the existence, uniqueness, and stability of almost periodic solutions for for some nondensely nonautonomous evolution equations. We demonstrate that the problem can be reduced to a linear autonomous discrete dynamical system. Additionally, we show that even if the forcing term is almost periodic in the weak (Stepanov) sense, the solutions become almost periodic in the strong (Bohr) sense. For illustration, we provide examples of a size structured population dynamic model and an epidemic model with age of infection.

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Multiple solutions for elliptic problems involving the fractional $(p_1(x), p_2(x))$-laplacian

Communication Info

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Keywords:
(1) Fractional p(x)-Laplace operator
(2) three critical-points theorem
(3) weighted variable exponent spaces

Abstract

The aim of this paper is to investigate weak solutions for a Dirichlet $(p_1(.,.), p_2(.,.))$-Laplace problem with weight. The main tool used for obtaining the existence result is a recent three critical-points theorem established by Ricceri.

In recent years, great attention has been focused on the study of problems involving fractional and nonlocal operators of elliptic type. This category of operators come up in a quite natural way in many different applications such as phase transition phenomena, continuum mechanics, population dynamics, minimal surfaces and game theory, as they are the typical outcome of the stochastically stabilization of L´evy processes, see [1-3].

In this work, we are concerned with the following Dirichlet problem

$$\begin{cases} \left(-\Delta_{p_1(.,.)}\right)^s u(x) + \left(-\Delta_{p_2(.,.)}\right)^s u(x) + w_1(x)|u|^{\bar{p}_1(x)-2}u + w_2(x)|u|^{\bar{p}_2(x)-2}u \\ \qquad\qquad = \lambda f(x,u) + \mu g(x,u) \quad \text{in } \Omega, \\ u = 0 \qquad\qquad \text{on } \mathrm{R}^N \setminus \Omega. \end{cases}$$

where $\Omega \subset \mathrm{R}^N$ is a Lipschitz bounded open domain, $N \geq 2$, s is a fixed real number such that $0 < s < 1$ and λ, μ are two positive parameters. $w_i : \Omega \to (0,+\infty)$ such that $w_i \in L^1(\Omega)$ with $ess\sin f_{x\in\Omega} w_i(x) > 0$ (i =1, 2), f, g : $\Omega \times \mathrm{R} \to \mathrm{R}$ are two Caratheodory functions with subcritical growth conditions and $p \in C^0(\bar{\Omega} \times \bar{\Omega})$ a function such that

$$1 < p^- = \inf_{(x,y)\in\bar{\Omega}\times\bar{\Omega}} p(x,y) \leq p(x,y) \leq p^+ = \sup_{(x,y)\in\bar{\Omega}\times\bar{\Omega}} p(x,y) < +\infty.$$

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Existence of solutions for upper semicontinuous differential inclusions with ϕ-Laplacian

Communication Info

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Keywords:
(1) differential inclusion
(2) boundary value problems
(3) upper semi-continuous multifunction
(4) measurability
(5) condensing map
(6) fixed point

Abstract

In this work, we prove the existence of solutions for the specified boundary value problems:

$$\begin{cases} \left(\phi\left(x'(t)\right)\right)' \in F\left(t, x(t)\right), \text{ a.e. on } [0, T]; \\ ax(0) - b\phi\left(x'(0)\right) = A, cx(T) - d\phi\left(x'(T)\right) = B; \end{cases}$$

$$\begin{cases} \left(\phi(x'(t))\right)' \in F(t, x(t)), \text{ a.e. on } [0, T]; \\ x(0) = x(T), x'(0) = x'(T); \end{cases}$$

where F is a multi-valued map, $\phi:]-a_0, a_0[\to \mathbb{R}$ is a function, a, b, c, d, A and B are real numbers. The existence of the solution is obtained under the following conditions :

(H1) $F: [0, T] \times \mathbb{R} \to \mathcal{P}(\mathbb{R})$ is an L^1-Carathéodory multi-valued mapping with nonempty convex compact values;
(H2) $\phi:]-a_0, a_0[\to \mathbb{R}$ is an homeomorphism, where $0 < a_0 \leq +\infty$.

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THE SIXTH EDITION OF THE INTERNATIONAL CONFERENCE ON RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
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Conformable Fractional Semilinear Evolution Equations With time Delay and Noncompact Analytic Semigroup.

Communication Info

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Keywords:
(1) conformable Fractional derivates
(2) measure of noncompactness
(3) differential equation with delay .

Abstract

In this work, we study a class of conformable fractional evolution equations, with delay and noncompact analytic semigroup. First of all, we give the form of the solution. Furthermore, Our results are proved by using some standard fixed points theorems and measure of noncompactness. At the end, as an application, we give an illustrative example. we obtain various criteria on the existence and uniqueness of mild solutions.

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On weak solutions to the fractional p-Laplacian problem via Young measures

Communication Info

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Keywords:
(1) Fractional p-Laplacian
(2) Young Measure
(3) Galerkin method

Abstract

In this presentation, we show the existence result of the following fractional p-Laplacian system
$(-\Delta)_p^s u = f(x,u) \quad in\,\Omega\,,\; u = 0 \quad in\; IR^n \backslash \Omega\,.$
Under appropriate assumptions, we obtain the existence of weak solutions by applying Galerkin's approximation combined with the theory of Young measures [1].

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Existence of renormalized solutions for some strongly nonlinear and noncoercive elliptic problem in anisotropic weighted Sobolev spaces

Communication Info

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Keywords:
(1) Anisotropic weighted Sobolev spaces
(2) strongly nonlinear equation
(3) renormalized solutions

Abstract

In this article we establish some properties and Lemmas in weighted anisotropic Sobolev spaces. As an application, we study the following strongly and non-coercive elliptic problem.

$$-\sum_{i=1}^{N} D^i a_i(x, u, \nabla u) + g(x,u,\nabla u) = f(x) \quad \text{in} \quad \Omega,$$
$$u = 0 \quad \text{on} \quad \Omega,$$

where the Carathéodory functions g(x,u,∇u) and the data f(x) is assumed to be in $L^1(\Omega)$. We prove both the existence and regularity of renormalized solutions for elliptic equation in anisotropic weighted Sobolev space $W_0^{1,\vec{p}}(\Omega, \omega_1, \omega_2)$.

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Existence result for fuzzy fractional evolution equations involving Krasnosel'skii fixed point theorem

Communication Info

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Keywords:
(1) Fuzzy fractional evolution equations
(2) Fuzzy semigroups

Abstract

The primary focus of this paper is to investigate the existence of two distinct types of fuzzy mild solutions for fuzzy fractional evolution equations employing Caputo's gH-differentiability. The proofs leverage an extended Krasnoselskii fixed point theorem applicable to fuzzy metric spaces, fuzzy strongly continuous semigroups, and fundamental tools of fuzzy fractional calculus.

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ICRAMCS 2024
THE SIXTH EDITION OF THE INTERNATIONAL CONFERENCE ON RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
April 25-26-27, 2024 | Marrakech, Morocco

Almost Anti Periodic Weak Solutions of Some Nonlinear Evolution Equations

Communication Info

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Keywords:
(1) Almost anti periodicity
(2) Nonlinear evolution equation
(3) Stepanov almost anti periodicity
(4) Strongly maximal monotone operator
(5) Weak solution

Abstract

In this work, we are interested in studying the existence, uniqueness and global attractivity of the almost anti periodic weak solutions for some nonlinear evolution equations governed by strongly maximal monotone operators with Stepanov almost anti periodic forcing terms. Our results are new. A concrete example is given to illustrate the abstract results.

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IGA for time-dependent diffusion problems in three space dimensions

Communication Info

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Keywords:
(1) Diffusion problems
(2) Finite element method
(3) Isogeometric analysis
(4) NURBS
(5) Implicit time integration schemes

Abstract

We propose a NURBS-based isogeometric analysis method to solve time-dependent diffusion problems which occur in many applications in structural engineering and fluid mechanics. The geometry is constructed exactly using high-order Non-Uniform Rational B-spline functions which are integrated in finite element analysis to represent the temperature. High-order implicit schemes are used for the time integration eliminating restrictions related to the explicit time steeping. The combined techniques ensure high accuracy for the thermal distributions in the 3D heat diffusion problems. The performance of the proposed method was examined by solving many examples of heat diffusion problem, and the obtained results demonstrate that our method is stable, efficient, simple and strongly reduces the number of degrees of freedom to achieve a prescribed accuracy with a reasonably large time step.

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Enhancing Physics Informed Neural Networks For solving Nonlinear Partial Differential Equations

Communication Info

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Keywords:
(1) Machine learning
(2) Partial differential equations
(3) Neural networks
(4) Physics-informed neural networks

Abstract

Numerical accuracy is a key property in the resolution of Partial differential equations. With the arise of machine learning, Particularly Artificial Neural Networks (ANN) and the innovative Physics Informed Neural Networks (PINN), new promising methodologies have emerged tackling this challenge. In this paper, we conduct an enhancement of the PINN method for solving non-linear PDEs.

From decades past up to the present, Partial Differential Equations were solved numerically using discretization methods such as Finite Elements, Finite difference, Finite volume methods... Although their effectiveness in solving PDEs, the discretization process remain challenging and time consuming. Alternatively, machine-learning methods are non-discretization methods that have given promising results.

PINNs are uniquely trained to solve machine learning tasks while respecting any given laws of physics described by the PDE. In this study, we aim to enhance the PINNs method for solving PDEs, encompassing different aspects starting with the accuracy, the computational efficiency, and data requirement to the generalization capabilities of the proposed approach.

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THE SIXTH EDITION OF THE INTERNATIONAL CONFERENCE ON RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
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Analysis of dynamics and optimal control of cutaneous leishmaniasis during human migration

Communication Info

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Keywords:
(1) Leishmaniasis
(2) mathematical model
(3) immigration
(4) stability
(5) optimal control

Abstract

This article delves into the impact of global human immigration on community health, with a specific focus on non-communicable diseases such as leishmania. By utilizing a mathematical model, we analyze the complex relationship that exists between sand flies and human migration in the spread of leishmania, emphasizing the pressing need for early intervention strategies. Our model incorporates population dynamics of both sand flies and humans, optimal testing or screening strategies, and a range of measures to reduce leishmania transmission in both populations. Our findings demonstrate that immigration has a major role in the potential spread of human-borne leishmania, Stressing the necessity of the importance of global collaboration in addressing this issue. Our article provides valuable insights for health authorities and policymakers in safeguarding public health and economic stability. During this investigation is to introduce a mathematical model, consisting of a SEIR human and SEI sand fly's framework, to examine the patterns of this disease's dissemination. The mathematical analysis involves the investigation of solution positivity boundedness, and it is demonstrated that a disease-free equilibrium not present. On top of that, the points of endemic equilibrium are determined, and the global stability behavior is explored. Not only that, strategies for optimal control are employed to minimize the quantity of exposed and diseased people among humans, sand flies, and immigrant humans. The optimal control properties can be described using Pontryagin's maximum principle. The findings reveal that the execution of ideal plans successfully lowers the incidence of exposure and illness in sand flies, humans, and human immigrants. Theoretical results are supported by numerical simulations of every compartment for human and sand flies, elucidating their impact on the spread of leishmaniasis.

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ENTROPY SOLUTIONS FOR SOME NON-COERCIVE QUASILINEAR p(x)-PARABOLIC EQUATIONS WITH L1-DATA

Communication Info

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Keywords:

(1) Sobolev spaces with variable exponents

(2) quasilinear non-coercive parabolic equations

(3) boundary value problems

Abstract

We consider the following quasilinear non-coercive p(x)-parabolic problem

$$\frac{\partial u}{\partial t} - div\ a(x,t,u,\nabla u) + |u|^{p(x)-2}u = f(x,t) \ \ in\ \ Q_T.$$

with f belong to $L^1(Q_T)$ We show the existence of solutions in the parabolic space with variable exponent V. Moreover, we show that these solutions are also renormalized solutions for our quasilinear p(x)- parabolic problem.

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Analytical Solutions to ζ-Fractional Initial Value Problems Via Modified Sumudu Transform

Communication Info

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Keywords:
(1) ζ -Fractional calculus
(2) Sumudu transform
(3) Cauchy initial value problems

Abstract

This paper presents analytical solutions to ζ-fractional initial value problems (IVP) through the application of the modified Sumudu transform. Utilizing this method, we derived a concise solution for the Cauchy initial value problem.

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THE SIXTH EDITION OF THE INTERNATIONAL CONFERENCE ON RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
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Existence of entropy solution for a nonlinear parabolic problem in weighted Sobolev space via optimization method

Communication Info

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Keywords:
(1) Nonlinear degenerate parabolic problem.
(2) entropy solutions.
(3) Weighted Sobolev space

Abstract

Let $\Omega \subset \mathbb{R}^N$ ($N \geq 2$) be a bounded open set, T is a fixed positive number and p be a real number such that $1 < p < \infty$. Our aim in this work is to study the existence and uniqueness for weak solution in weighted Sobolev spaces of the nonlinear degenerate parabolic problem

$$\begin{cases} \dfrac{\partial u}{\partial t} - div\,(\omega|\nabla u|^{p-2}\nabla u) + |u|^{p-2}u = f & in\ \ Q :=]0;T[\times \\ u = 0 & on\ \ \Gamma :=]0;T[\times\, \partial\Omega, \\ u(.,0) = u_0 & in\ \Omega, \end{cases}$$

where ω is a measurable positive and a.e finite function defined in $\mathbb{R}^N$, α is real function satisfying the following assumptions:

(H_1) $\omega \in L^1_{loc}(\Omega)$and $\omega^{\frac{-1}{p-1}} \in L^1_{loc}(\Omega)$.
(H_2) $\omega^{-s} \in L^1(\Omega)$ where $s \in \left(\frac{N}{P},\infty\right) \cap \left(\frac{1}{p-1},\infty\right]$.
(H_3) $f \in L^1(Q)$.

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Mathematical Modeling of the Boufa Drug Addiction in morocco

Communication Info

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Keywords:
(1) mathematical modeling
(2) optimal control

Abstract

In this work, we aim to describe the dynamic of the addiction to the "Boufa" drug that has been used contagiously among the youth in Morocco. The population that we are going to study is composed of two age groups: those below 18 years old and those above 18 years old. Therefore, we have in each group three compartments: susceptible, addicted, and recovering. Our objective is to find the best strategy to reduce the number of Boufa users. We use two control strategies, which are awareness programmes through media and education and treatment. Pontryagin's maximum principle is used to characterize the optimal controls. The numerical simulation is carried out using MATLAB. Consequently, the obtained results confirm the effectiveness of the optimisation strategy.

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Renormalized Solution to nonlinear parabolic problems with measure data in Musielak spaces

Communication Info

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Keywords:
(1) Lower order term
(2) Musielak-Sobolev spaces
(3) Parabolic equations

Abstract

Our purpose in this talk is to show the existence of renormalized solution for the nonlinear parabolic problems with two lower order terms in Musielak spaces, likes the form

$$\frac{\partial b(u)}{\partial t} + A(u) + g(x,t,u,\nabla u) + H(x,t,\nabla u) = f - \operatorname{div}(F)$$

where A is a Leray Lions operator and g, H are two lower order terms. The second term is a measure data.

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Avoiding degeneracy using Lebesgue product integral

Communication Info

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Keywords:
(1) Integral product
(2) Non autonomous equations
(3) Maximal regularity

Abstract

The integral product becomes an efficient tool to deal with non-autonomous evolution equations [1] and [3]. Gregor Schmidt, in order to encounter the overlap problem between the Borelean sets [2], has introduced the ordered integral product. This latter concept will enable us to avoid degeneracy of some non-autonomous equations governed by a family of measurable operators. The key tool is a smooth skip of pathological operators that harm natural evolution. As a consequence, we obtain a regularity result with less constraint hypotheses on the family of operators A(t) governing the evolution when these ones arise from some irregular non autonomous forms on separable Hilbert spaces.

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Numerical Methods for Viscoelastic Taylor-Couette Flow

Communication Info

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Keywords:
(1) Oldroyd-B model
(2) Taylor-couette
(3) Computational methods

Abstract

Polymer and polymer matrix composites play an essential role in many industries. Designing and processing this class of material has led to significant research and development of the simulation of viscoelastic fluids in complex geometries.
In this work, We present a short review of the progress and challenges of numerical methods for simulating the complex flow behavior of the Oldroyd-B model in the classic Taylor-Couette geometry.

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STRONGLY QUASILINEAR PARABOLIC SYSTEMS IN DIVERGENCE FORM WITH WEAK MONOTONICITY

Communication Info

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Keywords:
(1) *quasilinear parabolic system.*
(2) $L^p(0,T;W^{-1,p}(\Omega;IR^m))$.
(3) *Young measures.*

Abstract

The existence of solutions to the strongly quasilinear parabolic system

$$\frac{\partial u}{\partial t} - div\,\sigma(x,t,u,Du) + g(x,t,u,Du) = f\ ,$$

is proved, where the source term f *is assumed to belong to* $L^p(0,T;W^{-1,p}(\Omega;IR^m))$. *Further, we prove the existence of a weak solution by means of the Young measures under mild monotonicity assumptions on* σ.

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Existence results for nonlinear hybrid $[\Psi, \Phi]$ Caputo-Fabrizio fractional differential

Communication Info

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Keywords:
(1) Caputo-fabrizio fractional integral
(2) $[\Psi, \Phi]$ Caputo-fabrizio fractional derivative
(3) Banach fixed point theorem.
(4) The Adams–Bashforth methods

Abstract

The aim of this paper is to develop a theory of fractional hybrid differential equations with perturbations of second type involving $[\Psi, \Phi]$ Caputo-Fabrizio fractional derivative of an arbitrary order $\nu \in(0,1)$. We demonstrate the existence and uniqueness of solutions for a particular class of nonlinear fractional hybrid differential equations with initial conditions by applying Banach's fixed point theorem and some fundamental concepts on fractional analysis. As an example, a significant case is given to illustrate the utility of our theoretical findings. We also, give a simulation of the solution by applying the Adams Bashford with three steps method

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On a class of Elliptic systems in general Fractional variable exponents Sobolev spaces

Communication Info

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Keywords:
(1) Elliptic systems
(2) General fractional p(x, .)-Laplacian
(3) Three Critical Points Theorem

Abstract

This talk is concerned with the existence and the multiplicity of weak solutions for a nonlocal fractional elliptic system of (p(x, .), q(x, .)) -Kirchhoff type with weight and homogeneous Dirichlet boundary conditions. The approach is based on the three critical points theorem introduced by Recceri and on the theory of general fractional Sobolev spaces with variable exponents.

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Nonlinear parabolic equations with singular lower order term

Communication Info

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Keywords:
(1) Singular problem
(2) Nolinear parabolic equations
(3) Lower order term

Abstract

We prove the existence of a nonnegative solution to nonlinear parabolic problems with absorption terms and a singular lower order term. More precisely, we analyze the interaction between the absorption term and the singular term to get a solution for the largest possible class of the data

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MEASURE DATA FOR A GENERAL CLASS OF NONLINEAR ELLIPTIC PROBLEMS

Communication Info

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Keywords:
(1) Anisotropic Sobolev spaces
(2) Measure data
(3) maximal monotone graph

Abstract

In this work; we discuss the existence and uniqueness of a suitable notion of solution for which a nonlinear multivalued elliptic problem $\beta(u) - div\ a(x, Du) \ni \mu$ in Ω; governed by a general Leary-Lions operator [4]; where β is a maximal monotone graph on $\mathbb{R}^2$ with $0 \in \beta(0)$ and Ω is a bounded open set of $\mathbb{R}^N$; $(N \geq 2)$. In terms of the paper (Brezis et al., 2007, [3]), we study the notion of solution for this kind of problem for which any diffuse measure is “good measure”. These results can be viewed as a generalization of the problem (E; f) in [1] such that we extend the existence results to measure data [2].
The functional setting involves anisotropic Sobolev spaces $W^{1,\vec{p}}(\Omega)$ [5]; with $\vec{p} = (p_1, \dots, p_N)$; they are function spaces that generalize the classical Sobolev spaces by allowing different degrees of smoothness in different directions.

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Existence of solutions for a fractional (p(x,.),q(x,.))-Laplacien system under Neumann boundary conditions

Communication Info

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Keywords:
(1) Elliptic systems
(2) Nonlocal problem
(3) Neumann problem
(4) Mountain Pass Theorem

Abstract

In this talk, we consider a class of elliptic systems involving the fractional (p(x,.); q(x,.))- Laplacien operators under the Neumann boundary conditions. Our main tools are based on Mountain Pass theorem.

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ICRAMCS 2024

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

April 25-26-27, 2024 | Marrakech, Morocco

On an almost sure asymptotic behavior result for a chaotic linear dynamic.

Communication Info

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Keywords:
(1) Linear Chaos
(2) Random Initial data
(3) Chaotic Semigroups

Abstract

In our talk we will be interested in a very special class of linear systems. The associated dynamics are complex and erratic despite their deterministic description via a linear Cauchy problem, $\frac{du(t)}{dt}=A\;u(t),\;\;u(0)=u_0\in H$. see [1] **and references therein. Inspired by the work of N. Burq** [2] **treating nonlinear schr\"{o}dinger equation, we will use appropriate tools to prove that the solutions are better behaved for randomly chosen initial data than would be predicted by the classical semigroup theory. We shall prove that the corresponding flows enjoy very nice probabilistic asymptotic behavior. Precisely, in a separable Hilbert setting and under suitable conditions on the generator $(A,D(A)),$ we can construct a measure μ on the Borel sigma-algebra $\mathcal{B}(H)$ with the following properties:**
\begin{itemize}
\item a) μ is a centred Gaussian measure,
\item b) the domain of $D(A)$ has a full μ

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Nonlinear and nonlocal interactions of complex systems: Allometry and criticality

Communication Info

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Keywords:
(1) Vegetation patterns
(2) Critical
(3) Symmetry-breaking instability

Abstract

The self-organization phenomenon is universal and appears in many far-from-equilibrium systems, such as chemistry, fluids, nonlinear optics, and laser physics [1], [2]. Vegetation patterns could be aperiodic, such as localized patches that can be isolated and randomly distributed in space, creating a well-defined spatial pattern , or labyrinth [3]. Spatial periodic and localized patterns are a well-documented issue in various areas of the natural sciences, ranging from population dynamics to chemistry and optics [4]. We present a model that considers the non-linear and non-local facilitative and competitive interactions in arid and semiarid climates. These two botanical processes are interconnected and operate at different spatial scales. Seed dispersal is modeled as a diffusion process. We consider landscapes populated by a dominant species to be isotropic and homogeneous environmental conditions. We included the allometric factor in the modeling, considering the age classes [5]. We show that the allometric factor reduces the range of symmetry-breaking instability and favors the formation of homogeneous cover rather than vegetation patterns.

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THE SIXTH EDITION OF THE INTERNATIONAL CONFERENCE ON RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
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Existence of infnitely many positive energy solutions for a multiple critical Hardy-Sobolev-Maz'ya problem with concave-convex nonlinearities

Communication Info

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Keywords:
Infnitely many solutions.
Hardy-Sobolev- Maz'ya exponents.
Concave-convex.
Fountain Theorem.
Dual fountain Theorem.

Abstract

In this paper, we consider the following multiple critical Hardy-Sobolev Maz'ya problem

$$\begin{cases} -\Delta u = \sum_{i=1}^{l} \mu_i \frac{|u|^{2^*(s_i)-2-\varepsilon_n u}}{|y|^{s_i}} + a(x)|u|^{q-2}u & \text{in } \Omega, \\ u = 0 & \text{on } \partial\Omega, \end{cases}$$

where Ω is a smooth bounded domain in $\mathbb{R}^N$, $\mu_i \geq 0\ \forall i = 1,2 \dots$ and there exist i_0 such that $\mu_{i_0} \neq 0$, $a \in C^1(\bar{\Omega}, \mathbb{R}^{*+})$, $0 < s_1 < s_2 < \cdots < s_l < 2$, $x = (y, z) \in \mathbb{R}^k \times \mathbb{R}^{N-k}, 2 \leq k < N$, $1 < q < 2$ and $2^*(s_i) := \frac{2(N-s_i)}{N-2}$ is the critical Hardy-Sobolev-Maz'ya exponent. Under some conditions on Ω and N, we prove that the above problem has infinitely many positive energy solutions.

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Analyze the singularity of the heat flux with the reduced basis method

Communication Info

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Keywords:
(1) Reduced basis method
(2) Heat flux singularity
(3) Greedy algorithm
(4) POD
(5) Finite element method

Abstract

The heat flux in the steady state heat conduction problem becomes infinite [3] at the re-entrant corner due to geometric discontinuities or materiel properties, solving this problem using the conventional numerical methods, such as the bondary element method (BEM) and the finite element method (FEM), have difficulties in analyzing the accurate singular heat flux field. In this work we employe a new method [1] that enable to accurate and rapid numerical simulations with a low cost are required, we consider a technique which combines high and low fidelity methods [2] to reduce the computational cost and solve the problem with singularities. The reduced basis (RB) method allows to obtain a quickly and accurate solution of the parameterized PDEs [4].

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Existence of solution for a variable growth anisotropic equation

Communication Info

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Keywords:
(1) Topological degree
(2) Dirichlet conditions
(3) Generalized Sobolev spaces
(4) Anisotropic p(x)-Laplacian
(5) Variable growth
(6) Periodic solution

Abstract

The idea behind the present paper is to establish the existence of a periodic non-negative solution for a degenerate parabolic equation with anisotropic p(x)-Laplacian operator and strongly nonlinear source under Dirichlet type boundary conditions. This will be approached by a proof based on the Leray-Schauder topological degree, which can be tricky to work with in this type of equations.

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Numerical simulation of an anisotropic bead type thermistor

Communication Info

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Keywords:
(1) Thermistor problem
(2) Anisotropic Sobolev space
(3) Finite element method
(4) Numerical solution

Abstract

We have developed a 3D numerical algorithm for the computation of the numerical solutions in a bead type thermistor. This algorithm combines a fixed-point technique with a standard finite element method (FEM). Some numerical tests have shown the existence of non-symmetric solutions and this leads to multiple many solutions (at least three). We discuss the numerical results obtained for different values of the exponents pj and the applied voltage on different meshes.

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Numerical analysis of some mathematical models arising from micromagnetism.

Communication Info

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Keywords:
(1) Landau-Lifshitz equation
(2) Finite difference method
(3) Finite element method
(4) Fourier-spectralmethod
(5) Adaptive time-stepping algorithm

Abstract

This presentation is devoted to the numerical study of some mathematical problems arising from micromagnetism. The aim is to analyze the behavior of the models based on various physical parameters, some of which may exhibit subtle variations that are difficult to measure. We employ numerical approaches. The models considered rely on the use of the Landau-Lifshitz-Gilbert (LLG) equation describing the evolution of the magnetization field in a ferromagnetic material.

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ICRAMCS 2024
THE SIXTH EDITION OF THE INTERNATIONAL CONFERENCE ON RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
April 25-26-27, 2024 | Marrakech, Morocco

Global analysis of a stochastic non-autonomous SIR model with vaccination

Communication Info

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Keywords:
(1) Stochastic Gaussian noise
(2) Non-autonomous SIR model
(3) Vaccination

Abstract

We analyze the dynamics of a stochastic non-autonomous SIR epidemic model. The parameters of the model are allowed to depend on time, to incorporate the seasonal variation. Furthermore, the vaccinated population is divided into three subpopulations, each one represents a different stage. For the proposed model, we prove the mathematical and biological well-posedness [3]. That is, the existence of a unique global almost surely positive solution. Moreover, we establish some conditions under which the disease vanishes or persists in the population [1,2]. The established theoretical results along with the performed numerical simulations exhibit the effect of the different stages of vaccination along with the stochastic Gaussian noise on the dynamics of the studied population.

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THE SIXTH EDITION OF THE INTERNATIONAL CONFERENCE ON RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
April 25-26-27, 2024 | Marrakech, Morocco

Optimal control for a class of linear infinite-dimensional systems using integral reinforcement learning

Communication Info

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Keywords:
(1) optimal control
(2) reinforcement learning
(3) linear systems in an infinite-dimensionnel

Abstract

This work deals with the design of an optimal adaptive control for a class of parabolic systems utilizing a reinforcement learning approach. First, an integral policy iteration algorithm is presented to learn the optimal solution of the algebraic Riccati equation online, assuming that the dynamics operator is a Riesz operator with unknown eigenvalues. Furthermore, the developed approach does not require any knowledge of the system dynamics. The obtained algorithm is tested first with the heat equation before applying it to the case study, which is the reactor model. Numerical simulations are performed to demonstrate the effectiveness and superiority of the proposed algorithm.

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ICRAMCS 2024

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

April 25-26-27, 2024 | Marrakech, Morocco

Infinitely many solutions for a Neumann elliptic system involving critical Sobolev growth and Hardy potential.

Communication Info

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Keywords:
(1) Laplacian,
(2) Hardy potential,
(3) Critical Sobolev exponent,
(4) Infinitely many solutions,
(5) Pohozaev identity.

Abstract

In this paper, we will prove the existence of two disjoint and infinite sets of solutions for the following Neumann elliptic system with critical Sobolev exponents and Hardy potential.

$$\begin{cases} -\Delta u - t\dfrac{u}{|x|^2} = \dfrac{2\alpha}{\alpha+\beta}|u|^{\alpha-2}u|v|^{\beta} + \dfrac{2p}{p+q}|u|^{p-2}u|v|^{q} & \text{in } \Omega \\ -\Delta v - t\dfrac{v}{|x|^2} = \dfrac{2\beta}{\alpha+\beta}|u|^{\alpha}|v|^{\beta-2}v + \dfrac{2q}{p+q}|u|^{p}|v|^{q-2}v & \text{in } \Omega \\ \partial_{\upsilon}u = \partial_{\upsilon}v = 0 & \text{on } \partial\Omega \end{cases}$$

where $\Omega \subset \mathbb{R}^N$ is a smoothly bounded domain containing the origin, $N \geq 3, \bar{t} =, \frac{(N-2)^2}{4}, t \in [0, \bar{t}), 2^* - \sqrt{1-\frac{t}{\bar{t}}} < p+q < 2$, $\alpha+\beta = 2^*$ and $2^* := \frac{2N}{N-2}$ denotes the critical Sobolev exponent.

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ICRAMCS 2024

THE SIXTH EDITION OF THE INTERNATIONAL CONFERENCE ON RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
April25-26-27, 2024 | Marrakech, Morocco

Third order non-oscillatory central schemes for non-local conservation laws

Communication Info

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Keywords:
(1) Finite volumes methods
(2) traffic flow models
(3) conservation laws

Abstract

We present a third-order non-oscillatory central scheme for one-dimensional non-local conservation laws. The proposed scheme is an extension of the second-order central scheme of the Nessyahu-Tadmor scheme. We combine the minmod limiter with a quadratic polynomial in the new scheme to avoid oscillations. Numerical experiments show that the new scheme is non-oscillatory and provides good discontinuity resolution.

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Compact Almost Automorphic Processes and Applications

Communication Info

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Keywords:
(1) almost automorphic process
(2) Complete trajectory
(3) Nonlinear evolution equation
(4) Weak solution

Abstract

This work has two aims. Firstly, we introduce the concept of compact almost automorphic processes on a complete metric space. The existence of a complete trajectory that is compact almost automorphic is studied. Secondly, we apply our result to obtain the existence of compact almost automorphic weak solutions for some nonlinear evolution equations. A concrete example is given to illustrate the abstract result.

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Renormalized solutions for some nonlinear parabolic problems with degenerate coercivity in Anisotropic Sobolev spaces

Communication Info

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Keywords:
(1) nonlinear parabolic problems
(2) Renormalized solutions
(3) Non-coercive equation
(4) Anisotropic Sobolev spaces

Abstract

The aim of this paper is to study the nonlinear parabolic problem defined as follows

$$\begin{cases} u_t + Au + |u|^{p_0-2}u = f(x,t,u,\nabla u) & in\ \Omega \times (0,T) = Q_T, \\ u = 0 & on\ \ S_T, \\ u(0,t) = u_0 & in\ \ \Omega, \end{cases}$$

where the nonlinear term $f(x,t,s,\mathcal{E})$ satisfies only some growth condition. We prove the existence of the renormalized solutions in the anisotropic spaces. Also, we conclude some regularity results.

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An elliptic system related to the stationary thermistor problem in anisotropic Orlicz-Sobolev spaces

Communication Info

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Keywords:
(1) Coupled system
(2) Capacity solution
(3) Thermistor problem
(4) Anisotropic Orlicz-Sobolev spaces

Abstract

In this work, in the context of anisotropic Orlicz-Sobolev spaces, we analyze the existence of a capacity solution to a coupled nonlinear elliptic system, whose unknowns are the temperature inside a semiconductor material, and the electric potential. The system describes the heat produced in a semiconductor device by an electric current which may be considered as a generalization of the well-known thermistor problem.

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A numerical study of thermoelastic Bresse system with second sound

Communication Info

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Keywords:
(1) Numerical stability
(2) Finite element method
(3) Numerical simulations

Abstract

In this work, we numerically consider a thermoelastic Bresse system with second sound. We study the numerical energy and the exponential decay of the thermoelastic problem. First, we give a variational formulation written in terms of tranformed derivatives corresponding to a coupled linear system composed of five first-order variational equations. A fully discrete algorithm is introduced and a discrite stability property is proved. A priori error estimates are also presented. Finally, some numerical simulations are given in order to validate the theoritical results.

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The Nehari manifold for elliptic system with strongly coupled critical terms and concave-convex nonlinearities involving sign-changing weight functions

Communication Info

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Keywords:
(1) Elliptic system ;
(2) Strongly coupled critical terms ;
(3) Positive solutions;
(4) Nehari manifold;
(5) Variational method;
(6) Sign-changing weight function ;

Abstract

In present paper, we consider the following elliptic system with strongly coupled critical terms and concave-convex nonlinearities involving sign-changing weight functions

$$\begin{cases} -\Delta u = \lambda f(x)|u|^{q-2}u + h(x)\left(\frac{\eta_1\alpha_1}{2^*}|u|^{\alpha_1-2}|v|^{\beta_1}u + \frac{\eta_2\alpha_2}{2^*}|u|^{\alpha_2-2}|v|^{\beta_2}u\right), & \text{in } \Omega, \\ -\Delta v = \mu g(x)|v|^{q-2}v + h(x)\left(\frac{\eta_1\beta_1}{2^*}|u|^{\alpha_1}|v|^{\beta_1-2}v + \frac{\eta_2\beta_2}{2^*}|u|^{\alpha_2}|v|^{\beta_2-2}v\right), & \text{in } \Omega, \\ u = v = 0, & \text{on } \partial\Omega, \end{cases} \tag{1.1}$$

By the Nehari manifold method and variational method, two positive solutions are obtained for (1.1).
We refer the reader to Ambrosetti–Azorezo–Peral [1], de Figueiredo–Gossez–Ubilla [2], EL Hamidi [3] and Wu [4], etc. Recently, in [4] the author has considered a semilinear scalar elliptic equation involving concave–convex nonlinearities and sign-changing weight function, where for the definition of Nehari manifolds we refer the reader to Nehari [5].

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Solving parabolic PDEs using Physics Informed Neural Networks

Communication Info

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Keywords:
(1) Artificial neural networks
(2) Physics Informed Neural Networks
(3) Parobolic PDEs

Abstract

Recently, Neural Networks and physics-based models are combined to solve Partial Differential Equations [1-5]. This combination is a promising approach for solving PDEs efficiently and accurately [2,3].

In this work, we explore the application of Physics Informed Neural Networks (PINNs) for solving parabolic PDEs. We proceed by approximating the solution of parabolic PDE using Multi-Layer Neural Networks (MLNN). The parameters of the MLNN will be learned by minimizing the mean squared error loss using back-propagation algorithm and a specific cost function constructed from physical law of the PDE.

We provide some numerical experiments for illustration and we compare the approximated solution with the exact one. We study the effect of the hyperparameters of MLNN such as the activation function, the number of neurons, optimisation algorithm and learning rate.

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Ulam stability of $\wp$-mild solutions for ψ-Caputo-type fractional semilinear differential equations

Communication Info

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Keywords: Semilinear differential equations; ψ-Caputo differential derivatives; Mittag-Leffler-Ulam-Hyers stability.

Abstract

We study in this paper the existence and uniqueness of solutions to initial value problems for a semilinear differential equations involving ψ-Caputo differential derivatives of an arbitrary $l\in (0,1),$ using the fixed theorem. We do analyze further the M-L-U-H stability and the M-L-U-H-R stability. Then we conclude with an example to illustrate the result.

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Dynamics of a Delayed Rumor Propagation Model with Consideration of Psychological Factors and Forgetting Mechanism

Communication Info

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Keywords:

Rumor spreading, local stability, global stability, time delay

Abstract

A delayed rumor propagation model with psychological factors and forgetting mechanism is formulated. The local stability of the rumor-free equilibrium and the rumor-prevailing equilibrium is discussed by analyzing the corresponding characteristic equations.
Using Lyapunov functional, we prove that the rumor-free equilibrium is globally asymptotically stable when the basic reproduction number $R0 \leq 1$.
Also, a sufficient condition is obtained for the global asymptotic stability of the rumor-prevailing equilibrium when $R0 > 1$.
Numerical examples are presented to illustrate the theoretical results

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Reaction-Diffusion systems in Museilack Orlicz spaces with Neumann boundary

Communication Info

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Keywords:
(1) Museilack-Orlicz space
(2) Non linear reaction-diffusion systems
(3) Non-homogeneous

Abstract

In this study, we discuss the existence results for solutions of some nonlinear parabolic systems with non-homogeneous Neumann boundary associated to the reaction-diffusion model .

$$(S)\begin{cases}\dfrac{\partial u_1}{\partial t} - div(a(x,t,\nabla u_1) = f_1(x,u_1,u_2) \ \ in \ \ Q_T\\ \dfrac{\partial u_2}{\partial t} - div(a(x,t,\nabla u_2) = f_2(x,u_1,u_2) \ \ in \ \ Q_T\end{cases}$$

where, the operator $A(u_i) = a(x,t,\nabla u_i)$ is a generalized Leray-Lions operator defined on the inhomogeneous Musielak-Orlicz spaces (vector field $a(x,t,\nabla u_i)$ have a growth prescribed by a generalized N-function).

The source term $f_i(x,u_1,u_2)$ belongs to $L^1(\Omega \times (0,T))$.

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EXISTENCE AND UNEQUENESS OF WEAK SOLUTIONS TO NONLINEAR ELLIPTIC p(u)-LAPLACIAN PROBLEMS WITH VARIABLE

Communication Info

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Keywords:
(1) *Degenerate elliptic problem*
(2) *weak solution*
(3) *uniqueness*
(4) variable exponent
(5) Weighted Sobolev space

Abstract

In this work, our objective is to prove the existence and uniqueness of weak solutions to a class of nonlinear degenerate weighted elliptic p(u)-Laplacian problem with Dirichlet-type and $L\infty$ data. For this we use some results of Sobolev spaces with weighted and variable exponents and some theorems such as that of Minty-Browder theorem.

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Existence and uniqueness of solutions of Hammerstein functional integral equations

Communication Info

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Keywords:
Existence;
uniqueness;
nonlinear HTFIE

Abstract

The author deals with nonlinear and general Hammerstein type functional integral equations (HTFIEs). The first objective of this work is to apply and extend Burton's method to general and nonlinear HTFIEs in a Banach space via the Chebyshev norm and complete metric. The second objective of the paper is to extend and improve some earlier results to nonlinear HTFIEs. The authors prove two new theorems with regard to existence and uniqueness of solutions (EUSs) of HTFIEs via the technique called progressive contractions, which belongs to T. A. Burton, and the Chebyshev norm and complete metric.

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Solving a Caputo fractional initial value problem with data in a Orlicz space

Communication Info

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Keywords:
(1) *Caputo derivative*
(2) *Fractional initial value problem*
(3) *Orlicz space*

Abstract

Within this manuscript, we establish the existence and uniqueness of a solution to a fractional-order initial value problem involving a Caputo fractional derivative. The foundation of our research is Schaefer's fixed point theorem and the Banach-Picard theorem. Two examples illustrating the results obtained are given, in the second example a process of Picard iterations used to estimate the exact solution

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Numerical evaluation of fractional differential equations solutions by Monte Carlo simulation

Communication Info

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Keywords:
(1) Fractional differential equations;
(2) Monte Carlo method;
(3) Variance reduction technique.

Abstract

Monte Carlo scheme is a new numerical method different from classic tools of the numerical analysis machinery. It is based on the probability theory and statistics framework. This paper is devoted to present a new numerical algorithm for computing approximate solutions of fractional differential equations (FDEs) by random enumeration. Thus, the proposed Monte Carlo scheme facilitates the direct numerical evaluation of an FDE solution at any given time within a certain interval, without iterating over multiple time steps. Precisely, this approach does not impose any conditions on the size of the discretization steps.

In order to demonstrate our contribution, we will provide illustrative examples which prove the effectiveness of our result compared to other methods such as the finite difference method.

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NUMERICAL ANALYSIS FOR PDEs WITH STOCHASTIC COEFFICIENTS MODELING DRUG TRANSPORT IN TUMORS

Communication Info

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Keywords:
(1) Drug transport equation.
(2) random coefficients.
(3) finite difference method.
(4) multilevel Monte Carlo.

Abstract

We consider a Mathematical model of drug transport in the tumor given by a system of PDEs equations with random coefficients and initial data.
Together with the finite difference method (FD) we applied a multilevel Monte Carlo method to simulate this random PDEs. we also derived the overall Convergence rate and the total computation Cost estimate. Finally, some numerical results are presented to confirm our theoretical results.

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Existence and Multiplicity of Solutions for a P(X)-Biharmonic Problem

Communication Info

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Keywords:
(1)Biharmonic problem
(2)Kirchhoff problem
(3) Elliptic equation

Abstract

This work deals with a class of value problem involving the $p(x)$-biharmonic elliptic equation

$$\boldsymbol{M_1(t_1) - M_1(t_2) = \lambda f(x,u) + \mu g(x,u)} \text{ in } \boldsymbol{\Omega}$$
$$\boldsymbol{u = \Delta u = 0}, \text{ on } \boldsymbol{\Omega}. \qquad \textbf{(1.1)}$$

Where,

$$\boldsymbol{t_1} = \int_{\Omega} \frac{1}{p(x)} |\Delta u|^{p(x)} dx \text{ and } \boldsymbol{t_2} = \int_{\Omega} \frac{1}{p(x)} |\nabla u|^{p(x)} dx$$

$\boldsymbol{\Omega \subset R^N}$ is a bounded domain in $\boldsymbol{R\hat{}N}$ ($\boldsymbol{N \geq 1}$) with smooth boundary , $\boldsymbol{\Delta_{-\{p(x)\}} u = \Delta(|\nabla u|^{\{p(x)-2\}} \nabla u)}$ **is the** $\boldsymbol{p(x)}$ −Biharmonic , $\boldsymbol{p \in C(\overline{\Omega})}$, $\boldsymbol{p(x) > 1}$ for every $\boldsymbol{x \in \overline{\Omega}}$ and $\boldsymbol{\lambda , \mu \in R}$.

Problems like (1.1) are usually called nonlocal problems because of the presence of the integral over the entire domain,
and this implies that the first equation in (1.1). For more details see for example [2] and [6].

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EBERLEIN-WEAKLY ALMOST PERIODIC SOLUTIONS FOR SOME PARTIAL DIFFERENTIAL EQUATION WITH INFINITE DELAY

Communication Info

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Keywords:
(1) almost periodic solution
(2) partial functional differential equation
(3) infinite delay
(4) Lotka-Volterra model.

Abstract

In this work we prove some new results concerning the (new) class of Eberlein weakly almost periodic in Stepanov sense functions (Sp-E.w.a.p. for short), including a composition result, we also prove that a S*p*-E.w.a.p. and uniformly continuous function is indeed Eberlein weakly almost periodic. Some concrete examples are also provided.
In the rest, we prove that a Sp-E.w.a.p. forcing term of some partial functional differential equation with infinite delay lead to stronger conclusion, namely, Eberlein-weakly almost periodic solution. The theoretical results are then applied to some Lotka-Volterra model with diffusion.

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A Crowd Dynamics Model to Explore How Panic Affects Decision-Making in Emergency Situations

Communication Info

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Keywords:
(1) Crowd dynamics
(2) Mathematical modelling
(3) Emergency evacuation

Abstract

Grasping the complexities of crowd dynamics in situations of panic is essential for advancing public safety measures during emergencies. At the heart of this complexity lies the profound impact of emotions and panic on the decision-making processes of both individuals and groups. To delve into this critical aspect, our research introduces a novel approach that integrates an agent-based model for simulating crowd movement with a model for the contagion of panic. Our approach diversifies by integrating specific movement laws for different categories of panic-affected crowds, taking into account how emotions influence both the velocity and trajectory of movement. Our investigations span various scenarios, including homogenous and heterogenous crowds, as well as examining the effectiveness of security personnel in mitigating panic situations.

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Almost periodic solution for linear renewal equations with infinite delay via reduction principle

Communication Info

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Keywords:
(1) Renewal equations,
(2) Reduction principle,
(3) Almost periodicity,

Abstract

In this talk we prove, for nonhomogeneous autonomous linear renewal equations with infinite delay, that if the forcing term is almost periodic then every bounded solution on the whole real line is also almost periodic. Additionally, the existence of a bounded solution on the half-positive real line implies the existence of an almost periodic solution. Next, we present a result on uniqueness. To illustrate our results, we propose an application to an epidemic model with waning immunity.

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Chaos, Solitons & Fractals, Volume 181, 2024

On a class of Degenerated nonlocal p(x)-Biharmnic problem with q(x)-Hardy potential

Communication Info

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Keywords:
(1) Degenerat p(x)-biharmonic operato 1
(2) variational methods 2
(3) Ljusternik-Schnirelman3
(4) q(x)-Hardy's inequality.4

Abstract

This work deals to study a class of nonlocal Navier boundary value problems involving the degenerate p(x)- Biharmonic operator and q(x)-Hardy potential.
By using the variational method and min-max argument based on Ljusternik-Schnirelmann theory on C^1 manifoleds [7} we establish the existence of at least one nondecreasing sequence of positive eigencurves $(\mu_k(\lambda))_{k\geq 1}$. A direct characterization of the principal curve $\mu_1(\lambda)$ is given.

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ICRAMCS 2024

THE SIXTH EDITION OF THE INTERNATIONAL CONFERENCE ON RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
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The Cauchy Problem of Fuzzy conformable fractional Differential Equations

Communication Info

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Keywords:
(1) Conformable differentiability
(2) Cauchy conformable problem
(3) Fuzzy valued function

Abstract

The Cauchy problem of fuzzy conformable differential equations is investigated by the use of
The concept of conformable-differentiability [1].
The existence and uniqueness theorem is obtained .
for the solution of the Cauchy conformable problem
$x^{(q)}(t) = F\big(t, x(t)\big),\ x(t_0) = x_0$ (1), were $q \in [0,1]$ for the
fuzzy-valued mappings of a real variable whose values are normal, convex, upper
semicontinuous, and compactly supported fuzzy sets in R^n, where the function F
satisfies the generalized Lipschitz condition. And we show the relation between a solution and its approximate soltion to the Cauchy conformable problem of the fuzzy conformable differential equation, furthermore, we prove the existence and uniqueness theorem for a solution to the equation (1).

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Modeling and analysis of the transmission of Echinococcosis with application in Morocco

Communication Info

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Keywords:
(1) Cystic Echinococcosis (EC)
(2) Deterministic modeling
(3) Basic reproduction number
(4) Optimal control

Abstract

Cystic Echinococcosis, caused by the tapeworm Echinococcus granulosus is considered one of the serious zoonotic diseases with global prevalence, as it threatens human health and the development of animal industry gravely [1] .
A mathematical modeling for the dynamic of EC is a very powerful tool to understand its behavior , in order to guide intervention and control strategies .
In this work , we propose a deterministic model for the transmission cycle of EC involving complex interactions between intermediate hosts (humans / livestock) and definitive hosts (we will talk about dogs) [2]. The results show that the dynamic of the model is completely set one the basic reproduction number R_0 [3] , and that both the disease free equilibrium and the endemic equilibrium exist. We study the stability of the equilibriums based on two cases of R_0 (R_0 <1 and R_0 >1) . We then give a numerical simulation based on data found of Echinococcosis transmission in some regions of Morocco [4] . And finally we propose some control strategies such as inspection of infection in dog populations at least 4 times/year , slaughterhouse monitoring , explain the transmission dynamic of the disease to the civilians (especially in rural areas) , ... , then we give a numerical simulation to show the effectiveness of the approach .

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Asynchronous Exponential Growth For Some Semi-Linear Evolution Equations With Nondense Domain

Communication Info

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Keywords:
(1) Hille-Yosida opertator
(2) Asynchronous Exponential Growth
(3) Evolution Equations

Abstract

In our paper we studied Asynchronous exponential growth for the following semi-linear differential Equation Z'(t)=A Z(t)+F(Z(t)), t\in [0,+\infty[, Z(0)=x\in X.
With (X,|.|) is a Banach space. A:D(A)\to X is a linear closed operator (D(A) is the domain of definition of the operator A). F:X\to X is nonlinear operator. Our main results would be extensions of results obtained in [1]. We posit that the linear part is not densely defined however, it conforms to the resolvent estimates stipulated by the Hille-Yosida theorem [2], and has asynchronous exponential growth. We used the theory of integrated semigroups and integral solutions [3]. We studied also AEG(for short) strictly positive in Banach Lattice spaces with positive semigroups [4], also we mentioned the relation between AEG and the intrinsic gowth constant [5]. Then we given some sufficient conditions ensuring AEG of the nonlinear semigroup solution.

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A discrete-time prey-predator model with immigration

Communication Info

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Keywords:

(1) Difference equations

(2) Immigration effect

(3) NSDF scheme

(4) Chaos

Abstract

In this study, we explore the dynamical analysis of a discrete-time prey-predator model with an immigration effect. We employ a non-standard finite difference scheme (NSFD) to derive the proposed model. The analysis focuses on the stability of the equilibrium points. More specifically, we explore local dynamical characteristics at equilibrium solutions and the existence of periodic solutions for the under-considered model. We explore the existence of bifurcations of codimension 1 (codim 1), such as period-doubling and Neimark-Sacker bifurcations, when some parameters go through certain curves. We verify chaotic solutions using Lyapunov exponents and bifurcation diagrams. We also studied chaos using the hybrid control strategy.

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Mathematical analysis of a delayed prey-predator model with Hattaf-Yousfi functional response and double Allee effect in prey

Communication Info

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Keywords:
Prey-predator, Double Allee

Abstract

The presence of a double Allee effect can have profound implications for the dynamics and persistence of prey and predator populations in ecological systems. With this our paper aims to describe and study the changes in stability of a delayed prey-predator model with Hattaf-Yousfi functional response and a double Allee effect in prey population growth.

Firstly, we demonstrate that the proposed model is mathematically and ecologically well-posed. Then, we determine the conditions for existence and conduct a local stability analysis of all equilibrium points. Additionally, we investigate the necessary conditions for the existence of the Hopf bifurcation.

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Note on recurrence of strongly continuous semigroups

Communication Info

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Keywords:
(1) C0-semigroups
(2) Hypercyclicity
(3) Recurrence
(4) Super-recurrence

Abstract

A strongly continuous semigroup (shortly C0-semigroup) $(T_t)_{t\geq 0}$ on a Banach space X is said to be recurrent if for each open subset U of X, there exists some $t > 0$ such that $T_t(U)\cap U$ is nonempty. In this talk, we discuss proper classes of recurrent C0-semigroups called super recurrent C0-semigroups and sub-space super recurrent C0-semigroup. We study the relationships between these new notions and other existent notions of linear dynamics of C0-semigroups such as hypercyclicity, supercyclicity and recurrence. Moreover, we characterize some properties of these classes of C0-semigroups. Furthermore, we give some sufficient and necessary conditions for a C0-semigroup to be (subspace) super recurrent. As an application we study the case of the translation semigroups.

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EXISTENCE OF ENTROPY SOLUTION FOR SOME NON COERCIVE QUASLINEAR PARABOLIC PROBLEM

Communication Info

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Keywords:
(1) Entropy solutions.
(2) p(x)-parabolic problem.
(3) Non-coercive quasilinear problem.

Abstract

In this paper, we consider the following non coercive quasilinear for p(x)-parabolic problem ::

$$\begin{cases} u_t + Au + |u|^{p(x)-2}u = f(x) - \operatorname{div} F(x,t,u) & \boldsymbol{in}\ Q_T \\ \boldsymbol{u = 0} & \boldsymbol{in}\ \sum_T \\ \boldsymbol{u(x,0) = u_0} & \boldsymbol{\Omega} \end{cases}$$

with $f \epsilon L^1(Q_T)$ and $u_0 \epsilon L^1(\boldsymbol{\Omega})$. We prove the existence of entropy solutions for this quasilinear p(x)-parabolic equation, and we conclude some regularity results.

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Variational and Numerical Analysis of a quasistatic contact problem with thermo-viscoelasticity

Communication Info

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Keywords:
(1) Thermo-viscoelastic
(2)Viscoelastic constitutive law,
(3)Contact,
(4)Friction
(5)Numerical simulation

Abstract

This research aims to investigate a quasistatic frictional contact problem involving a thermo-viscoelastic body and a thermally conductive foundation. In our study, we utilize a Kelvin-Voigt model to represent displacement behavior within the constitutive relation. Additionally, the heat conduction aspect is characterized by a parameter associated with temperature. The contact condition is described by an instantaneous normal response and a unilateral speed constraint, resembling a version of Coulomb's law for dry friction. We formulate a variational approach for the problem and establish the existence of its weak solution using a combination of techniques, including the theory of monotone operators and the Banach fixed-point theorem. To demonstrate the effectiveness of our methodology, we incorporate various numerical simulations that showcase the performance of the proposed approach.

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

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The existence of solutions for first-order impulsive differential equations

Communication Info

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Keywords:
(1) existence
(2) impulsive differential equations
(3) fixed point theorem

Abstract

In this study, we utilize the nonlinear alternative of Leray-Schauder type and Krasnoselskii's fixed point theorem within a cone to examine the existence of two positive solutions for a first-order impulsive differential equation,

$$\left(\phi(y'(t))\right)' = f(t, y(t)), t \in J := [0,1], t \neq t_k, k = 1, \ldots, m,$$
$$y(t_k^+) - y(t_k^-) = I_k\left(y(t_k^-)\right), k = 1, \ldots, m,$$
$$y'(t_k^+) - y'(t_k^-) = \bar{I}_k\left(y(t_k^-)\right), k = 1, \ldots, m,$$
$$y(0) = y'(0) = 0.$$

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On 1-Laplacian elliptic problems involving a singular term

Communication Info

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Keywords:
(1) Singular elliptic equations
(2) p-Laplacian
(3) 1-Laplacian

Abstract

In this paper, we look at the problem

$$\begin{cases} -\Delta_p u + |\nabla u|^p = f h(u) & \text{in } \Omega, \\ u \geq 0 & \text{in } \Omega, \\ u = 0 & \text{on } \partial\Omega, \end{cases}$$

With Ω is a bounded open subset of $\mathbb{R}^N$ with Lipschitz boundary, Δ_p is the p-laplacian operator for $1 \leq p \leq N$, $f \in L^1(\Omega)$ is nonnegative and h is a continuous function that may be singular at s=0. We will demonstrate the existence of solution in the case $1 \leq p \leq N$. Moreover, if p=1, f>0 and h is decreasing, we will show the uniqueness of the solutions.

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Tower building technique on elliptic curve with embedding degree 54

Communication Info

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Keywords:
(1) Elliptic curve,
(2) Finite field
(3) Tower building
(4) Embedding degree 54
(5) Twist curve

Abstract

Pairing-based cryptography is one of the newest security solutions that has attracted a lot of attention. This is due to the ability to work with e_cient and faster pairings, making security more practical. Additionally, working with the extension finite field of the form F_{p^k} is more useful and secure, especially when k > 12, making the implementation more crucial. In this paper, we present case studies on improving pairing arithmetic calculations on curves with embedding degree 54. We employ the tower-building technique and study the cases where using a degree 2 and/or 3 twist can carry out most operations in $F_{p^{54}}$.

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A Common Fixed Point Theorems In C^*-Algebra-Valued Gb-Metric Spaces

Communication Info

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Keywords:
(1) $C*$-algebra
(2) Gb-metric space
(3) $C*$-algebra-valued

Abstract

In this manuscript, using the concept of C∗-algebra-valued Gb-metric spaces which generalizes the concept of C*-algebra-valued G-metric spaces and gives some basic common fixed point theorems for self mappings with contractive condition on such spaces. As an application, existence and uniqueness results for a type of operator equation and an integral equation are given.
The main idea consists in using the set of all positive elements of a unital C*-algebra instead of the set of real numbers. Obviously such spaces generalize the concept of G-metric spaces. In this paper, we will introduce a new notion of C*-algebra-valued Gb-metric space and establish a common fixed point result in such spaces.

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Existence of fixed point in the conical shell

Communication Info

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Keywords:
(1) Cone
(2) Fixed point
(3) Leray Schauder index

Abstract

Motivated and inspired by M. A. Krasnosel'skii [4] and Guo [3], in this paper we establish the existence of fixed points in conical shell for strict set-contraction mappings leaving invariant a cone in ordered Banach space and satisfying some suitable properties of the norm. The proofs are based on the topological methods, in particular, the Leray Schauder index.

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ICRAMCS 2024

THE SIXTH EDITION OF THE INTERNATIONAL CONFERENCE ON RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
April 25-26-27, 2024 | Marrakech, Morocco

A quantitative study for some partial differential inclusions in α-norm

Communication Info

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Keywords:
(1) Differential inclusion
(2) Asymptotically almost periodic solution
(3) Analytic semigroup

Abstract

The primary objective of this work is to investigate the existence of mild solutions and asymptotically almost periodic solutions of a class of differential inclusions. These inclusions involve a forcing multi-valued function that relies on implicit spatial derivatives of the state variable. First, we show the existence of mild solutions with the help of a scale of Banach spaces developed in [1], the theory of analytic semigroups [2], and the fixed-point theory for the measure of noncompactness. Furthermore, we examine the existence of asymptotically almost periodic solutions for our problem. We introduce a novel approach to simplify the complexities associated with singularities when taking the α-norm.

Finally, our study concludes with an illustrative example that effectively demonstrates the abstract findings we have uncovered.

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SOME FIXED POINT THEOREMS IN DISLOCATED QUASI-B-METRIC SPACES

Communication Info

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Keywords:
(1) fixed point
(2) dqb-tricyclic
(3) tricyclic contraction

Abstract

In this communication, we introduce the concept of a disclоct quasi-b-metric space [1], elucidating its basic definitions and properties. Additionally, we propose the concepts of Geraghty-type dqb-tricyclic Banach contraction and dqb-tricyclic-Kannan contraction within this framework. These innovations pave the way for successfully proving the existence of fixed-point theorems within these spaces. The main theorem [5]presented in this work extends and consolidates previous discoveries from recent literature [1], [3] , [4] into a unified framework ,the implications of our results extend beyond theoretical mathematics, potentially impacting fields such as functional analysis, optimization, and mathematical modeling.

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Cone measure of weak noncompactness and related fixed point theorems

Communication Info:

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Keywords:
(1) Partially ordered Banach space;

(2) Fixed point theorem;

(3) Measure of weak noncompactness;

(4) Measure of nonconvexity;

(5) Integral equations.

Abstract:

The concept of cone metric spaces, introduced by Huang and Zhang in 2007 [1], marked a significant shift in the study of convergence properties and fixed point theorems. In 2016 [2], the concept of cone measure of noncompactness was introduced and used to establish some significant extensions of Darbo's fixed point principle and to investigate the solvability of some classes of integral equations.

Building upon this foundation, we introduce the concept of the cone measure of weak noncompactness (C-MWNC) as a generalization of the classical MWNC [3]. Combining the benefits of an ordered approach with those of MWNC, we derive new insights into fixed points in partially ordered Banach spaces. This leads to a relaxation of compactness requirements in multiple fixed-point theorems.

Finally, to demonstrate the effectiveness of our theoretical results, we study the solvability of a system of functional integral equations using a particular C-MWNC.

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THE SIXTH EDITION OF THE INTERNATIONAL CONFERENCE ON RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
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Convergence of random iteration in a separable Banach space

Communication Info

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Keywords:
(1)Random fixed point
(2) Random iteration
(3) Weakly contractive random operator
(4) Separable Banach space

Abstract

The study of random fixed point theorems was initiated by the Prague school of probabilists in the 1950's. The random fixed-point theory finds its roots in the work of Špaček [1] and Hanš [6, 7].

On the other hand, various iterative techniques have been studied for approximating the random fixed point of random mappings by Beg and Abbas [4], Choudhury [2], Choudhury and Ray [3], Saha and Dey [5].

In this work, we study the almost strong convergence of random iteration for a weakly contractive random operator in a separable Banach space.

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Existence of Solutions for Semi-Linear Fractional Differential Equations with Non Instantaneous

Communication Info

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Keywords:
(1) Impulsive fractional differential equation
(2) \psi-Caputo fractional derivative
(3) Mild solution

Abstract

Using the theory of analytic semigroup and fractional power of closed operators, we study the existence of solutions for a class of semi-linear fractional differential equations with non-instantaneous impulses. Some applications involving fractional partial differential equations with impulses are presented.

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Fixed Point Theorem and Application of Mixed Monotone Mappings in Partially Ordered

Communication Info

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Keywords:
(1) Coupled fixed point
(2) Integral equations
(3) Hyperbolic metric

Abstract

In this work, we establish the existence of new fixed points for mixed monotone nearly asymptotically nonexpansive mappings. We extend and generalize some well-known results concerning monotone nearly asymptotically nonexpansive mappings in a uniformly convex hyperbolic metric space. Furthermore, we apply our results to solve the following nonlinear integral equation:

$$x(t) = \int_0^1 a(t,s) f\big(s, x(s)\big) g\big(x(s)\big) ds$$

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THE SIXTH EDITION OF THE INTERNATIONAL CONFERENCE ON RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
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Results of existence for hybrid problems differential equations using the fractional derivative of ψ −Caputo

Communication Info

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Keywords:
(1) ψ-*fractional integral*
(2) ψ-*Caputo fractional derivative*
(3) Caratheodory ´ function

Abstract

The Banach fixed point theorem and the nonlinear are used to investigate the existence of solutions for fractional hybrid differential equations involving ψ-Caputo fractional derivative of order $1 < \alpha \leq 2$. order functional and proved under mixed Lipschitz and Caratheodory conditions. as well as some basic definitions and properties of ψ-fractional integral and ψ -Caputo fractional derivative.
As application, we conclude this paper by giving an illustrative example to demonstrate the applicability of the obtained result

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Proper generalized method applied to biharmonic problem

Communication Info

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Keywords:
(1) PGD
(2) Biharmonic problem

Abstract

Biharmonic problem has been raised in many research fields, such as elasticity problem in plate geometries or the Stokes flow problem formulated by using the stream function. The fourth order partial differential equation can be solved by applying many techniques. When using finite elements C1 continuity must be assured. For this purpose Hermite interpolations constitute an appealing choice, but it imply the consideration of many degrees of freedom at each node with the consequent impact on the resulting discrete linear problem. Spectral approaches al-low exponential convergence whilst a single degree of freedom is needed. However, the enforcement of boundary conditions remains a tricky task. In this paper we propose a separated representation of the stream function which transform the 2D solution in a sequence of 1D problems, each one be solved by using a spectral approximation.

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THE SIXTH EDITION OF THE INTERNATIONAL CONFERENCE ON RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
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Analysis of nonlocal fractional Hilfer pantograph Langevin equation and inclusion

Communication Info

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Keywords:
(1) Differential inclusions
(2) Hilfer Langevin equation
(3) nonlocal conditions

Abstract

This work aims to explore the existence and uniqueness of results for pantograph Langevin equations and their inclusion in the weighted space involving the Hilfer fractional derivative, along with nonlocal conditions. We will do this by using common fixed-point theorem tools for both single-valued and multi-valued functions. We employ Krasnoselskii's fixed-point theorem to derive the existence results for the single-valued problem and Banach's fixed-point theorem to get the uniqueness result. On the other hand, using the nonlinear alternative for contractive maps, the existence results of the inclusion problem are obtained when the right-hand side is convex. We provide examples to support the validity of our results.

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THE SIXTH EDITION OF THE INTERNATIONAL CONFERENCE ON RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
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FIXED POINT THEOREMS FOR ψ-CONTRACTION MAPPING IN FUZZY N-CONTROLLED METRIC SPACE

Communication Info

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Keywords:
(1) fixed point
(2) fuzzy metric space
(3) ψ-contraction

Abstract

This manuscript consists of the idea of n-controlled metric space in fuzzy set theory to generalize a number of fuzzy metric spaces in the literature [1], for example, pentagonal, hexagonal, triple, and double controlled metric spaces and many other spaces in fuzzy environment. Various examples are given to explain definitions and results. [5], [2], [3].
We define open ball, convergence of a sequence and a Cauchy sequence in the context of fuzzy n-controlled metric space. [4]
We also prove, by means of an example, that a fuzzy n-controlled metric space is not Hausdorff.
At the end of the article, an application is given to prove the uniqueness of the solution to fractional differential equations.

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THE SIXTH EDITION OF THE INTERNATIONAL CONFERENCE ON RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
April 25-26-27, 2024 | Marrakech, Morocco

Harmonic Analysis On The Quaternionic Unit Ball

Communication Info

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Keywords:
(1) Homogeneous Spaces ;
(2) Gabor Transform ;
(3) Helgason-Fourier Transform ;
(4) Uncertainty Principles ;

Abstract

In this paper, we will recall the main results of the quaternionic hyperbolic group and the Helgason Fourier transform on the quaternionic unit ball, then we introduce the notion of the Gabor transform associated to this transform. Finally, we will prove certain properties on the Gabor frames and Beurling's theorem.

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Extension and refinement of the Poincaré inequality

Communication Info

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Keywords:
(1) Ultraspherical polynomials
(2) Sobolev spaces
(3) Poincaré 's inequality

Abstract

The aim objective of this note is to study $E_n^{\alpha}(f)$ the error of best approximation by polynomials of degree at most n in the Hilbert space $L^2(I,\mu_\alpha)$ with respect to the normalized ultraspherical probability measure μ_α defined by:

$\mu_\alpha(dx) := C_\alpha(1-x^2)^{\frac{\alpha}{2}-1}dx, \quad \alpha > 0.$ We establish and analyze a sharp estimate of $E_n^{\alpha}(f)$ in terms of the error of best approximation for higher order derivatives of f in appropriate Sobolev spaces. These estimations are a natural extension of the 'integral) Poincaré inequality.

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The semi-Fredholmness on a weighted simplicial complex

Communication Info

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Keywords:
(1) Weighted 3-simplicial complex
(2) 3-simplicial complex Gauss-Bonnet operator
(3) Non-parabolicity at Infinity
(4) Semi-Fredholmness

Abstract

In this communication, we create a weighted 3-simplicial complex and we construct on it a weighted Gauss-Bonnet operator G. We introduce the non-parabolicity at infinity of G and we study it. We use the non-parabolicity at infinity of G to ensure its semi-Fredholmness.

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Some results on unbounded absolute weak convergence

Communication Info

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Keywords:
(1) uaw-convergence.
(2) un-convergence.
(3) KB-space.

Abstract

We shall establish the stability of unbounded absolute weak convergence (uaw-convergence) under passing from sublattices. Following that, we will study the closeness and the completeness for the uaw-topology. Finally, we give an important approximation property and sequence characterization of KB-spaces by using the uaw-convergence and the un-convergence in the bidual of a Banach lattice. As consequences, we will present some interesting characterization of a discrete KB-space, reflexive space and discrete reflexive space.

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An extension of the Alzer-Fonseca-Kovačec inequality via weak sub-majorization and its applications

Communication Info

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Keywords:
(1) Alzer-Fonseca-Kovčec inequality
(2) Matrix inequalities
(3) Weak sub-majorization

Abstract

The famous Alzer-Fonseca-Kovačec inequality [1] states as follows:

$$\left(\frac{\alpha}{\beta}\right)^{\lambda}\left(\left(a\nabla_{\beta}b\right)^{\lambda}-\left(a\#_{\beta}b\right)^{\lambda}\right)\leq (a\nabla_{\alpha}b)^{\lambda}-(a\#_{\alpha}b)^{\lambda}$$

$$\leq \left(\frac{1-\alpha}{1-\beta}\right)^{\lambda}\left(\left(a\nabla_{\beta}b\right)^{\lambda}-\left(a\#_{\beta}b\right)^{\lambda}\right),$$

where a and b are two positive real numbers, $0\leq \alpha<\beta \leq 1$, $\lambda \geq 1$, $a\nabla_{\alpha}b = \alpha a+(1-\alpha)b$ and $a\#_{\alpha}b = a^{\alpha}b^{1-\alpha}$.

In this talk, we present an extension of the Alzer-Fonseca-Kovačec inequality using the weak sub-majorization theory. Furthermore, we present some new real power inequalities of Young's inequality, extending a key results of [4].
As applications of these results, we provide some new inequalities for matrices, unitarily invariant norms and traces.

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About a preserving problem on Aluthge transform

Communication Info

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Keywords:
(1) Aluthge transform
(2) Spectrum and trace
(3) Orthogonal projections

Abstract

Let H and K be two complex separable Hilbert spaces, such that dim(H)≥2 and B(H) the algebra of bounded linear operators of H on itself.
For every A, B∈B(H), the semistar Jordan product is denoted by A►B=1/2(AB+B*A) and for every λ∈[0, 1], the λ-Aluthge transform of A is denoted by $\Delta_\lambda(A)$.
We characterize the bijective maps ϕ: B(H)→B(K)
Satisfying the following condition for some λ∈(0, 1),
$\Delta_\lambda(\phi(A)$►$\phi(B))=\phi(\Delta_\lambda(A$►$B))$, ∀A, B ∈B(H).

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Tensor Full Orthogonalization method for approximation of T-function

Communication Info

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Keywords:
(1) Krylov sub-spaces
(2) Linear tensor equations
(3) T-function

Abstract

Computing the approximation of the problem f(A)b where A is a square matrix of size n, b is a vector of size n and f is a function for which f(A) is defined, is an important task in many areas of science and engineering. For example, the evaluation of the function f(z) = log(z) is used in Markov model analysis [5]. Frequently A is large and sparse, which make the evaluation of f(A) by direct methods infeasible. Instead, the object is to approximate f(A)b using iterative methods. In the literature, they exist many class of iterative methods that evaluate f(A)b, but the most famous class is the well know Krylov subspace methods, see [2]. The aim of this project is to evaluate the tensor problem f(**A**)*$\mathbf{B}$, where **A** and **B** are three-way tensors, leaving the specific dimensions to be defined, * is the T-product defined in [4], and f is a function [1]. Using the Tensor Arnoldi process, which can be considered as a generalization of the well know Arnoldi method developed in [3]. In this talk, we will develop some new Tensor Krylov subspace methods using projections onto special low dimensional tensor Krylov sub-spaces via the T-product. To this, we introduce some new tensor products with some new related algebraic properties.

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Study of the translation surfaces generated by principal normal indicatrices of two regular curves using remarkable lines in Euclidean 3-space

Communication Info

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Keywords:
(1) Translation surface
(2) Normal curvature
(3) Geodesic curvature
(4) Gaussian curvature
(5) Mean curvature

Abstract

In differential geometry, a translation surface is a surface obtained by translating a curve $\alpha = \alpha(u)$ along another curve $\beta = \beta(v)$. Translation surfaces can be locally parametrized by

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

where $\alpha : I \subset \mathbb{R} \to E^3$ and $\beta : J \subset \mathbb{R} \to E^3$, with E^3 a 3-dimensional Euclidean space.

In this study, we concentrate on the translation surface defined by

$$M_N: X(u,v) = N_\alpha(u) + N_\beta(v),$$

where $u \to N_\alpha(u)$ and $v \to N_\beta(v)$ represent the principal normal indicatrices of the curves $\alpha(u)$ and $\beta(v)$. By calculating the normal curvature, geodesic curvature, and geodesic torsion of the curves $u \to N_\alpha(u)$ and $v \to N_\beta(v)$, we determine the necessary and sufficient conditions for these curves to be remarkable curves. Furthermore, we identify the essential conditions for this surface M_N to be developable or minimal surface. This study is reinforced by giving examples followed by illustrations.

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Four-Dimensional Real Third-Power Associative Division Algebras with Omnipresent Idempotent

Communication Info

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Keywords:
(1) Divion algebra
(2) Third-power associative algebra;
(3) Power-commutative algebra.

Abstract

In [2], we have proven that every third-power associative real algebra, with unit element, without divisors of zero, and algebraic of degree 8, is quadratic. In the present work, we extend this result to more general situation. Indeed, we show that if A is a four-dimensional third-power associative real division algebra with omnipresent idempotent, then A is power-commutative his last generalizes previously known results of Diankha et al [1].

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On indices and monogenity of certain number fields defined by trinomials

Communication Info

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Keywords:
(1) Index of a number field
(2) Monogenity
(3) Newton polygon
(3) Theorem of Ore

Abstract

A number field K is called monogenic if is a ring of integers $\mathbb{Z}_K$ admits a power integral basis of the form$(1, \alpha, \dots, \alpha^{n-1})$, where n is the degree of K. In this talk, we study the prime common divisors of indices of certain families of number fields defined by trinomials of type $x^n + ax^m + b$. As an application of our results, we provide explicit conditions on a and b for which these number fields are not monogenic. Our method based on a classical theorem of Ore on the decomposition of primes in number fields.

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Conserving Allen-Cahn equation coupled with Navier-Stokes

Communication Info

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Keywords:
(1) Multifluids flow
(2) Navier–Stokes
(3) Allen–Cahn

Abstract

Our primary focus is on conducting numerical simulations of various unsteady flows involving the multiple fluids within a single entity. The concept of multiple flow involves the examination of diverse fluids with distinct properties(such as viscosity, density, and other characteristics) and how they collectively exhibit dynamic behaviors within a unifed flow, encompassing factors like velocity and pressure. In these multi-fluid flows, the determination of the position of the interface is one of the unknowns, and the evolution of this interface influences the dynamics of each fluid. The numerical simulation of such processes presents many challenges, primarily to accurately describing the behavior of the moving interface. In this study, we provide an original time-discrete formulation of the coupled equations coupling the velocity and pressure of an unsteady flow of two immiscible fluids and the Allen-Cahn equation defining their interface. First, we demonstrate that this time-discrete formulation is properly posed. Then, for the actual approximation of solutions, we propose a new family of iterative schemes.

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Local ergodic theorems for C_0-semigroup

Communication Info

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Keywords:
(1) Ergodic theorem
(2) C_0-semigroups
(3) Local mean ergodic
(4) Local spectral
(5) single valued extension property “SVEP”

Abstract

Let $T(t)$ $\{t>0\}$ be a C_0-semigroup of bounded linear operators on the Banach space X into itself and let A be their infinitesimal generator. We show that if $T(t)$ is uniformly ergodic, then A does not have the single valued extension property, which implies that A must have a non-empty interior of the point spectrum.

Furthermore, we introduce the local mean ergodic for C_0-semigroup $T(t)$ at a vector (x in X) and we establish some conditions implying that $T(t)$ is a local mean ergodic at x.

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Hyperstability of a σ-quadratic functional equation in ultrametric n-Banach spaces

Communication Info

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Keywords:
(1) fixed point theorem
(2) functional equations
(3) ultrametric n-Banach space
(4) hyperstability

Abstract

In this paper, we investigate the hyperstability [1] of the following σ-quadratic functional equation [2]

$$f(x+y)+f(x+\sigma(y))=2f(x)+2f(y),$$

where $f: X \to Y$ with X is normed space, Y is ulrametric n-Banach space [3][4] [5], and $\sigma: X \to X$ is a homomorphism. In addition, we prove some interesting corollaries corresponding to some inhomogeneous outcomes.

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MORPHISMS ON SOME CURVES AND THEIR APPLICATIONS TO THE DETERMINATION OF ALGEBRAIC POINTS

Communication Info

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Keywords :
(1) Algebraic point
(2) Chevalley-Weil theorem
(3) Quotient of Fermat curve
(4) Hurwitz curve
(5) Morphism

Abstract

The purpose of this paper is to determine rational morphisms between Hurwitz curves of equation : $x^n y^l + y^n + x^l = 0$ and the quotients of Fermat curves of equation: $y^m = x^r(x-1)$ where the integers $n \geq l \geq 1$ are coprime and the integer $m = n^2 - nl + l^2$. Using these morphisms, we determine explicitly algebraic points of degree at most 3 of the Hurwitz curve: $x^3y^2 + y^3 + x^2 = 0$ birationally equivalent to the quotient of Fermat curves of equation: $y^7 = x^2(x-1)$. We also determine algebraic points of degree at most 2 over $\mathbb{Q}$ of the family curves of equation: $y^{3n} = x^{4n} - 1$ by using the Chevalley-weil theorem and the morphism between this family and the special Picard curve of equation: $y^3 = x^4 - 1$.

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Special affine connections on symmetric spaces

Communication Info

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Keywords:
(1) Symmetric spaces
(2) Special connections
(3) Lie algebras
(4) Poisson algebras
(5) Jordan algebras

Abstract

Let G/H be a symmetric space and $\mathfrak{g}=\mathfrak{m}\oplus\mathfrak{h}$ the canonical decomposition of the Lie algebra $\mathfrak{g}$ of G. We denote by ∇^0 the canonical affine connection on G/H. A torsion-free G-invariant affine connection on G/H is called special if it has the same curvature as $\n^0$. A special product on $\mathfrack{m}$ is a commutative, associative, and $Ad(H)$-invariant product. We show that there is a one-to-one correspondence between the set of special affine connections on G/H and the set of special products on $\mathfrak{m}$. We introduce a subclass of symmetric spaces called strongly reducible for which we prove that the canonical affine connection ∇^0 is the only special affine connection. Finally, we study a subclass of commutative, associative algebra which allows us to give examples of symmetric spaces with special affine connections (see [1]).

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(VLD) property in Banach spaces

Communication Info

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Keywords:
(1) V-set
(2) Relatively compact Dunford-Pettis property
(3) Unconditionally converging operator

Abstract

In this paper, we study the notion of **V**-sets in Banach spaces and Banach lattices, and we give some characterizations of it in terms of sequences. As an application, we establish new properties of unconditionally converging operators and 1-Schur property in Banach lattices. Next, by introducing the concept of the property **(VLD)** in Banach spaces, we investigate the Dunford-Pettis completely continuous property of unconditionally converging operator. Finally, we derive the relationships between the property **(VLD)** and the relatively compact Dunford-Pettis property (resp., the Pelczynski' s property **(V)**), and we deduce some examples of Banach spaces with the property **(VLD)**.

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Some new results on LW-compact operators

Communication Info

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Keywords:
(1) Banach lattices
(2) Positive operators
(3) The order continuity of norm
(4) L-weakly compact sets
(5) LW-compact operators
(6) Dunford-Pettis operators
(7) AM-compact operators

Abstract

Hajji et al. introduced and studied the class of LW-compact operators. An operator T: E→ X from a Banach lattice E to a Banach space X, is called LW-compact if T maps L-weakly compact sets of E into relatively compact sets of X [5]. The aim of this communication is to present some characterizations and to study the domination problem of this class of operators. More precisely, we obtained that an operator T : X → E, from a Banach lattice E to a Banach space X, is LW-compact if and only if $||T(x_n)||\to 0$, for every L-weakly compact sequence (x_n) of E which is weakly convergent to 0. Also, an operator T is LW-compact if and only if T restricted on E^a is AM-compact, where E^a is the maximal ideal on which norm is order continuous. Finally, we obtain that the class of LW-compact operators satisfied the domination problem if and only if the norm of F is order continuous or $(E^a)'$ discrete.

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Commutative properties for 3-prime near-rings involving multiplicative derivations

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Keywords:
(1) Prime near-rings
(2) Multilplicative derivations
(3) Commutativity

Abstract

In [1], the notion of multiplicative derivation of a ring R was introduced by Daif as follows: A mapping d: R → R, not necessarily additive, is called a multiplicative derivation if d(xy) = xd(y)+d(x)y holds for all x, y ∈ R. Of course any derivation is a multiplicative derivation, but the converse is not true in general. For more details, see for instance [2], Examples 1.1 & 1.2, and [3]. Being motivated by this difference, it is more interesting to study the 3-prime near-rings involving multiplicative derivation. Our results show that in some theorems obtained earlier the assumption of additivity in case of a derivation is altogether superfluous (see [4], Theorems 2 & 5). Besides additivity, it has also been shown that even the “torsion freeness restriction” is not required in ([4], Theorem 6). Also, some new related results have been obtained. An example is given to show that the necessity of the 3-primeness hypothesis imposed on the various theorems cannot be marginalized.

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THE SPECTRAL IDEMPOTENT OF (b,c)-INVERSES

Communication Info

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Keywords:
(1) Inverse along an element ;
(2) Polarity along an element ;
(3) (b,c)-inverse ;

Abstract

In this note we give a new characterization of (b,c)-invertible elements in rings and Banach algebras of operators using spectral idempotents elements. At first we define a (b,c)-polar element which has two (b,c)-spectral idempotents and establish the equivalence between this notion and the (b,c)-invertible element introduced by Drazin [1]. In particular, as the (b,c)-invertibility is a class that encompasses the Drazin inverse, the Moore-Penrose inverse, the group inverse and the inverse along an element, respectively, the (b,c)-polarity is a generalization of polar element, well-supported element, simple polar element and polar element along an element. Consequently, we have obtained a wider class that encompasses all types of polarities (polarity, quasipolarity, simple polarity, well-supportivity and polarity along an element).

Further characterizations are obtained in the Banach space context.

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Cosine and Sine addition and subtraction law with an automorphism

Communication Info

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Keywords:
(1) Functional equation
(2) Semigroup
(3) Automorphism
(4) Addition law

Abstract

Let S be a semigroup. Our main results is that we describe the complex-valued solutions of the following functional equations

$$g(x\sigma(y)) = g(x)g(y) + f(x)f(y), \qquad x, y \in S,$$
$$f(x\sigma(y)) = f(x)g(y) + f(y)g(x), \qquad x, y \in S,$$

and

$$f(x\sigma(y)) = f(x)g(y) + f(y)g(x), \qquad x, y \in S,$$

where $\sigma: S \to S$ is an automorphism that need not be involutive. As a consequence we show that the first two equations are equivalent to their variants. We also give some applications.

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Characterization of 3-prime near-rings involving multiplicative derivations

Communication Info

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Keywords:
(1) Prime near-rings
(2) Multiplicative derivations
(3) Commutativity

Abstract

In this work, N represent a right near-ring. In [1], the notion of Jordan ideal was defined as follows: An additive subgroup J of N is said to be a Jordan ideal of N if $j \circ n \in J$ and $n \circ j \in J$ for all $j \in J$, $n \in N$. An additive mapping $d : N \to N$ is called a derivation if $d(xy) = d(x)y + xd(y)$ hold for all $x, y \in N$, or equivalently as noted in [3], that $d(xy) = xd(y) + d(x)y$ for any $x, y \in N$. In [2], the notion of multiplicative derivation on ring was introduced by Daif as follows: A mapping $d : N \to N$, which is not assumed to be additive, is called a multiplicative derivation if $d(xy) = xd(y) + d(x)y$ holds for all $x, y \in N$.

Our contribution is to study the notion of multiplicative derivation satifying certain algebraic identities in 3-prime near-rings which forces N to be a commutative ring.

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ICRAMCS 2024
THE SIXTH EDITION OF THE INTERNATIONAL CONFERENCE ON RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
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On finiteness of some noncommutative Gröbner bases over finite fields

Communication Info

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Keywords:
(1) Finite field, Finiteness
(2) Initial ideal
(3) Linear change of variables
(4) Noncommutative Gröbner bases

Abstract

Eisenbud and al. proved that if $\mathbb{K}$ is a field of characteristic 0 and $\gamma: \mathbb{K}\langle X_1, X_2, \dots, X_n\rangle \longrightarrow \mathbb{K}[x_1, x_2, \dots, x_n]$, the map from the noncommutative ploynomial ring to the commutative one which sends X_i to x_i then any noncommutative ideal $\mathcal{J} = \gamma^{-1}(\mathcal{I})$ has a finite Gröbner basis even after a linear change of variables. By an example they prove that if $\mathbb{K}$ is of characteristic $p \neq 0$ then this result does not always hold.
In this work, by considering a coefficient finite field $\mathbb{K}$. And :

- we prove that if the ideal $\mathcal{I}$ is 0-dimensionnal then the ideal $\mathcal{J} = \gamma^{-1}(\mathcal{I})$ has a finite Gröbner basis ;
- then we give a sufficient and necessary condition for ideals of type $\gamma^{-1}(\mathcal{I})$ to have finite Gröbner basis ;
- we finish by investigating the particular case where $\mathcal{I}$ is a principal ideal.

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On Disk-cyclicity of Linear Relations

Communication Info

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Keywords:
(1) Disk-cyclic
(2) Disk transitive
(3) Linear Relation

Abstract

We introduce and study the two notions of disk-cyclicity and disk transitivity of linear relations. We show that the equivalence between diskcyclic linear relation and disk transitive linear relation, furthermore, we give two criteria for determining the disk-cyclicity of linear relations.

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On the existence of C_0-semigroups generated by closed generalized Drazin-Riesz operators

Communication Info

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Keywords:
(1) Drazin inverse
(2) Closed Browder operators
(3) Riesz operators
(4) C_0-semigroups

Abstract

We establish the existence of infinitesimal generators of C_0-semigroups which are closed generalized Drazin-Riesz invertible operators and give a non-trivial example of a closed generalized Drazin-Riesz operator which generates a C_0-group (resp. C_0-semigroup).

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Pythagorean Fuzzy Multigroups

Communication Info

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Keywords:
(1) Multiset
(2) Fuzzy Multigroups
(3) Pythagorean Fuzzy Multigroups

Abstract

This study is motivated by the concepts of Pythagorean fuzzy groups and intuitionistic fuzzy multigroups. In this paper, the notion of Pythagorean fuzzy multigroups is presented, and its many properties are examined to study the various algebraic structures of Pythagorean fuzzy multisets. Next, we examine Pythagorean fuzzy multigroups' intersection and union.

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

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Titchmarsh's Theorem for the analytical Fourier-Mellin transform on the space $L_2(G)$

Communication Info

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Keywords:
(1) Fourier analysis
(2) Fourier-Mellin transform
(3) Lipschitz class

Abstract

Many important transforms are used in applied sciences, among them the analytical Fourier-Mellin transform [1], which is used to give excellent results in image processing [2, 3].
As we know, one of the most important topics in the mathematical literature is the relationship between the regularity conditions imposed on a certain function and the behavior of its Fourier transform. This is what we find proved in Titchmarsh's theorem [4].
In our work, after creating a new translation operator by combining the usual translation and the Mellin translation, we introduced two different lipchitz classes in the space $L_2(G)$, where $G = R_+^* \times S_1$ and S_1 is the unit circle of the plane R^2. Afterwards, we gave two extensions of the Titchmarsh's theorem under the analytical Fourier-Mellin transform for functions that belong to these lipchitz classes.

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Neutron-gamma ray discrimination methods using organic scintillators

Communication Info

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Keywords:
(1) Neutron-gamma discrimination
(2) Machine learning
(3) Scintillation detectors

Abstract

Neutron spectrometry using scintillation detectors is an increasingly popular technique for many different applications, including in the areas of non-proliferation and medical imaging [1]. Scintillation detectors have high efficiency for detecting neutrons, making them suitable for a variety of different neutron energies. Additionally, these detectors are relatively inexpensive and simple in design, making them easy to maintain and use [2]. However, there are several background radiations in the detection of these neutrons, including gamma radiation, which complicates the neutron detection process [3]. In this context, various techniques have been proposed to discriminate neutrons from gamma radiation. This work presents state-of-the-art machine learning based methods for neutron-gamma discrimination using organic scintillation detectors [4][5].

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Polynômes orthogonaux

Communication Info

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Keywords:
(1) Polynômes orthogonaux ;
(2) Relation récurrente de Polynômes orthogonaux ;
(3) Polynômes orthogonaux de Sobolev.

Abstract

Les polynômes orthogonaux de Sobolev ceux sont des polynômes qui forment une famille orthogonale pour un produit scalaire de type :

$$\langle P|Q\rangle = \sum_{k=1}^{n} \lambda_k \int_a^b P^{(k)}(x)Q^{(k)}(x)w_k(x)dx$$

Où

$$\forall m \in \mathbb{N},\ \ \forall k \in [\![1,n]\!],\ \ w_k > 0, \int_a^b |x|^m\, w_k(x)dx < +\infty\,.$$

Lorsuqe $\lambda_1 = \lambda_2 = \cdots = \lambda_n = 0$ on parle de polynômes orthogonaux classique, l'un des grand résultat pour ce type de polynômes est la relation récurrente d'ordre 2. Le résultat qu'on traite voir [1] est que la relation récurrente d'ordre 2 existe si st seulement si

$$(P,Q) \in \mathbb{R}[X]^2,\quad \langle XP|Q\rangle = \langle P|XQ\rangle$$

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Dual Approach with Automated Penalty Parameter Selection for an Elastoplastic Contact Problem

Communication Info

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Keywords: Electro-elastic
(1) Elasto-plasticity;
(2) Signorini conditions;
(3) Augmented Lagrangian;

Abstract

In this article, we consider a mechanical contact problem between an elastoplastic body and a rigid foundation. The material behavior is given by Hencky's nonlinear elastic constitutive law. We introduce an iterative method based on Kacanov's method, with a Lagrangian formulation augmented at each iteration. In order to improve the algorithm in the discrete case, we propose an alternative approach consisting of an automatic and optimal selection of the penalty parameter, which is accompanied by an approximate algorithm. To do this, we eliminate two unknowns, the primary and the auxiliary, and thus formulate a purely dual algorithm, enabling us to study the convergence of our method in depth. Finally, numerical experiments on two-dimensional problems are carried out to demonstrate the performance of the proposed method.

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The dynamic slip condition for oscillatory shear flow

Communication Info

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Keywords:
(1) Oscillatory shear flow
(2) Laplace transform
(3) Navier slip, Dynamic slip

Abstract

The oscillatory shear flow between two infinite parallel plates is a fundamental phenomenon in fluid dynamics. In our study, we explore the interplay of Navier slip and dynamic slip conditions within this shear flow regime. We also examine the influence of the Reynolds number on dimensionless velocity and shear stress fields. Graphical representations these intricate relationships. The solutions for oscillatory motions combine permanent and transient components. Additionally, through graphical analysis, we determine the time required for the system to reach its periodic solution. This duration is notably shorter for motions resulting from cosine oscillations of the plate. Furthermore, the effects of the dynamic slip parameters on the evolution of the flow are analysed and discussed.

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On dual Rickart and dual Baer semimodules

Communication Info

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Keywords:
(1) Weak dual Rickart semimodules
(2) weak dual Baer semimodules
(3) i – dual Rickart semimodules
(4) i – dual Baer semimodules

Abstract

This paper generalizes the Rickart (resp. Baer) dual property to semirings and semimodules. We introduce weak dual Rickart (resp. Baer) semimodules, then identify i-dual Rickart semimodules as a specific subclass of the former. Basic links between the various dual Baer and dual Rickart semimodules are discussed. A characterization of the dual Rickart semimodules by their endomorphism semiring is provided.

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Orthogonal polynomials and computer Science

Communication Info

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Keywords:
(1) Orthogonal polynomials
(2) Linear Algebra «Maple»
(3) Difference equation

Abstract

As an extension of the Askey-scheme, recently, it has been introduced the so-called *d*-Askey-scheme, which is a table describing families of hypergeometric *d*-orthogonal polynomials. We derive limit relations linking between all levels of the 2-Askey scheme (Figure 1). To this end, we use three methods. The first one is based on a recurrence relation. The second one uses difference and differential equations, and the third one deals with the

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AUTOMATIC CONTINUITY OF GENERALIZED DERIVATIONS ON CERTAIN *-BANACH A-MODULES

Communication Info

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Keywords:
(1) Generalized derivation,
(2) Module
(3) Involution

Abstract

Let A be an algebra, M be a left A-module and d be a derivation on A. A linear map F: M→M is called a generalized derivation associative to d if

F(am) = aF(m) + d(a)m (a ∈ A, m ∈ M). In [6], Bresar introduced the concept of generalized derivations.

In this article, we prove several results about the automatic continuity of generalized derivations in the case A is a

*-Banach algebra and M is a Banach left A-module [1].

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The linear trigonometric moment problem for recursive sequences

Communication Info

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Keywords:
(1) Linear moment problem,
(2) K-moment problem,
(3) Hankel matrix,
(4) Linear trigonometric recursive sequences.

Abstract

The linear moment problem has been extensively studied in the literature, particularly in relation to topics in physics such as quantum dynamical systems. Recently, there has been considerable investigation of the linear moment problem using various methods.
This talk aims to delve into the linear trigonometric moment problem concerning both homogeneous and nonhomogeneous recursive sequences. Specifically, we present results concerning the close relationship between the linear trigonometric moment problem and sequences defined by homogeneous or nonhomogeneous recursive relations. Additionally, leveraging properties of the Toeplitz matrix and its associated quadratic form, we establish conditions for the solvability of the nonhomogeneous linear trigonometric moment problem and derive those pertaining to the homogeneous linear trigonometric moment problem.

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THE SIXTH EDITION OF THE INTERNATIONAL CONFERENCE ON RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
April 25-26-27, 2024 | Marrakech, Morocco

Duality and orthogonality on right quaternionic Banach spaces

Communication Info

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Keywords:
(1) Quaternionic Banach spaces
(2) S-spectrum
(3) Duality
(4) Orthogonality

Abstract

In this paper, we study the properties of the S-spectrum of right linear bounded operators on a right quaternionic Banach space. We prove some relations between the S-spectrum and most of its important parts; the approximate S-spectrum, the compression S-spectrum and the surjective S-spectrum. Among other results, we provide some properties of duality and orthogonality on a right quaternionic Banach space.

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ICRAMCS 2024

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

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Linear preservers of (m,n)-isosymmetric operators

Communication Info

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Keywords:
(1) Linear preservers problem
(2) (m,n)-isosymmetric.

Abstract

Let H be a complex infinite-dimensional Hilbert space. Given two positive integers n and m, an operator $T\in\mathcal B}(H)$ is said to be (m,n)-{\it isosymmetric}, if
$$
\sum_{k=0}^m(-1)^{m-k} \binom{m}{k} T^{*k} \left(\sum_{j=0}^n(-1)^{j}\binom{n}{j} T^{*n-j} T^{j}\right)T^{k}=0
$$
or equivalently,
$$
\sum_{j=0}^n(-1)^{j}\binom{n}{j} T^{*n-j} \left(\sum_{k=0}^m(-1)^{m-k} \binom{m}{k} T^{*k} T^{k}\right)T^{j}=0
.$$ In the present paper, we focus on linear maps on $\mathcal{B}(H)$, the algebra of all bounded linear operators on H, that preserve (m,n)-isosymmetric.

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Slater index of doubly regular tournaments

Communication Info

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Keywords:
(1) Doubly regular Tournament
(2) Skew-spectrum
(3) Spectral distance
(4) Slater index

Abstract

An n-tournament T is a digraph with n vertices $\{v_1,\ldots,v_n\}$ in which every pair of vertices is joined by exactly one arc. The skew-adjacency matrix of T is the n × n zero-diagonal matrix $S = [s_{ij}]$, such that $s_{ij} = 1$ if v_i dominates v_j and $s_{ij} = -1$ if v_j dominates v_i. The distance between two n-tournaments T and T' is the number d(T, T') of pairs {*i, j*} from {1, ..., n} for which the arc between *i* and *j* does not have the same direction in T and in T´. The spectral distance λ(T, T') between tournaments is defined as an Euclidean distance between the spectrum of T and that of T'. For this communication, we are particularly interested in the spectral distance between a tournament T and a transitive tournament R. As an application, an improved lower bound on the Slater index of doubly regular tournaments is given.

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Convergence Analysis of a Finite Volume Scheme for a Parabolic System

Communication Info

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Keywords:
(1) Finite Volume Method
(2) Convergence
(3) Image Processing
(4) Nonlinear reaction-diffusion

Abstract

This work analyzes a finite volume scheme for a nonlinear reaction-diffusion system applied in image processing. We first demonstrate the existence of a solution within this scheme. Then, using a series of derived estimates and Kolmogorov's compactness criterion, we rigorously prove the convergence of the finite volume solution to the weak solution of the system. Finally, numerical simulations are presented.

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

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Psuedo-Euclidean Novikov algebras

Communication Info

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Keywords:
(1) Flat pseudo-Euclidean Lie algebras
(2) sep pseudo-Euclidean Novikov algebras
(3) left symmetric algebras
(4) double extension
(5) flat pseudo-Riemannian Lie groups

Abstract

A pseudo-Euclidean algebra is an algebra $(g, \bullet)$ endowed with a nondegenerate symmetric bilinear form $\langle, \rangle$ such that the left multiplications of $\bullet$ are skew-symmetric with respect to $\langle, \rangle $. We call $(g, \bullet, \langle, \rangle)$ Novikov (resp. $\Ll\Rr$) if $\bullet$ is left symmetric and the right multiplications commute (resp. both the left and the right multiplications commute). We call $(g, \bullet, \langle, \rangle)$ Milnor if $\bullet$ is Lie-admissible and there exists a nondegenerate two sided ideal I such that $g\bullet g\subset I$ and $I\bullet g=0$. It is well known that the determination of simply connected Lie groups having a flat left invariant pseudo-Riemannian metric is equivalent to the determination of real left symmetric pseudo-Euclidean algebras. In this paper, we give a complete description of a subclass, namely, pseudo-Euclidean Novikov algebras. We show first that a pseudo-Euclidean algebra is Novikov if and only if it is a $\Ll\Rr$-algebra.

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

April25-26-27, 2024 | Marrakech, Morocco

k-skew-spectrally monomorphic tournaments

Communication Info

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Keywords:

(1) Tournament

(2) Seidel adjacency matrix

(3) Skew-spectral monomorphy

Abstract

A tournament is k-skew-spectrally monomorphic if all the k×k principal submatrices of its Seidel adjacency matrix have the same characteristic polynomial. Transitive n-tournaments are trivially k-skew-spectrally monomorphic. We show that there are no others for k ∈{4, ..., n −4}. Furthermore, we prove that for n ≥7, a tournament is (n-3)-skew-spectrally monomorphic if it is switching equivalent to a transitive tournament or its Seidel adjacency matrix is a skew-conference matrix.

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ICRAMCS 2024

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

April 25-26-27, 2024 | Marrakech, Morocco

A New Algorithm For Inversing A Blocks Of Pentadiagonal Matrix

Communication Info

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Keywords:
(1) Inverse.
(2) Blocks pentadiagonal.
(3) matrices.

Abstract

A block pentadiagonal matrix is a type of matrix with nonzero elements only on five diagonals: the main diagonal and two diagonals above and below it.
It can be represented in block form, with blocks on the main diagonal and four off-diagonal blocks, with zeros elsewhere. Block pentadiagonal coefficient matrices appear in various branches of mathematics, applied science, engineering, parallel computing, and the numerical solution of ordinary and partial differential equations. The inverse of these structured matrices has been a focal point for many authors. For this reason, we present a new algorithm for inverting a block of a pentadiagonal matrix, along with some interesting results.

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ICRAMCS 2024

THE SIXTH EDITION OF THE INTERNATIONAL CONFERENCE ON RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
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Tensorial GMRES Method for Solving ILL-Problems

Communication Info

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Keywords:
(1) Tensor
(2) Regularisation techniques
(3)GMRES

Abstract

In this work, we develop a new iterative Krylov subspace method to solve large multi-linear tensor equations. Using the particularity of the t-product [1, 2] for two tensors, we define the tensor global Arnoldi and t-global GMRES algorithms as defined in [3]. Moreover, we show how tensor–based global approaches may be used to solve ill-posed problems arising from recovering blurry multichannel (color) images. The Tikhonov regularization technique is then used to supply approximate regularized solutions [4]. Finally, we review a generalized cross-validation and discrepancy principle type of criterion for the selection of the regularization parameter in the regularization [5]

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ICRAMCS 2024

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

April 25-26-27, 2024 | Marrakech, Morocco

Le produit scalaire externe d'une matrice par une famille de vecteurs

Communication Info

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Keywords:
(1) loi externe
(2) *produit scalaire*
(3) *les A-modules*
(4) cours d'algèbre linéaire

Abstract

Le but de ce travail est d'introduire ***le produit scalaire externe*** dans le cours de l'algèbre linéaire en premier cycle universitaire. Cet outil s'avère très important quand la nature des éléments n'est pas importante dans le raisonnement. nous introduisons le produit scalaire d'une matrice par une famille de vecteurs de E. De façon plus précise, nous découvrons que E^m est un $M_{m,n}(K)$ module.

Très souvent en algèbre linéaire, il faut regarder une matrice comme une famille de ses colonnes (par exemple un déterminant est une forme multilinéaire). Par conséquent, nous sommes amenés à faire un raisonnement globale[1] sur les colonnes de la matrice et non sur les coefficients. Donc nous introduisons la notion du produit scalaire externe d'un vecteur colonne $X \in K^n$ par une famille F d'un K espace vectoriel. Ce nouveau produit s'adapte au point de vue globale des matrices en algèbre linéaire et permet de transférer les propriétés matricielles aux vecteurs. Nous découvrons grâce à cette notation une méthode qui facilite les applications dans l'enseignement en premier cycle universitaire: Détermination de la matrice d'une application linaire, calcul de la puissance d'une matrice, Détermination d'une base de l'orthogonal dans un espace euclidien, l'écriture simple de la bijection entre un espace vectoriel et son dual.

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THE SIXTH EDITION OF THE INTERNATIONAL CONFERENCE ON RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
April 25-26-27, 2024 | Marrakech, Morocco

About Spectral Slater Index of Tournaments

Communication Info

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Keywords:
(1) Tournament
(2) Skew-spectrum
(3) Spectral distance
(4) Slater index

Abstract

A *tournament matrix* T is a (0, 1)-matrix that satisfies $\mathrm{T} + T^t = \mathrm{J} - \mathrm{I}$, where J is the all ones matrix and I is the identity matrix. The Slater index i(T) of a tournament T is the minimum number of arcs that must be reversed to make T transitive. In this paper, we define a parameter Λ(T) from the spectrum of the skew-adjacency matrix of T, called the spectral Slater index.
This parameter is a measure of remoteness between the spectrum of T and that of a transitive tournament.
We show that Λ(T) ≤ 8 i(T) and we characterize the tournaments with maximal spectral Slater index. As an application, an improved lower bound on the Slater index of doubly regular tournaments is given.

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Positivity and stability of evolution equations and application to population dynamics

Communication Info

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Keywords:
(1) Exponential stability
(2) Control theory
(3) Population dynamics

Abstract

In the first part of this talk, we study the positivity of a large class of perturbed semigroups. By exploiting the positivity, we find a characterization of (uniform) exponential stability. Our approach is essentially based on feedback theory and control theory of infinite-dimensional linear system and useful tools of positive semigroup.
In the second part, we consider a spatially and size structured population model with unbounded birth process which is transformed into a closed-loop system. We then give a condition on birth and death rates in such a way that the solution decays exponentially.

The first part was published in [1] (with Bounit and Hadd) and the second was published in [2].

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April 25-26-27, 2024 | Marrakech, Morocco

Regional fractional optimal control problem of a bilinear reaction diffusion equation using distributed bounded controls

Communication Info

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Keywords:
(1) Infinite dimensional bilinear systems.
(2) Bilinear Control Fractional optimal
(3) Regional optimal control problem
(4) Controllability.
control problem regional optimal control problem

Abstract

This work examines the regional fractional distributed optimal control for a bilinear reaction-diffusion equation that is driven by bounded, distributed controls. We formulate the problem as the minimization of a functional consisting of the difference between the desired and actual fractional values over a time interval, along with an energy term. We prove the existence of an optimal control and characterize it using an optimality system.

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THE SIXTH EDITION OF THE INTERNATIONAL CONFERENCE ON RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
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Stability of non-autonomous bilinear systems

Communication Info

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Keywords:
(1) Exponential stability
(2) Finite-time stability
(3) Non-autonomous system
(4) Multiplicative control

Abstract

This work explores the stabilization of abstract infinite-dimensional non-autonomous bilinear systems, focusing on two distinct forms of stability: exponential and prescribed time stability. Non-autonomous systems, characterized by time-varying dynamics, pose significant challenges in stabilization due to the inherent complexities introduced by the time-dependence. Based on the theory of nonlinear maximal monotone operators and the fixed-point arguments, we discuss the well-posedness of the closed-loop system. Moreover, in order to achieve exponential stability, we construct a feedback control, based on a designed Lyapunov function and a weak observability inequality. Subsequently, we apply the obtained results to prove prescribed time stability. Furthermore, we provide applications on non-autonomous diffusion-reaction equation and transport equation.

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Uniform exponential stabilization for distributed discrete bilinear systems with time delay

Communication Info

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Keywords:
(1) Discrete bilinear systems
(2) Feedback control
(3) Uniform exponential stabilization
(4) Time delay

Abstract

In this paper we investigate the feedback stabilization problem for distributed discrete bilinear systems with time delay. Sufficient and necessary conditions for uniform exponential stabilization are given. Furthermore, under weaker conditions, the weak stabilization is achieved for the considered systems. Applications and illustrative simulations are presented.

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On well-posedness and regularity of second order boundary systems

Communication Info

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Keywords:
(1) Regular linear systems
(2) Cosine functions
(3) Semigroups theory

Abstract

In this paper, we will employ regular systems theory to address several questions regarding second-order systems.
One of the focal points will be giving meaning to the well-posedness of the second-order problem with a perturbed domain generator.

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Indirect boundary controllability of coupled degenerate and singular hyperbolic systems

Communication Info

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Keywords:
(1) Control
(2) Wave equation
(3) Hardy-Poincaré inequalities
(4) HUM

Abstract

In this talk, we consider the boundary controllability of a system of two degenerate and singular wave equations coupled by velocities, with boundary control acting on only one equation. The other equation is controlled indirectly through the coupling between the equations. When the coupling parameter is small, we show that by observing only one component of the associated homogeneous system, one can recover the full energy of both components. As a consequence, using the Hilbert Uniqueness Method of Lions, we deduce the indirect controllability result for sufficiently large time.

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Strong and exponential stabilization for second-order semilinear systems with time delay

Communication Info

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Keywords:
(1) Exponential stabilization
(2) Control theory
(3) Second order systems

Abstract

This paper is focused on the problem of strong and exponential stabilization for second-order semilinear systems with time delay. We introduce a suitable feedback control that ensures energy dissipation. Existence and uniqueness of closed-loop systems are demonstrated using cosine families theory, and sufficient conditions for both strong and exponential stabilization are provided. The result is applied to the stabilization of the several partial differential equation control systems with time delay.

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Feedback stabilization for a class of bilinear time-delay systems in Banach spaces

Communication Info

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Keywords:
(1) Bilinear systems
(2) Banach spaces
(3) Time delay
(4) Exponential stabilization
(5) Strong stabilization

Abstract

In this paper, we consider the question of feedback stabilization for a class of distributed bilinear time-delay systems, evolving on a real Banach state spaces. Then, we provide sufficient conditions for strong stabilization via bounded feedback control. Moreover, we consider the decomposition of the state space via the spectral properties of the systems to discuss the exponential stabilization. Finally, applications to some functional differential equations of are provided

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Finite-Time Stabilization for distributed bilinear Systems

Communication Info

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Keywords:
(1) Bilinear systems
(2) Finite-time stabilization
(3) Nonlinear control

Abstract

In this work, we study the finite-time stabilization (FTS) of a class of distributed bilinear systems.
Some conditions on the system and control operators are considered to guarantee the well-posedness of the system in closed-loop; while the stabilization conditions rely on the construction of a Lyapunov function, which requires an observation condition.
The main idea consists of decomposing the nominal system into two subsystems, one of them is finite-time stable (without control), so that the study can be focused on the other. These results are illustrated via examples and supported by numerical simulations.

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Dynamics of Linear Operators: Super-Recurrence Case

Communication Info

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Keywords:
(1) Hypercyclicity
(2) Supercyclicity
(3) Super-Recurrence

Abstract

In this note, we introduce and study the notion of super-recurrence of operators.
We investigate some properties of this class of operators and show that it shares some characteristics with supercyclic and recurrent operators.
We specifically prove that a given operator is super-recurrent if and only if it admits a dense subset composed of super-recurrent vectors for T.
Furthermore, we establish that the notion of super-recurrence is invariant under certain operator transformations, such as quasi-similarity and similarity.
Moreover, we show that if T is super-recurrent, then $\sigma(T)$ and $\sigma_p(T^*)$, the spectrum of T and the point spectrum of T^* respectively, have some noteworthy properties.

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New improvement of Jensen's inequality for (p,h)-convex functions with applications

Communication Info

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Keywords:
(1) (p,h)-Convex function;
(2) Operator inequality;
(3) Norm Inequalities.

Abstract

Nowadays, in science and modern analysis the convexity and their inequalities plays an important role in economics, applied Mathematics, Mathematical Analysis, Mathematical Physics and optimization theory. The work on the convexity is extended day by day by using some new notions utilizing novel and modern methods in recent years. The main goal of this article is to present new inequalities for (p,h)-convex and (p,h) log-convex functions for a non-negative super-multiplicative and super-additive function h. This class generalizes quite a number of different convexities which exist in the literature. As applications of our results, we present many inequalities for the trace, and the unitarily norms for operators. The significance of the obtained results is the way they extend known results from the setting of convex functions to other classes of functions.

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On some matrix mean inequalities via the log-convexity property

Communication Info

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Keywords:
(1) Log-Convex function;
(2) Operator inequality;
(3) Norm Inequalities.

Abstract

Let $f: [0;1] \to [0;+\infty[$ be a log-convex function, $0 \leq \eta \leq \frac{1}{2} \leq \tau \leq 1$ and m be a positive integer. Then by using the Jensen's inequality we prove that $\frac{\eta^m}{\tau}(f^m(1)\nabla_\tau f^m(0) - f^m(\tau) + r_m(f(0)^{\frac{m}{2}} - f^{\frac{m}{2}}(\tau))^2 \leq (f(1)\nabla_\eta f(0))^m - f^m(\eta)$ and $\frac{(1-\tau)^m}{1-\eta}(f^m(1)\nabla_\eta f^m(0) - f^m(\eta) + r'_m(f(1)^{\frac{m}{2}} - f^{\frac{m}{2}}(\eta))^2 \leq (f(1)\nabla_\tau f(0))^m - f^m(\tau)$ where ∇_η stands for the weighted arithmetic mean and r_m, r'_m are two positive numbers. Furthermore, by selecting some appropriate log-convex functions, we obtain some new refinements of certain classical inequalities between the difference arithmetic-power, arithmetic-harmonic and arithmetic-geometric means for scalars and matrices as well as matrix norm and determinant. The importance of the results obtained is twofold; the results themselves and the way in which they extend many of known results in the literature.

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Stability of the weakly L^p-integrable C_0-semigroup

Communication Info

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Keywords:
(1) Semigroup of linear operators
(2) stability
(3) tempered distributions

Abstract

The stability of the weakly L^p-integrable C_0-semigroup on a Banach space is investigated for $p \in [1; \infty)$.
We prove that a such semigroup can be extended to an uniformly exponential stable one. Further, we provide a condition on the resolvent which is sufficient and necessary for the semigroup to be uniformly exponentially stable. Besides, a characterization of the weak L^2-integrability in terms of the resolvent is given. The approach lies on tempered distributions and a weaker complex inversion formula.

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THE SIXTH EDITION OF THE INTERNATIONAL CONFERENCE ON RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
April 25-26-27, 2024 | Marrakech, Morocco

The Narrow Recurrence of Random Dynamical Systems

Communication Info

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Keywords:
(1) Recurrence
(2) Hypercyclicity
(3) Random dynamical system

Abstract

Let (Ω, F, P) be a probability space, where F is countably generated, and X be a Polish space. Let φ be a random dynamical system on X with time T on X. The skew product flow $\{\Theta_t;\ t \epsilon T\}$ induced by φ is a family of continuous operators acting on Pr_Ω, the set of all probability measures on $X \times \Omega$, with marginal P, which is a Polish space equipped with the narrow topology, see [1] or [2]. In this work, we introduce and study the notion of narrow recurrence of the flow $\{\Theta_t;\ t \epsilon T\}$ on Pr_Ω and we give some results, which can be considered as an initiation of applications of properties of topological dynamics on stochastic process theory and random dynamical systems

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Dynamics of elementary operators on Banach ideal of operators

Communication Info

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Keywords:
(1) Orbit
(2) Supercyclicity
(3) J-class operators
(4) J^{mix}-class operators
(5) Elementary operators

Abstract

Let X be a separable Banach space over the field C of complex numbers, B(X) the algebra of all bounded linear operators on X and (J, $||.||_J$) be an admissible Banach ideal of B(X). For A, B $\in$ B (X), let $L_A \in$ B(B(X)), and $R_B \in$ B(B(X)) be the left and the right multiplication operators, respectively. The two-sided multiplication $M_{A,B} \in$ B(B(X)) is defined by $M_{A,B}$ (S)=($L_A R_B$)(S)=ASB and the generalized derivation $\delta_{A,B} \in$ B(B(X)) is defined by $\delta_{A,B}$ (S)=(L_A - R_B)(S)=AS-SB.

The aim objective of this presentation is concerned to study the transmission of some proprieties related to linear dynamics from operators $A, B \in B(X)$ to their elementary operators L_A, R_B, $M_{A,B}$ and $\delta_{A,B}$ defined on an admissible Banach ideal of operators (J, $||.||_J$).

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A dissipativity approach to the well-posedness of non-autonomous boundary problems

Communication Info

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Keywords:
(1) Non-autonomous equations
(2) Dissipative operators
(3) Population dynamics

Abstract

In this talk , we study a general class of non-autonomous hyperbolic boundary Cauchy problems. Using the concept of m-dissipative operators, we show the well-posedness of these problems and give a variation of constants formula of their solutions. To illustrate our results, we provide an application to a non-autonomous size-structured population model with delayed birth process.

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THE SIXTH EDITION OF THE INTERNATIONAL CONFERENCE ON RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
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Disjoint strong transitivity of composition operators

Communication Info

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Keywords:
(1)Composition operators
(2) disjoint hypercyclic operators
(3) strong disjoint hypercyclic operators

Abstract

A Furstenberg Family $\mathcal{F}$ is a collection of infinite subsets of the set of positive integers such that if $A\subset B$ and $A\in \mathcal{F}$, then $B\in \mathcal{F}$. For a Furstenberg family $\mathcal{F}$, finitely many operators $T_1,...,T_N$ acting on a common topological vector space X are said to be disjoint $\mathcal{F}$-transitive if for every non-empty open subsets $U_0,...,U_N$ of X the set $\{n\in \mathbb{N}:\ U_0 \cap T_1^{-n}(U_1)\cap...\cap T_N^{-n}(U_N)\neq\emptyset\}$ belongs to $\mathcal{F}$. In this paper, we characterize the disjoint $\mathcal{F}$-transitivity of $N\geq2$ composition operators $C_{\phi_1},\ldots,C_{\phi_N}$ acting on the space $H(\Omega)$ of holomorphic maps on a domain $\Omega\subset \mathbb{C}$ by establishing a necessary and sufficient condition in terms of their symbols $\phi_1,...,\phi_N$.

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Dynamique topologique sur l'interval

Communication Info

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Keywords:
(1) hypercyclic
(2)transitivity
(3) mixing

Abstract

Let X be a complex topological vector space. This project focuses on dynamical système given by the iteration of a linear continuous operators on X. The aim of this work is to study the linear dynamics of operators and of interval maps. More precisely, the study of cyclicity [1], supercyclicity [2] and hypercyclicity [3]. Also we are interested in the study of the dynamic properties operators; transitivity [4], mixing [5], weakly mixing of the interval map and the relation between all these properties.

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April 25-26-27, 2024 | Marrakech, Morocco

Mise en place d'un modèle mathématique digital de détection des maladies de plantes

Communication Info

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Modèle mathématique digital
Deeplearning
Détection des maladies
Plantes

Abstract

La zone agricole de Sidi Bennour est considérée comme l'une des régions agricoles les plus riches du Maroc, notamment pour la betterave avec une production de 748.663 Tonnes au titre de 2020/2021. Avec l'augmentation du changement climatique, un nombre croissant de maladies des plantes menacent l'agriculture de la betterave et en conséquence la sécurité alimentaire.

Les chercheurs dans ce domaine cherchent des moyens d'améliorer la santé des végétaux. La détection et la détermination précoces de ces maladies aident à protéger les cultures de la betterave et son l'environnement dans la zone agricole de Sidi Bennour.

Dans ce cadre nous proposons la mise en place d'un modèle mathématique de détection à base de Deep Learning qui permet à partir des modèles génétiques de détecter rapidement et précisément les maladies de la betterave.

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ICRAMCS 2024

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

April 25-26-27, 2024 | Marrakech, Morocco

Mathematical Modeling of Water Quality

Communication Info

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Keywords:
(1) Statistical data
(2) mathematical modeling
(3) deep Learning

Abstract

Water is an essential element for the life of every living being on earth, and represents a key limiting factor for sustainable development, improved quality of life and peace. The high mineral content of this resource is constantly increasing due to a variety of human activities, such as over-abstraction of water flows but also contamination by open sewage discharges.

The main research content of the water environment. The mathematical model of water environment refers to the mathematical expression used to describe the water quality factors of water bodies under the influence of various factors that change with time and space and control conditions.

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An Explicit Spectral Fletcher-Reeves Conjugate Gradient Method for Bi-criteria Optimization

Communication Info

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Keywords:
(1) Multicriteria optimization
(2) Pareto optimality
(3) Spectral conjugate gradient method
(4) Descent directions
(5) Line search

Abstract

In this work, we propose an extension of the well-known spectral Fletcher-Reeves conjugate gradient method (SFRCG) for solving unconstrained bi-criteria optimization problems avoiding scalarization techniques. Two particular advantages in this contribution are to be noted. First, the suggested descent direction common to both criteria may be directly computed by a given formula without solving any intermediate subproblem, making the implementation of the proposed algorithm more too simple as in the scalar case. Second, the proposed direction verifies a sufficient descent property which does not depend neither on the line search nor on any convexity assumption. After proving the existence of an appropriate bi-criteria Armijo-type stepsize, global convergence of the proposed algorithm is established under standard hypothesis. Numerical results and comparisons with other methods show the effectiveness of our SFRCG method, particularly on large-scale dimensional problems.

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April 25-26-27, 2024 | Marrakech, Morocco

MATHEMATICAL MODELING, ANALYSIS, AND OPTIMAL CONTROL OF THE N+7 COMPARTMENT SMOKING EPIDEMIC MODEL

Communication Info

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Keywords:
(1) Optimal control
(2) Stability analysis
(3) Epidemic model

Abstract

In this study, we present a new mathematical model for the n+7 compartment smoking epidemic and analyze its behavior using optimal control techniques. We examine the system's basic properties and use Lyapunov functions and Routh-Hurwitz criteria to perform stability analysis [1]. Our results show that the system is globally and locally asymptotically stable at the free equilibrium E_0 when $R_0<1$, and globally and locally asymptotically stable at the endemic equilibrium E^* when $R_0>1$. We also conduct a sensitivity analysis to identify the model parameters that significantly impact the reproduction number R_0 [2]. Our goal is to identify optimal strategies for minimizing the number of heavy smokers, maximizing the number of sick heavy smokers who receive hospital treatment, and increasing the number of rich and poor heavy smokers who seek treatment at private and public smoking treatment centers. We use Pontryagin's maximum principle in continuous time to characterize the optimal controls [3], and we confirm our theoretical findings through numerical simulations conducted using Matlab.

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

April 25-26-27, 2024 | Marrakech, Morocco

ON THE CONVERGENCE OF BLOCK-COORDINATE METHODS FOR SOLVING UNCONSTRAINED PROBLEMS

Communication Info

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Keywords:

(1) Block Coordinate Descent

(2) Convergence

(3) Stationary point

Abstract

We consider the Block-Coordinate (BC) methods for minimizing a continuous function over a feasible set defined as the cartesian product of convex compact sets. In this method, the coordinates are partitioned into N blocks and, at each iteration, the objective function is minimized with respect to one of the coordinate blocks while the other coordinates are held fixed. The convergence of this method is guaranteed towards a stationary points, if certain assumptions are satisfieded, such as the convexity and the existence of a unique minimum in each block while the other coordinates are held fixed [1]. Or if the objective function satisfies certain separability and regularity properties, and is pseudoconvex in every pair of coordinate blocks.

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ICRAMCS 2024
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Minimizing a fractional function over a compact set

Communication Info

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Keywords:
(1) Fractional optimization
(2) Fréchet subdifferential
(3) separation theorem

Abstract

In this work, we give necessary optimality conditions for strict optimality solutions of the following specific fractional minimization problem:

$$(P):\begin{cases} min_x \quad \varphi(x) = \dfrac{f(x)}{g(x)} \\ \qquad\qquad x \in \Omega. \end{cases}$$

Where the constraint set is a compact subset of an Asplund space [1], f and g are assumed to be locally Lipchitz.

In order to achieve our purpose, we use an exact separation theorem proposed by Zheng, Yang and Zou [2], which is actually a generalization of the convex separation theorem to nonconvex sets. They then added a powerful tool to functional analysis and optimization theory.

We give our optimality conditions in terms of Fréchet subdifferential [3,4,5].

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THE SIXTH EDITION OF THE INTERNATIONAL CONFERENCE ON RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
April 25-26-27, 2024 | Marrakech, Morocco

New Second-Order Optimality Conditions for a Class of bilevel Optimization Problems

Communication Info

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Keywords:
(1) Bilevel optimization
(2) Second-order directional derivative
(3) Partial calmness

Abstract

The bilevel optimization problem (BOP) entails a sequence of two optimization programs with smooth and non-smooth data, where the constraint region of the upperlevel problem is implicitly determined by the solution set of the lower-level problem. In order to derive second-order necessary optimality conditions, we reformulate this hierarchical program (BOP) into a single-level optimization problem by employing the value function of the lower-level problem. However, it is important to note that the problem (LLVF) we encounter does not satisfy the standard constraint qualifications in nonsmooth programming, and it lacks regularity at all feasible points. To circumvent this hurdle, we employ the concept of partial calmness, this condition addresses the challenging constraint by incorporating it into the objective function, this approach proves instrumental in overcoming the challenges posed by non-standard constraints and irregularity. To illustrate the obtained results, we provide concrete examples.

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ϵ-Efficiency in multiobjective fractional problems

Communication Info

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Keywords:
(1) Vector optimization
(2) Fractional objective
(3) Efficiency conditions

Abstract

In this work we establish an original formula that describes a necessary and sufficient vector condition to characterize exact or approximate weak solutions of an unconstrained or constrained fractional multi-objective problem, when the objective functions of the numerators and denominators are assumed to be convex. This characterization has the particularity of combining ordinary (strong) and weak (Pareto) sub-differentials. Moreover, we give a vector characterization of exact or approximate proper and weak solutions for a fractional multi-objective problem with cone-constraints, where the objective functions of the numerators are convex and the denominators are concave. Finally, as application, we also derive a necessary and sufficient vector condition to determine exact or approximate proper and weak solutions of a linear fractional multi-objective problem under linear constraints.

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Optimal Solution of Laplace equation using genetic algorithms.

Communication Info

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Keywords:
(1) Laplace equation.
(2) Finite element.
(3) Genetic algorithms.

Abstract

We focus in this paper on the approximation of solutions of Laplace equation based on first-order finite elements. Our goal is to give the best subdivision that provides an optimal solution of this equation using genetic algorithms.
We present some numerical examples to show the performance of the method.

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Double Quadratic Residue Codes over *Fp×Fp*

Communication Info

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Keywords:
(1) Quadratic residue codes
(2) Double quadratic residue codes
(3) Complementary codes

Abstract

Let p be a prime integer and F_p the finite field of order p. Moreover, let q_1 and q_2 be prime integers such that p is a quadratic residue modulo q_1 and q_2. In this paper, we will introduce the class of double quadratic residue (QR) codes of length $n=q_1+q_2$, over the ring *Fp×Fp*. To study these codes and their properties, we will focus on two cases: In case I, we will assume that q_1 and q_2 are equal and then study double QR codes over the ring *Fp×Fp* of length $n=2q$, where q is a prime integer and p is a quadratic residue modulo p. Then in case II, we will study QR codes of length $n=q_1+q_2$, where q_1 and q_2 are distinct. We will stud the duals of double QR codes over the ring *Fp×Fp* and classify double QR codes thar are linear complementary dual codes (LCD). We will show that LCD double QR codes can be applied in secret sharing scheme.

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A Novel Development in Three-Dimensional Analytical Solutions for Air Pollution Dispersion

Communication Info

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Keywords:
(1) Analytical solution.
(2) Atmospheric dispersion.
(3) Sturm-Liouville eigenvalue problem.

Abstract

A new analytical solution is proposed for analyzing the three-dimensional dispersion of atmospheric pollutants, offering a fresh perspective on this crucial environmental concern. The study introduces the concept of dividing the planetary boundary layer into vertical sub-layers, each characterized by distinct average wind speeds and eddy diffusivities. This segmentation allows for a more detailed examination of atmospheric processes within the boundary layer. The model's validity is rigorously assessed by comparing its predictions with data from the Copenhagen Diffusion and Prairie Grass experiments, ensuring its applicability to real-world scenarios. Results reveal a significant correlation between predicted and measured crosswind-integrated concentrations, with statistical indices falling within acceptable ranges, underscoring the accuracy of the model's predictions and its potential for modeling atmospheric pollutant dispersion.

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Performance analysis of a queuing system with Egalitarian Processor Sharing under heavy traffic conditions

Communication Info

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Keywords:
(1) Queuing theory
(2) Egalitarian Processor sharing
(3) Performance evaluation
(4) Heavy traffic approximation

Abstract

We investigate a queuing model where customers arrive and are served according to a general distribution. This system consists of a single server functioning under the principle of egalitarian processor sharing, meaning customers share the server equally. Customers in this queue are allowed to re-enter after exiting. In this paper, we derive the performance metrics of this queuing system (average queue size and average response time) when the traffic intensity is very close to one

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ICRAMCS 2024
THE SIXTH EDITION OF THE INTERNATIONAL CONFERENCE ON RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
April 25-26-27, 2024 | Marrakech, Morocco

New approximate optimality conditions for approximate efficiency in multiobjective fractional programming problem

Communication Info

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Keywords:
(1) Multiobjective fractional programming problem
(2) Approximate efficient Solution
(3) Approximate optimality conditions

Abstract

In this paper, we establish approximate necessary and sufficient optimality conditions characterizing an approximate efficient solution of a multiobjective fractional problem under weakened constraint qualifications. As an application, we derive approximate necessary and sufficient optimality conditions characterizing an approximate efficient solution for some classical constrained optimization problems.

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Improved Parameter Extraction Procedure for Silicon Carbide Power MOSFET Model

Communication Info

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Keywords:
(1) Power device
(2) SiC MOSFET model
(3) Parameter extraction
(4) Netlist
(5) SPICE simulation,
(6) Optimization algorithm

Abstract

In this paper, an enhanced parameter extraction procedure for Silicon Carbide (SiC) power MOSFET model is presented. The improved parameter extraction method uses nonlinear optimization algorithm to find the optimal model parameters based on the measured I-V data points for the SiC power MOSFET device [1]. A correct I-V model equations and good initial guess values of the model parameters are provided to algorithm in order to minimize the errors between the model and measured data [2]. In addition, by providing good initial guesses the algorithm will give optimal solution avoiding convergence problem with reduced number of iterations [3]. The nonlinear optimization program used in this work is Levenberg-Marquardt (LM) algorithm [4]-[5]. The efficiency of the proposed extraction method is proved with the good agreements obtained between the model, datasheet and the measurement

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A Modified Crow Search Algorithm for Structure Optimization Problems

Communication Info

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Keywords:
(1) Metaheuristic
(2) Crow Search Algorithm
(3) Constrained optimization

Abstract

The Crow Search Algorithm [1,2] is a metaheuristic inspired by the foraging behavior of crows in nature. It utilizes a population of virtual crows to represent candidate solutions. The algorithm mimics the hunting behavior of crows, where individuals search for food by exploiting information from both local and global sources.
In this paper, we provide an overview of this algorithm, and propose a new modified version (MCSA). The study presents experimental results obtained by applying MCSA to selected test problems.
We analyze the algorithm's performance in terms of solution quality and compare the results with the basic CSA and other metaheuristics (CSA, PSO, GA) [1,3,4].
The applicability of our algorithm is demonstrated by applying it to structural optimization problem (Welded beam designee problem, Gear train design, Tension/compression spring problem) [5,6], and the findings shall be compared to methods of references (CSA, PSO, GA). Results clearly illustrate the robustness of the suggested method.

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ICRAMCS 2024

THE SIXTH EDITION OF THE INTERNATIONAL CONFERENCE ON RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
April 25-26-27, 2024 | Marrakech, Morocco

UNCERTAINTY PRINCIPLES FOR THE CONTINUOUS MEHLER-FOCK WAVELET TRANSFORM.

Communication Info

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Keywords:
(1) Heisenberg uncertainty inequality
(2) Mehler-Fock transform
(3) The continuous Mehler-Fock wavelet transform

Abstract

On this talk, some uncertainty principles for the continuous Mehler-Fock wavelet transform are proved. In particular, Donoho Stark and Lieb type uncertainty principles are given. An analogue of Heisenberg's inequality for $M\psi$ is also obtained.

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ICRAMCS 2024
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Necessary Optimality Conditions in Unconstrained Nondifferentiable Programming in terms of s-Holder Subdifferential

Communication Info

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Keywords:
Exact calculus, s-Holder subdifferential, normal cone.

Abstract

We try in this paper to derive new necessary optimality conditions in unconstrained nondifferentiable programming. The main generalized differential object of our study is the so-called s-Holder subdifferential of extended-real-valued functions defined on arbitrary real Banach spaces.

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Optimality conditions for bilevel multiobjective programming problems with extremal value function

Communication Info

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Keywords:
(1) Pareto subdifferential
(2) Multi-composed vector mappings
(3) Optimality conditions

Abstract

The aim of this paper is to establish optimality conditions characterizing properly and weakly efficient solutions for a vector bilevel programming problem with extremal value function (BMP). Our approach is based essentially on the general formula concerning the Pareto subdifferential rule of multi-composed convex mapping under a constraint qualification. As application, we deduce weak efficiency Pareto optimality conditions for a bilevel multiobjective fractional programming problem with extremal value function.

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ICRAMCS 2024

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Sequential approximate weak optimality conditions for robust multiobjective fractional optimization problems

Communication Info

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Keywords:
(1) Robust optimization
(2) Multiobjective fractional programming problem
(3) Conjugate function
(4) Approximate weak efficient solution

Abstract

The goal of this paper is to state sequential optimality conditions characterizing completely an approximate weak efficient solution for a vector constrained robust multiobjective fractional programming problem in the absence of constraint qualification, in terms of the approximate subdifferentials of the functions involved at an approximate weak efficient solution. We present an example illustrating our main results.

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ICRAMCS 2024
THE SIXTH EDITION OF THE INTERNATIONAL CONFERENCE ON RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
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A new resolution approach for the CETSP problem

Communication Info

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Keywords:
(1) CETSP
(2) MINLP
(3) Heuristic

Abstract

In this paper, we study a recent generalization of the well-known Traveling Salesman Problem (TSP) [1] called Close Traveling Salesman Problem (CETSP). In the CETSP [2], areas should be visited instead of points where the requirement of the "Close-Enough" variant (feature) is only to come close to a given area rather than reaching an exact location for an extra travelling freedom. First, we propose an improved mathematical formulation based on mixed integer nonlinear programming features (MINLP) [3]. Then, we develop a new resolution approach based on the closet pair of node algorithm (three step heuristic) to solve the CETSP efficiently using a new different strategy. The proposed approach is compared to related heuristics [4,5] using existing test benchmarks from the literature. Computational experiments show that our approach is efficient in small and large instances with known optimal values. Comparison and potential savings in terms of complexity and times are discussed.

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Synergizing CG-algorithm through Learning mechanisms

Communication Info

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Keywords:
(1) Dial-A-Ride Problem
(2) Column Generation Algorithm
(3) Machine Learning

Abstract

The Dial-A-Ride Problem (DARP) is a substantial concern within the realm of door-to-door transportation. It entails the development of a set of feasible schedules to complete a set of transportation requests, where each request concerns a group of users specifying their origins and destinations while meeting a range of constraints [1]. This work addresses a variant of the Dial-A-Ride Problem with time windows, incorporating drivers' preferences, as introduced in [4]. Our suggested solution methodology combines learning mechanisms within the framework of a column generation algorithm. The column generation algorithm decomposes this complex problem into two main components: a master problem and a sequence of pricing subproblems, as outlined in [2]. To solve the pricing subproblem, we implement a custom learning heuristic. This heuristic draws upon information from previously generated feasible solutions [3] and the current dual values to facilitate a highly efficient search across the subproblem network. The experimental results show that our learning solution method consistently boosts the performance of the CG algorithm, reducing the running time, which increases the applicability to solve large instances of the problem.

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Efficient Numerical Solution of Two-Parameter Singularly Perturbed Boundary Value Problems using UE-Spline Collocation Methods.

Communication Info

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Keywords:
(1) Singularly Perturbed Boundary value problems
(2) UE-spline
(3) Collocation method

Abstract

In this paper, we introduce a new collocation method employing UE-splines on a graded mesh for resolving a specific class of singularly perturbed two-parameter boundary value problems characterized by boundary layer phenomena in the solution. Additionally, we analyze the stability and uniform convergence of the method's parameters. To validate its efficacy, we conduct comparisons with various benchmark problems drawn from existing literature, thereby showcasing the effectiveness of our proposed approach.

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Localization Operators and Scalogram in the Framework of Mehler–Fock Wavelet Transform

Communication Info

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Keywords:
(1) Mehler–Fock transform
(2) Localization operators
(3) Scalogram

Abstract

The The main objective of this paper is to study the localization operators associated to the Mehler–Fock wavelet (MF-wavelet) transform introduced in Prasad and Verma (Inf Process 16:1850050, 2018). First, we study the boundedness and compactness properties of these operators. Then, we show that these operators are in Schatten-von Neuman class. Some results on the scalograms in this framework are also given.

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Solving the Close Enough Traveling Salesman Problem with an efficient Genetic Algorithm

Communication Info

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Keywords:
CESTSP
TSP
Optimization

Abstract

We explore a variation of the Traveling Salesman Problem referred to as the Close-Enough Traveling Salesman Problem ($CETSP$). In this scenario, if a salesman is within a specified distance of a node, it is considered visited. To address the $CETSP$, we propose using a genetic algorithm termed $GACETSP$. Specifically, our newly proposed algorithm is presented in two versions, $[GACETSP]randtour$ and $[GACETSP]inttour$, allowing us to test and assess two resolution strategies for our problem. Subsequently, we analyze the outcomes produced by these two versions by comparing them with results found in existing literature. Overall, our approach is highly efficient and outperforms heuristics found in the literature.

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A Comparative Study of Social Optimization Algorithms for Stochastic Combinatorial Optimization Problems

Communication Info

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Keywords:
(1) Stochastic combinatorial optimization
(2) Social optimization algorithms
(3) Probabilistic Traveling Salesman Problem (PTSP)

Abstract

Stochastic Combinatorial Optimization Problems (SCOPs) are common challenges in various domains such as logistics, planning, and network design. They involve uncertain and dynamic data distributions that make them difficult to solve by traditional mathematical and dynamic programming methods, especially for large-scale instances. In this study, we compare several social optimization algorithms inspired by natural collective behaviors, such as particle swarm optimization [1] and bee colony optimization [2], and apply them to representative SCOPs, such as the Probabilistic Traveling Salesman Problem (PTSP) [3]. We also propose novel enhancements to the bee algorithm, especially for the observer bees. We evaluate the performance of these algorithms by their solution quality and CPU execution time, using extensive simulations. We find that social optimization algorithms can achieve competitive or superior results than classical methods and some existing heuristics. This study contributes to advancing the field of social optimization algorithms for tackling SCOPs.

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Multi-Objective Training Model for RBF Neural Networks: Application to Classification Problems

Communication Info

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Keywords:
(1) Multi objective Training
(2) Neural Networks
(3) Classification problems.

Abstract

The Radial basis function neural network (RBFNN) is a type of neural network that employs radial basis functions as activation functions within its hidden layer, resulting in its output being a linear combination of these hidden layer outputs [1]. This study introduces a multi-objective optimization model for training RBFNNs [2], aiming to achieve two objectives: first, to minimize the sum of distances between the input vectors and the corresponding centers of selected neurons in the hidden layer, and second, to reduce the overall error of the RBFNN, defined as the disparity between the calculated and expected results. To solve this model, a genetic algorithm-based approach is utilized, enabling the determination of optimal data partitioning and output layer weights for improved generalization [3]. To illustrate the advantages of our model, we apply it to classification problems [4]. Numerical experiments demonstrate the effectiveness of the proposed theoretical framework and highlight the advantages of this new modeling approach.

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Comprehensive Learning Bat Algorithm

Communication Info

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Keywords:
(1) *Bat algorithm*
(2) *Comprehensive Learning Strategy*
(3) *Optimization*

Abstract

The bat algorithm (BA) is a metaheuristic optimization algorithm that was inspired by the prey hunting behavior of bats and is used to solve non-linear, often high-dimensional, optimization problems [1,2,3]. We explore a new approach to improve the performance of the bat algorithm (BA) by combining a comprehensive learning strategy (CLS) [7]. The BA algorithm, which has shown some capabilities [1,2,3], tends to converge towards local rather than global solutions. The CLS strategy, by bringing together various learning techniques, enables a more complete exploration of the solution space, which helps to identify and eliminate sub-optimal solutions [7]. It can also guide the search to areas of the solution space more likely to contain optimal solutions. The use of learning techniques can also accelerate convergence towards high-quality solutions, which is crucial when computation time is limited [7].

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April 25-26-27, 2024 | Marrakech, Morocco

A Fractional-Order Variation Model for Color Image Blind Deconvolution : A Game Theory Approach

Communication Info

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Keywords:
(1) Keyword1
(2) Keyword2
(3) Keyword3

Abstract

Image restoration is essential for recovering images degraded by various factors such as motion and sensor blur, defocusing, optical issues, atmospheric effects, and noise. A key challenge is the unknown nature of both the original image and the blur kernel (PSF), complicating effective restoration. This process is vital in areas like sensing, medical imaging, astronomy, remote sensing, and forensic investigations.

This paper introduces a novel blind image deconvolution technique leveraging Nash game theory, enabling the restoration of linearly degraded images without prior knowledge of the image or PSF. The method frames deconvolution as a two-player game, with roles assigned to image deblurring and PSF estimation, aiming for a Nash equilibrium as the optimal restoration strategy.

Additionally, we enhance this approach by incorporating fractional-order derivatives, aiming to improve the accuracy and robustness of image restoration. This advancement holds promise for the future of blind image deconvolution, expanding its application and effectiveness across multiple fields.

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Solving Travelling Salesman Problem Using Discrete Firefly Algorithm

Communication Info

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Keywords:
(1) *Discrete Firefly Algorithm*
(2) *Traveling Salesman Problem*
(3) *Metaheuristics*

Abstract

Traveling salesman problem (**TSP**) is among interesting problems tackled in combinatorial optimization [1].

TSP is NP-hard problem where the goal is to find the shortest tour length linking a given set of under the constraints that each node must be visited only once and the tour should end at the starting node, in this study, we solve the Traveling Salesman Problem using a new hybrid version of discrete firefly algorithm [2], a swarm intelligence metaheuristic, where some modifications were incorporated to enhance search efficiency and to keep a good balance alternating between local and global search.

The results from our application of the Firefly algorithm on some TSPLib instances [3], are compared with results of other metaheuristic algorithms.

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Integrative Modeling Approach for Understanding Crowd Dynamics in Panic Situations

Communication Info

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Keywords:
(1) Crowd dynamics
(2) Multiscale modeling
(3) Panic contagion
(4) Emergency evacuation
(5) Decision making

Abstract

One of the main objectives of crowd dynamics modeling is to ensure pedestrian safety across various facilities, particularly in situations involving dense and panicked crowds. Given the complexity of interactions among individuals, coupled with the diversity of their perceptions, emotional reactions, and decision-making during panic episodes, an integrative modeling approach is necessary to effectively understand crowd dynamics in such circumstances. In this context, we propose a conceptual framework for modeling crowd dynamics while considering emotional contagion. This approach relies on integrating a mobility model to describe individual movements and an emotional model to assess individual panic intensity. We explore various behavioral laws to represent the reactions specific to each population segment during panic situations, as well as environmental factors that may trigger such events.

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New optimization of Q for a general class of the fractional Zener model

Communication Info

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Keywords:
(1) Fractional derivative,
(2) Viscoelastic waves,
(3) Zener's model,
(4) Constrained optimization,
(5) Quality factor.

Abstract

The use of seismic waves to study media such as earth, thus to extract information on the fluid and solid phases and on the porous skeleton of the medium through which they pass. Seismic wave modeling is an essential research topic to study wave attenuation. The quality factor (i.e. Q) is a physical quantity that allows to measure the absorption of mathematical model and is a common assumption for the inversion of the seismic Q. We have developed new optimization of Q for a general class of the fractional Zener model, based on nonlinear constrained optimization methods with fractional order optimization. We prove by numerical results that the proposed method is more efficient to obtain almost constant Q.

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ICRAMCS 2024

THE SIXTH EDITION OF THE INTERNATIONAL CONFERENCE ON RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
April 25-26-27, 2024 | Marrakech, Morocco

Efficiency Assessment of a Malaysian University Faculty: A Network Data Envelopment Analysis in the Context of Hierarchical Systems with Shared Inputs

Communication Info

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Keywords:
(1) Efficiency
(2) Network Data Envelopment Analysis
(3) Shared Inputs

Abstract

This study presents an efficiency model tailored for the hierarchical structures of university faculties, employing network Data Envelopment Analysis (NDEA) to overcome limitations in conventional Data Envelopment Analysis (DEA) models. Unlike conventional DEA, NDEA addresses internal process operations and interdependence [1]. Our model strategically evaluates diverse faculty functions, utilizing shared inputs and introducing new subunits for efficiency assessment. Drawing on prior research by Kao [2] and Kashim et al. [3], we include essential subunits such as publication, grant, and innovation, aligning with the Malaysian Education Blueprint 2015–2025 (Higher Education) [4]. Analysis of 26 faculties in a Malaysian public university indicates widespread inefficiencies, with 69% demonstrating efficiency compared to Charnes and Cooper's [5] conventional DEA model. Our model simplifies faculty ranking and identifies areas for improvement, assisting university management in targeted performance enhancement.

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ICRAMCS 2024

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

April 25-26-27, 2024 | Marrakech, Morocco

Simulation Modelling and Analysis of Prime Movers Allocation with Static Quay Cranes in Container Terminal

Communication Info

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Keywords:

(1) Prime mover allocation

(2) Quay crane allocation

(3) Discrete-event simulation

Abstract

This study introduces a simulation model aimed to at enhancing the efficiency of container terminal operations. The model integrates findings from existing research [1-4] and adopts insights from Arango-Pastrana's study [5], focusing on optimizing the quay cranes and prime movers allocation, with a specific emphasis on prioritizing unloading tasks and considering container sizes to improve operational efficiency and capacity utilization. By implementing a loading sequence that follows successful unloading at the same bay, it assigns Quay Cranes (QCs) and Prime Movers (PMs) to individual vessels, aiding in identifying the optimal PM requirements. By optimizing resource allocation, the study enhances overall operational efficiency and capacity utilization within the container terminal. This study offers innovative solutions to address operational challenges through sophisticated simulation modelling and real-world data validation.

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Sensitivity of retaining solutions in urban excavations to two soil geotechnical parameters

Communication Info

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Keywords:
(1) landslides
(2) retaining solution
(3) excavation

Abstract

Landslides in urban environments, particularly in urban excavations, are as frequent as they are dangerous. And decision-makers in such projects would benefit from a more enlightened vision of the appropriate investments to be made, in order to avoid exorbitant expenditure in the event of a sudden geotechnical phenomenon.
In this paper, we show how, in the case of the city of Rabat, a good estimate of the two characteristics of the soil (the cohesion and the angle of friction) is one of the surest approaches for correctly selecting the right retaining solution [1]. We also present a comparison [2] between the direct shear test [3] and the triaxial test [4] giving these characteristics, with the triaxial test remaining the most representative of on-site soil conditions.

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On Proper Separation Theorems by Means of the Quasi-Relative Interior: Applications in Nonsmooth Optimization

Communication Info

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Keywords:
(1) Proper separation theorem
(2) Quasi-relative interior
(3) Karush–Kuhn–Tucker multipliers
(4) Vector optimization problems

Abstract

In this talk, we will establish several proper separation theorems for an element and a convex set and for two convex sets in terms of their quasi-relative interiors. Then, we shall prove that the separation theorem given by [3, Theorem 2.5] is in fact a proper separation theorem for two convex sets in which the classical interior is replaced by the quasi-relative interior. Besides, we will extend some known results in the literature, such as [1, Theorem 2.1] and [4, Corollary 2.2.2] through the quasi-relative interior and the quasi-interior, respectively. As an application, we shall provide Karush–Kuhn–Tucker multipliers for quasi-relative solutions of vector optimization problems. Several examples are given to illustrate the obtained results.

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Impulse controllability for the heat equation with dynamic boundary conditions

Communication Info

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Keywords:
(1) Impulse control
(2) Heat equation
(3) Dynamic boundary conditions

Abstract

We prove a logarithmic convexity that reflects an observability estimate at a single point of time for the heat equation with dynamic boundary conditions.

Consequently, we establish the impulse approximate controllability for the heat equation with dynamic boundary conditions by a control acting only at a single instant of time.

Moreover, we obtain an explicit upper bound of the cost of impulse control. At the end, we give a constructive algorithm for computing the impulse control of minimal L2-norm. We also present some numerical tests to validate the theoretical results and show the efficiency of the designed algorithm.

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ICRAMCS 2024

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

April25-26-27, 2024 | Marrakech, Morocco

MATHEMATICAL MODELING AND MONKEYPOX'S OPTIMAL CONTROL STRATEGY

Communication Info

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Keywords:
(1) Optimal Control.
(2) monkeypox virus.
(3) spread of monkeypox.

Abstract

This study delves into a continuous-time mathematical framework that delineates the transmission dynamics of the monkeypox virus across distinct regions, involving both human and animal hosts. We introduce an optimal approach that encompasses awareness campaigns, security protocols, and health interventions in areas endemic to the virus, aiming to curtail the transmission among individuals and animals, thereby minimizing infections in humans and eradicating the virus in animals. Leveraging the discrete-time Pontryagin principle of maximum, we ascertain optimal controls, employing an iterative methodology to solve the optimal system. Employing Matlab, we conduct numerical simulations and compute a cost-effectiveness ratio. Through a comprehensive cost-effectiveness analysis, we underscore the efficacy of strategies centered around safeguarding vulnerable individuals, preventing contact with infected counterparts–both human and animal–and fostering the utilization of quarantine facilities as the most potent means to govern the spread of the monkeypox virus.

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[3] Omar Balatif, Abderrahim Labzai,Mostafa Rachik. A DiscreteMathematicalModeling and Optimal Control of the Electoral Behavior with regard to a Political Party.
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ICRAMCS 2024
THE SIXTH EDITION OF THE INTERNATIONAL CONFERENCE ON RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
April25-26-27, 2024 | Marrakech, Morocco

Stability Analysis of Mathematical Model Measles

Communication Info

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Keywords:
(1) Spread of Infectious
(2) optimal Control.
(3) Measles disease.

Abstract

The measles epidemic, recognized as a perilous virus, holds the potential to be fatal for those infected. This lethal ailment has garnered significant public attention and incited fear across numerous countries globally. In our study, we developed a dynamic model, underpinned by comprehensive data on fatalities provided by the World Health Organization and the actual propagation of the epidemic. Employing the Routh-Hurwitz criteria and formulating Lyapunov functions, we achieved local and global stability for both the disease-free equilibrium and the disease equilibrium. Additionally, we conducted a sensitivity analysis of the model's parameters to determine their influence on the basic reproduction number R_0. To corroborate our theoretical findings, numerical simulations were executed using MATLAB.

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THE SIXTH EDITION OF THE INTERNATIONAL CONFERENCE ON RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
April25-26-27, 2024 | Marrakech, Morocco

Analyse, modélisation mathématique et stratégie de contrôle optimale de la variole du singe

Communication Info

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Keywords:
(1) Variole du singe
(2) L'analyse de stabilité
(3) Contrôle optimal

Abstract

Dans ce travail, nous présentons un modèle mathématique pour l'infection par la variole du singe [3]. En premier temps, nous étudions le comportement dynamique de ce modèle et discutons des propriétés fondamentales du système [4]. En construisant des fonctions de Lyapunov et en utilisant les critères de Routh-Hurwitz, l'analyse de stabilité du modèle confirme que le système est globalement, ainsi que localement, asymptotiquement stable à l'équilibre libre E^0 et à l'équilibre endémique E^*. En deuxième temps, nous effectuons une analyse de sensibilité des paramètres du modèle pour identifier les paramètres qui ont un impact significatif sur le nombre de reproduction R_0. Finalement, nous proposons une stratégie optimale pour lutter contre la propagation de cette épidémie [1,2], en ce sens nous utilisons trois contrôles qui représentent : 1) la sensibilisation ; 2) la mise en quarantaine des personnes infectées à domicile ou à l'hôpital ; 3) encourager la vaccination des personnes sensibles. Pour caractériser ces contrôles optimaux, nous appliquons le principe du maximum de Pontryagin [5]. Le système d'analyse et d'optimalité est résolu numériquement à l'aide de Matlab.

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Extremal eigenvalues of the Dirichlet bi-harmonic operator over a class of convex domains

Communication Info

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Keywords:
(1) Shape optimization
(2) Convex domains
(3) Bi-Laplacian
(4) Eigenvalue problem
(5) Support functions
(6) Gradient method

Abstract

This paper is devoted to the numerical resolution of some spectral shape optimization problems governed by the bi-Laplacian operator over a class of convex domains, with prescribed volume. Based on a new shape derivative formula [3, 2], we then show the existence of the shape sensitivity analysis of the eigenvalues for both buckling and clamped plate spectral problems. This allows us to express the shape derivative formula in term of support functions and to avoid the tedious computation required when one use the gradient descent method based on the classical shape derivative, involving the vector fields, notably when one opt for the finite element discretization (see [1]). In addition, we provide a numerical shape optimization process using the gradient descent method combined to the Galerkin finite element discretization for approximating the minimizers of the first ten eigenvalues for both problems. Finally, some numerical results are presented to show the efficiency of the proposed approach.

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ICRAMCS 2024

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

April 25-26-27, 2024 | Marrakech, Morocco

Optimal control and cost effectiveness analysis of information spreading model

Communication Info

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Keywords:
(1) Optimal control,
(2) rumors,
(3) compartment models,

Abstract

This paper delves into the pervasive issue of misinformation and disinformation propagation within social networks. Employing a compartmental model, inspired by epidemiological modeling [1], we characterize the dynamics of information diffusion as it spreads through different segments of a population. The model incorporates distinct compartments representing individuals susceptible to misinformation, actively spreading it, and those who have developed immunity to its influence. To mitigate the detrimental impact of misinformation, we introduce optimal control strategies that dynamically manipulate key parameters influencing the spread of false information. Leveraging control theory, we formulate an optimization problem to minimize the prevalence of misinformation while considering resource constraints and ethical considerations. Our findings highlight the effectiveness of targeted interventions in curtailing the dissemination of misinformation [2], [3], [4].

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Optimising Overhead Crane Operations with Model Predictive Control

Communication Info

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Keywords:
(1) Overhead crane
(2) Double pendulum model
(3) Model predictive control

Abstract

Overhead cranes play an essential role in port logistics by handling heavy containers and bulk goods [1]. However, controlling the oscillations of the payload during movement is difficult, requiring precise control to avoid accidents [2]. This article proposes a predictive model control (MPC) [3] approach to optimise the operation of the overhead crane by minimising the angles of oscillations of the payload and the cable while respecting the safety constraints and the limitations of the actuators [4]. The MPC algorithm applies to a double-pendulum model of the crane, linearized for an efficient calculation [5]. This model-based approach theoretically guarantees that the two oscillation angles remain within the permissible limits and avoid saturation of the actuator. Simulation studies conducted within the MATLAB/Simulink environment validate the effectiveness of the proposed approach. Results demonstrate that the MPC strategy exhibits robustness and stability in crane control, effectively reducing oscillations and enhancing operational safety.

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A discrete time model of the optimal control of a multi-strain system

Communication Info

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Keywords:
(1) Mathematical modeling,
(2) Optimal control theory
(3) Pontryagin Maximum

Abstract

The paper presents a model of the spread and development of mutant strains of an infectious disease using a discrete-time dynamic system[1], The integration of controllers into the system to affect its course is examined. Solutions are established, and the associated objective functional [2]and Hamiltonian are formulated. Pontryagin's Maximum Theorem [3], [4]is used to derive adjoints vectors and characterize optimal controllers. The study concludes with a numerical simulation, providing a visual representation and validation of the proposed methodology in the context of controlling the infectious disease and its mutant strains .

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Exponential stability and numerical results of a suspension bridge system

Communication Info

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Keywords:
(1) Suspension bridge model
(2) Energy method
(3) Finite element scheme

Abstract

Many bridges have experienced unexpected oscillations both during construction and after inauguration, sometimes leading to collapse. This collapse raises fundamental questions of deep mathematical and engineering interest, including how to improve the stability of suspension bridges. In this work, we investigate the stability of a suspension bridge model. By employing distributed damping and boundary damping, we demonstrate that the energy decays exponentially. Moreover, we develop a numerical algorithm based on the finite element method to approximate the spatial variable and the Crank-Nicolson scheme to discretize the time derivative, along with a Picard-type iteration process for solving the system of equations obtained by discretization.

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Analytical and numerical study for a suspension bridge model with thermoelastic Timoshenko beam

Communication Info

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Keywords:
(1) Suspension bridge,
(2) Timoshenko beam,
(3) Well–posedness,
(4) Stability exponential
(5) Finite element method

Abstract

In this work, we will discuss the asymptotic behavior of a linear problem that describes the vibrations of a coupled suspension bridge. The single-span road-bed is modeled as an extensible thermoelastic damped beam, which is simply supported at the ends. The heat conduction is governed by Cattaneo's law. The main cable is modeled as a damped string and is connected to the road-bed by a distributed system of one-sided elastic springs.

First, in this work, we prove the existence and uniqueness of the solution by semigroup theory. Second, we establish exponential stability using the energy method. Numerically, we introduce fully discrete approximations based on the finite element method to approximate the spatial variable and the implicit Euler scheme to discretize the time derivative.

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Optimal Covid-19 Control on Effectiveness of Detection Campaign and Treatment.

Communication Info

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Keywords:
(1) Covid-19
(2) Equations de Hamilton-Jacobi-Bellman
(3) Equations différentielles
(4) Principe de Maximum de Pontryagin
(5) Principe de Programmation Dynamique

Abstract

Ce papier traite un problème de contrôle optimal d'un modèle de Covid-19. Dans beaucoup d'articles, le contrôle est appliqué sur un paramètre du modèle. Dans notre travail, nous appliquons un contrôle sur deux paramètres que sont la campagne de détection des infectés et le traitement des malades avec comme objectif de ramener le système vers un état d'équilibre sans maladie stable. Pour ce faire nous sommes partis d'une modélisation faite dans un précédent papier [3] et aboutissant à une E.D.O. Nous avons prouvé la stabilité globale de l'équilibre sans maladie [2], l'existence et l'unicité d'une solution lipschitzienne et continue du système contrôlé et l'existence d'un contrôle optimal vectoriel. La résolution du problème de contrôle optimal s'est faite avec deux méthodes différentes : le principe du maximum de Pontryagin et la méthode de la programmation dynamique [1]. Enfin des simulations numériques basées sur des données réelles du Sénégal ont été proposées [4] suivies d'une discussion.

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A critical Review on SOC estimation of Li-ion battery using the Measurement-Based Techniques and Model-Based Techniques.

Communication Info

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Keywords:
Electric vehicle (EV)
Lithium-ion batteries (LiBs)
State of charge (SOC)
Battery management system (BMS)
SOC Estimation
Model-based method
Measurement-based method.

Abstract

The Lithium-ion batteries are widely utilized in the electric car, bus, and two-wheeler industries due to their high energy density, low cost, extended lifespan, high power density, and stable voltage. One of the essential systems that must be present in any electric vehicle (EV) is the battery management system (BMS) [1]. One major input to BMS is state of charge to ensure the battery's durability, safety, and reliable operation. The state-of-charge (SoC) estimation of EV batteries plays a crucial role in optimizing their performance and extending their lifespan [2]. As batteries are nonlinear and time-variant devices, estimating the state of charge or instantaneous remaining charge within a battery is a particularly challenging task. This work covers a deep understanding of SOC estimation techniques for BMS [3]. The two main approaches to explaining estimation of instantaneous remaining charge are model-based which relies on various battery models and their mathematical equations to explain the battery characteristics [4]. The second approach measurement-based is traditional method based on the battery experiments [1][5]. Model-based approaches are based on series-parallel combinations of resistance and capacitance electrical circuits [2], while measurement-based approaches are based on the conventional method uses the physical properties of the battery, which includes voltage, discharge current, resistance, and impedance [4]. The classification of the estimation methodologies to estimate SOC focusing with the estimation model/algorithm, benefits, drawbacks and estimation error are extensively reviewed [3]. The review highlights many factors and challenges with possible recommendations for the development of BMS and estimation of SOC in next-generation EV applications [3]. All the highlighted insights of this review will widen the increasing efforts towards the development of the advanced SOC estimation method and energy management system of lithium-ion battery for the future high-tech EV applications.

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Chemotherapy of cancer: optimal control problem with free-end time

Communication Info

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Keywords:
(1) Optimal control
(2) Free-end time
(3) Cancer
(4) Chemotherapy

Abstract

The main motivation for this work is to determine the optimal dosage and duration for cancer chemotherapy that minimizes tumor cell number, treatment side effects, and therapy cost using optimal control theory for a model representing the interaction between immune and tumor cells with chemotherapy intervention. The optimal control problem with free end-time has been formulated and the optimal control characterization has been given using the Pontryagin's maximum principle. The optimality system with a second transversality condition for the free end-time is added and solved numerically using a fourth order Runge-Kutta iterative approach and the iterative scheme of the gradient method. The results, with and without chemotherapy, are presented and discussed, and an optimal chemotherapy treatment strategy that has contributed to tumor elimination is suggested, along with the optimal treatment duration.

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Optimal control problem with isoperimetric constraint: chemotherapy of cancer

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Keywords:
(1) Optimal control
(2) Isoperimetric constraint
(3) Cancer
(4) Chemotherapy

Abstract

In this paper, we study an optimal control treatment strategy for a system of ordinary differential equations (ODEs) model of the interactions between a growing tumor, the immune system and chemotherapy intervention. Assuming that the total amount of chemotherapy drug during the therapy period is known and by applying techniques from optimal control theory, we aim to include an isoperimetric constraint on chemotherapy treatment and to discover how it gives the best results. Our objective is to minimize the tumor size and the side effects of therapy as well as the treatment cost on finite time interval. The optimal control problem is formulated and solved numerically using the forward-backward sweep method based on Runge-Kutta scheme combined with the secant-method.

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Support size based on extrema points for CSRBF functions in BEMD decomposition

Communication Info

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Keywords:
(1) BEMD decomposition
(2) CSRBF functions
(3) Bidimensional Intrinsic Modal Functions (BIMFs)

Abstract

This article suggests an adaptable method to determine the support size for compactly supported radial basis functions (CSRBF) [1, 2] in bidimensional empirical modedecomposition (BEMD) [3]. Each iteration of the BEMD process uses scattered points interpolation to generate the upper and lower envelopes using a set of local maxima and minima points, respectively, which gradually decrease throughout the BEMD process. The fixed support size for the CSRBF functions introduces reduced quality for the last bidimensional intrinsic modal functions (BIMFs) [4]. This is due to the lack of extrema points in the support for the last BIMfs.
This study presents a method to estimate the support size at each iteration, replacing the fixed support size of CSRBF functions in the BEMD process. The support size in this approach is determined using the maxima or minima points obtained prior to each interpolation procedure. The simulation results show that the proposed approach can be considered an adaptable BEMD with the CSRBF method, particularly for the last BIMFs.

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Mathematical modeling, analysis and optimal control of the spread of e-commerce practice behavior

Communication Info

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Keywords:
(1) Mathematical modeling,
(2) E-commerce,
(3) compartment models,
(4) Optimal control,

Abstract

E-commerce is the process of buying and selling goods and services over the Internet. E-commerce brings a number of economic benefits to both customers and merchants, but the use of e-commerce remains very limited despite the development of infrastructure, especially the Internet and transportation, which are the backbone of e-commerce. To study e-commerce among merchants, we proposed an epidemiological model that fits the studied problem, which is the lack of use of e-commerce by some merchants, which wastes some opportunities for the customer in terms of competitive offers and prices. The retailer also loses the opportunity to reach new markets without the inconvenience of travel. Finally, we used optimal control theory to evaluate the effectiveness of the proposed strategies to encourage merchants to use e-commerce.

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Mathematical model for reducing divorce cases according to social indicators for Morocco: optimal

Communication Info

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Keywords:
(1) The marital status model,
(2) optimal control,
(3) Pontryagin's maximum principle.

Abstract

In our research, we discuss a mathematical model for a person's social status. In most societies, we find the marital status of men and women as follows: Unmarried means a young man or woman of the legal age for marriage, but they are not married or engaged. The second situation is engagement, which is a stage that precedes marriage, the stage of acquaintance, and it is usually not long. The third social situation is marriage, which, as is customary, takes place according to the customs and traditions of each religion or culture. The next situation is the case of separation. This case is for married couples who are in a critical condition and who have problems, meaning they are separated and not divorced. The other situation is divorce, it is a legal separation. Moreover, the last situation is the widow. On the other hand, we worked on this research to eliminate and reduce the phenomenon of divorce, which has become widespread and unusual in that more than 50 percent of marriages do not last for more than a year. We discover two controls that permit us to minimize the number of divorced individuals while increasing the number of married individuals. The optimal control issues have been identified by applying a discrete version of Pontryagin's maximum principle and numerical simulation to validate the theoretical analysis.

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Boundary controllability of coupled singular wave equations

Communication Info

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Keywords:
Controllability, observability inequality, singular wave equations, coupled systems, multiplier methods,

Abstract

We deal with the controllability of a system of two singular wave equations coupled through the velocities by means of one control force acted at the nonsingular end point. To this aim, we study the wellposednes and some appropriate energy estimates of the associated nonhomogeneous system. Thanks to them, we prove an observability inequality. Finally, using the notion of solution by transposition combined with the Hilbert uniqueness method, we deduce the null controllability of the initial problem.

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Contrôle de la Variation dans une Classe de Systèmes Linéaires de Dimension Finie

Communication Info

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Keywords:
(1) Speed-controllability,
(2) Controllability
(3) Continuous Systems,
(4) Regulation
(5) Kalman's condition.

Abstract

Dans cet article, nous avons étendu le concept de contrôlabilité, traditionnellement utilisé pour contrôler l'état final d'un système, au contrôle exact de sa vitesse finale. Inspirés par la théorie de Kalman, nous avons établi certaines conditions pour caractériser le contrôle permettant au système d'atteindre exactement une vitesse finale souhaitée. Lorsque les hypothèses garantissant la contrôlabilité de la vitesse ne sont pas remplies, nous adoptons une stratégie de régulation qui implique de déterminer la loi de contrôle pour que la vitesse finale du système se rapproche aussi étroitement que possible de la vitesse finale prédéfinie, et ce à moindre coût.

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KOLMOGOROV BOUNDS IN THE CLT OF THE LSE FOR GAUSSIAN ORNSTEIN UHLENBECK PROCESSES

Communication Info

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Keywords:
(1) Rate of convergence of CLT using Malliavin calculus
(2) Gaussian Ornstein-Uhlenbeck processes
(3) Least squares estimator

Abstract

This talk is based on the published paper [1]. We consider the Ornstein-Uhlenbeck (OU) process defined as solution to the equation $dx_t = -\theta x_t\, dt + dG_{t'}\, x_0 = 0$ is a Gaussian process with stationary increments, whereas $\theta > 0$ is unknown parameter to be estimated. We provide an upper bound in Kolmogorov distance for normal approximation of the least squares estimator $\widetilde{\theta_T}$ of the drift parameter θ on the basis of the continuous observation $\{x_t, t \in [0,T]\}$, as $T \to \infty$. Our approach is based on some novel estimates involving a combination of Malliavin calculus and Stein's method for normal approximation. We apply our result to fractional OU processes of the first kind, and improved the upper bound of the Kolmogorov distance for the LSE $\widetilde{\theta_T}$ provided by [2] and [3], respectively, in the cases $H \in \left(0, \frac{1}{2}\right)$and $H \in \left(\frac{1}{2}, \frac{3}{4}\right)$. We also apply our approach to fractional OU processes of the second kind.

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Least squares estimation for non-ergodic weighted fractional Ornstein-Uhlenbeck process of general parameters

Communication Info

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Keywords:
(1) Drift parameter estimation
(2) Weighted fractional Ornstein-Uhlenbeck process
(3) Asymptotic behavior

Abstract

This talk is based on the published paper [1].
Let $B^{a,b} := \{B_t^{a,b}, t \geq 0\}$ be a weighted fractional Brownian motion of parameters $a > -1, |b| < 1, |b| < a + 1$. We consider a least square-type method to estimate the drift parameter $\theta > 0$of the weighted fractional Ornstein-Uhlenbeck process $X := \{X_t, t \geq 0\}$ defined by $X_0 = 0; dX_t = \theta X_t\, dt + dB_t^{a,b}$. In this work, we provide least squares-type estimators for θ based continuous-time and discrete-time observations of X. The strong consistency and the asymptotic behavior in distribution of the estimators are studied for all (a, b) such that $a > -1, |b| < 1, |b| < a + 1$. Here we extend the results of [2, 3] (resp. [4]), where the strong consistency and the asymptotic distribution of the estimators are proved for $-1/2 < a < 0, -a < b < a + 1$ (resp. $-1 < a < 0$, $-a < b < a + 1$). Simulations are performed to illustrate the theoretical results.

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Berry-Esseen Bounds for Drift Parameter Estimation of Discretely Observed Fractional Vasicek-Type Process

Communication Info

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Keywords:
(1) Parameter estimation
(2) Vasicek-type process
(3) Malliavin Calculus

Abstract

This talk is based on the published paper [1]. We study statistical estimation problems of drift parameters of Vasicek-type processes driven by fractional Brownian motion. Based on fixed-time-step observations and using Malliavin calculus combined with the recent Nourdin-Peccati analysis, we provide estimators of the drift parameters and analyze their asymptotic behaviors. More precisely, we study the strong consistency and the asymptotic distribution of the estimators and we give the rate of their convergence in law. In other words, we present the estimators chosen to estimate the drift parameters a and b respectively. We show their strong consistency and we prove in details how we obtained their speed of convergence in law depending on the values of the Hurst parameter H.

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Exploring the Generalized Gamma Distribution: Properties, Subfamilies, and Estimation Methods

Communication Info

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Keywords:
(1) Generalized Gamma distribution
(2) Mixed Models
(3) Estimation

Abstract

In this manuscript, we introduce the flexible family known as the generalized gamma distribution, which holds a prominent position in the statistical literature. This family includes various renowned models as subfamilies, including the exponential, gamma, and Weibull distributions. Our objective is to thoroughly examine crucial properties within the generalized gamma model and discuss a novel estimation technique that utilizes the generalized standardized gamma distribution. This technique aims to reduce the model to a single shape parameter while preserving its fundamental properties.

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ICRAMCS 2024

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

April 25-26-27, 2024 | Marrakech, Morocco

A note on the functional nonparametric conditional hazard function estimate in the single index for weak dependant data.

Communication Info

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Keywords:
(1) functional data
(2) weak dependence
(3) conditional risk function
(4) Asymptotic Property

Abstract

In this paper, I propose to study the asymptotic properties of the hazard function, for an explanatory Variable with values in a hilbert space (infinite dimension) and a response variable real in a weak dendendent framework in functional single-index model.

I consider the nonparametric estimation by the kernel method in the presence of the quasi-associated dependence.

I establish under general hypotheses the almost complete convergence with speed of the estimator built in the associated case.

The estimation of the conditional hazard function will be conducted by utilizing the two estimators, the conditional distribution function and the conditional density.

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ICRAMCS 2024

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April 25-26-27, 2024 | Marrakech, Morocco

Law of large number of the feed-forward network of multiclass processor sharing queues

Communication Info

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Keywords:
(1) Fluid limit
(2) Feed-forward network
(3) Multiclass processor sharing

Abstract

In this paper, we study the fluid approximation and the asymptotic analysis of multiclass open queueing network with feedback under processor sharing service discipline.
We consider a feed-forward network of multiclass processor sharing queues as a finite set of stations. Each one has a single server with multiple customer classes, an infinite storage capacity, arbitrary interarrival and service time distributions. Customers can only flow to downstream stations. The server is operating under the processor sharing discipline.
First, we give the detailed description of the stochastic model and the fluid model. Second, under mild assumptions, we prove the existence of the fluid model solution. Hereafter, we show the limit theorem. Finally, we study the asymptotic behavior of the fluid model solution.

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Stochastic equations with fractional Brownian motion at the boundary

Communication Info

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Keywords:
(1) Stochastic evolution equations driven by fractional Brownian motion
(2) Boundary problems
(3) white-noise

Abstract

During this presentation, we will explore the concept of stochastic problems involving fractional Brownian motion at the boundary. Our objective is to reframe this problem as a distributed stochastic problem by utilizing Greiner theory. Subsequently, we will establish the necessary conditions for ensuring well-posedness. Finally, we will conclude the talk by showcasing a few illustrative examples.

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THE SIXTH EDITION OF THE INTERNATIONAL CONFERENCE ON RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
April 25-26-27, 2024 | Marrakech, Morocco

Overcoming Computational Constraints in Structural Equation Models with Correlated Disturbances

Communication Info

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Keywords:
(1) Structural Equation Modeling
(2) Finite Iterative Method
(3) Correlated disturbances

Abstract

In this study, we propose an advanced refinement of the Finite Iterative Method (FIM) [1,2] for computing the covariance matrix implied by a Structural Equation Model (SEM) with correlated disturbances. Traditional methods such as FIM and Joreskog's formula [3,4] face limitations in handling these scenarios [5]. To address this issue, we introduce two novel methodologies aimed at enhancing computational efficiency and precision. Through rigorous mathematical, statistical, and empirical evaluation, we demonstrate unbiased nature of our proposed methods compared to classical approaches, in managing correlated disturbances. Additionally, we provide illustrative examples to reinforce the reliability and robustness of our methods. Moreover, we extend our approach to models with latent variables. The study offers reliable solutions applicable to a wider range of scenarios within SEM analysis.

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Fuzzy Rough Set in Discriminant Analysis

Communication Info

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Keywords:
(1) Fuzzy Rough set
(2) feature selection
(3) Discriminant Analysis

Abstract

Fuzzy-rough sets encapsulate the related but distinct concepts of vagueness (for fuzzy sets [1]) and indiscernibility (for rough sets [2]), both of which occur as a result of uncertainty in knowledge [3].
One of the many successful applications of fuzzy rough set theory has been feature selection. It refers to the problem of selecting those input features that are most predictive of a given outcome. The hybridization of these two theories provides a powerful approach for feature selection, offering a nuanced representation of relationships between features, accommodating real-world scenarios where data may not be precise.
Integrating fuzzy logic's capacity to capture uncertainty with the granulation process of rough sets not only enables adaptability to diverse data types but also facilitates flexible identification of relevant features, thereby enhancing discrimination power in predictive modeling.

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April 25-26-27, 2024 | Marrakech, Morocco

Wald test in the Cox model with correlated covariates

Communication Info

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Keywords:
(1) Proportionality hypothesis
(2) score test
(3) smooth function

Abstract

The Cox model, introduced by David Cox in 1972 [1], is the most widely used model in survival analysis. This model is based on the assumption of proportionality of covariates, explained by the fact that the hazard rates ratio is constant over time. Several global and partial tests have been proposed for this assumption. The impact of correlation between covariates on the proportionality test of each of them was clearly demonstrated by the work of Kraus (2008) [2]. Furthermore to avoid this impact, Kraus proposed a score test applied to an alternative which involves adding artificial temporal covariates to all covariates, and not just to the one in question for the test. A such idea requires estimating the parameters of the alternative for the proportionality test of a covariate each time, making this procedure quite lengthy in terms of both time and calculation.
In this communication, we propose applying the Wald test to the same alternative as proposed by Kraus. This test require only one estimation of the artificial covariates parameters to test the proportionality of each one of the covariates. A simulation study is conducted to compare the performance of these two tests.

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A Mixed space coupled Hidden Markov Model

Communication Info

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Keywords:
(1) Markov chains
(2) Coupled Hidden Markov Model
(3) Mixed probability distribution

Abstract

A coupled hidden Markov model cHMM is an HMM model whose hidden Markov chain is bi-dimensional. In this work, we focus to solve the likelihood and the decoding problems of a cHMM whose state space is composed of a continuous part and a discrete part. We adapt Forward, Backward and Viterbi algorithms to be able to study such cHMMs. Numerical examples are considered to show the well-functioning of the proposed algorithms.

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Stability Analysis of a Stochastic Model

Communication Info

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Keywords:
(1) Stochastic Modeling
(2) Stochastic Lyapunov function
(3) Stability Analysis

Abstract

In this study, we investigate a stochastic model and demonstrate that this model [1] has a unique global positive solution that belongs to a positively invariant Set. Subsequently, employing stochastic Lyapunov function methods [2], we establish the global asymptotic stability and exponential mean square stability [3] of the free equilibrium. Furthermore, we delve into the asymptotic behavior of the solution around the positive (endemic) equilibrium of the deterministic model [3].

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Absolute continuity of invariant measures for generalized Ornstein-Uhlenbeck operators

Communication Info

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Keywords:
(1) Stochastic differential equations
(2) Invariant measures
(3) Kolmogorov operators

Abstract

We will discuss regularity of the invariant measure associated to a class of generalized Ornstein-Uhlenbeck operators. Regularity here means that this measure is absolutely continuous with respect to a Gaussian reference measure on a separable Hilbert space. This extends a result by Da Prato and Debussche [1] to our setting.

Reference

[1] Da Prato and Debussche, *Absolute Continuity* of the Invariant Measures for Some Stochastic PDEs. Journal of Statistical Physics, 115, 2004, 451-468.

A benchmark of optimization procedures when estimating Cox model parameters

Communication Info

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Keywords:
(1) Cox model
(2) Likelihood function
(3) Optimization
(4) Benchmark
(5) Simulation

Abstract

Cox proportional hazard model ([1]) is extensively used in the field of survival analysis. It is applied to assess the impact of the covariates on the duration leading up to an event.
An important step in utilizing this model is its parameters estimation which involves the maximization of the log-likelihood function. Several optimization methods could be used to execute this step.
In order to facilitate the practical use of these mathematical methods in diverse fields, functions and packages have been developed within the R environment. We cite particularly the functions `bboptim` ([2]), `ucminf` ([3]), `nlminb` and `optim` ([4]).
Each of those functions utilize different mathematical optimization methods.
In this communication, we aim to assess the performance of the mentioned functions to determine which works the best, specifically in the context of Cox's log-likelihood function.

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[3] CRAN, Package ‘ucminf’, 2023
[4] Package ‘stats’, a basic package in R

Parametric Tests For Non Linear Regression Model

Communication Info

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Keywords :
(1) Local asymptotic normality.
(2) Local asymptotic linearity.
(3) Gaussian tests.

Abstract

In this research, we propose locally and asymptotically optimal (in Le Cam sense) parametric Gaussian tests for the problem of testing classical regression model against non linear regression model.
Simulations reveal the excellent finite-simple performances of Gaussian test with a symmetric and an asymmetric density (the skew-normal and skew-Student densities) using Rstudio programming.

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Exploring Deep Learning Techniques in Micromagnetic Mathematical Models

Communication Info

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Keywords:
(1) Ferromagnetism
(2) magnetization dynamics
(3) Deep learning
(4) Landau–Lifshitz equation

Abstract

In this talk, we present a method to solve the Landau-Lifshitz equation in high-dimensional spatial domains by using nonlinear Feynman-Kac formula and incorporating Deep Learning techniques. The Landau-Lifshitz equation can be transformed into Backward Stochastic Differential Equation to establish a robust framework for computational analysis. Our approach, which involves the use of advanced mathematical tools and deep learning models, is highly effective in capturing the intricate dynamics of magnetic moments.

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

April 25-26-27, 2024 | Marrakech, Morocco

ON SET-VALUED AUMANN-PETTIS INTEGRABLE SUPERMARTINGALE WITH UNBOUNDED VALUES

Communication Info

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Keywords:
(1)Set-valued supermartingale
(2) Pettis integration
(3) Slice topology

Abstract

The focus of this paper is to conduct an in-depth study of set-valued Aumann-Pettis integrable supermartingales [1]. So by using classical results on the projective limit of a sequence of subsets [2], we show the existence of martingale selections for a set-valued Aumann-Pettis integrable supermartingale with unbounded values [3] . Also we present a convergence and theorem of set-valued Aumann-Pettis integrable supermartingales whose values may be unbounded in Mosco sens [5] ana in Slice topology [4].

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Conditional Distribution and Density Estimation using B-Spline Approximation

Communication Info

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Keywords:
(1) Conditional Distribution
(2) B-spline Approximation
(3) Nadaraya-Watson estimation

Abstract

The estimation of conditional distribution functions is a fundamental problem in the fields of statistics. In this work, based on B-spline approximation, we propose an easy and efficient nonparametric method for approximating conditional. distribution and density functions with bounded support. We derive some asymptotic properties of the proposed estimator such as its asymptotic bias and variance. We show that the smooth proposed conditional distribution estimator associated with densities can outperform the Nadaraya-Watson estimator. Real data example is given to illustrate the efficiency and performance of our method.

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An Investigation of Pest Management Dynamics for Tea Plant in Turkey using Stochastic Models

Communication Info

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Keywords:
(1) Stochastic Differential Equation
(2) Simulation
(3) Pest Management

Abstract

In this study a compartmental mathematical model is used to analyze the stochastic dynamics of pest control and management. The stochastic model is analyzed using popular stochastic numerical schemes such as Euler-Maruyama, Milstein and Runge-Kutta methods. The numerical characteristics of the solution process are studied to comment on the stochastic dynamics of pest management for tea plant. Turkey is one of the leading tea exporters in the world and tea plant is an important economic factor for the Black Sea region of the country. Data from Turkey will be used to perform an assessment of the stochastic dynamics for pest control for the plant in Turkey. The stochastic results are also compared with the results of the deterministic counterpart of the model to interpret the relationship between these two models and the effects of the stochastic noise on the results.

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backward fractional doubly stochastic differential equations driven by Lévy processes

Communication Info

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Keywords:
(1) Fractional Brownian motion
(2) Lévy processes and non-Lipschitz coefficients
(3) Teugel martingale and Malliavin derivative

Abstract

In this paper, we consider a new class of fractional backward doubly stochastic differential equations driven by Teugels martingales associated with a L´evy process satisfying some moment condition and an independent Brownian motion with the Hurst parameter H greater than 1/2 we prove the existence and uniqueness under non-lipshitz condition on the generator using an iterated schema we construct.

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Regression spline modeling based on local polynomial kernel regression

Communication Info

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Keywords:
(1) Local polynomial regression
(2) Bandwidth
(3) B-spline
(4) Blossoming

Abstract

This study presents a new nonparametric regression estimator based on the local quasi-interpolation spline approach. This model employs a blooming technique to build a lower rank spline by combining a B-spline basis with a simple local polynomial regression. Different coefficients functionals are allowed to have different smoothing parameters (bandwidths) if the function has different smoothness. In addition, the number and location of the knots of this estimator are not fixed. In practice, we may employ a modest number of basis functions and then determine the smoothing parameter as the minimizer of the criterion. In simulations, the approach achieves very competitive performance with P-spline and smoothing spline methods. Simulated data and a real data exemple are used to illustrate the effectiveness of the method proposed in this paper. We also employ our method on the well-known COVID-19 data to demonstrate locally adaptive bandwidths.

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Energy Management Method for Electric-hydrogen Hybrid Energy Storage and Implementation of Battery Thermal Management System On EVs.

Communication Info

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Keywords:
(1) Battery thermal management
(2) hybrid thermal management system
(3) Hybrid energy,
(4) Economic energy management
(5) Li-ion battery pack
(6) Electro-thermal-aging model

Abstract

A methodology for modeling and validating the dynamics of Li-ion batteries in electric vehicles without disassembling them. The approach involves three steps: implementing the battery pack model, deriving electrical and thermal parameters from experiments, and validating the model through real tests. Results indicate accurate predictions with errors, although there are considerations regarding capacity decrease estimation uncertainties. An energy management method based on model predictive control (MPC) and dynamic programming (DP) is proposed for microgrids with intermittent energy resources. This approach maximizes the output of distributed power supply while ensuring power balance and cost optimization. Compared to traditional methods, the proposed approach proves feasible and effective in predicting the output power of renewable resources and load demand. The importance of thermal management systems (TMS) in advancing electromobility. It introduces a hybrid system incorporating phase change materials (PCMs) into the battery pack's base structure. This system aims to enhance mechanical strength and thermal management, resulting in improved performance. The analysis shows a 31.9% increase in thermal capacitance, allowing for heat dissipation and reducing auxiliary cooling system power, ultimately proving effective for high-performance electric vehicles.

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Étude Comparative de la Prédiction de la Concentration en Nitrates dans les Eaux de Surface : Réseaux de Neurones, Chaînes de Markov et Régression Linéaire

Communication Info

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Keywords:
(1) Qualité de l'eau
(2) Réseaux de neurons artificiels
(3) Chaine de Markov
(4) Régression Linéaire

Abstract

Le champ d'étude de cette recherche se concentre sur l'estimation de la concentration des nitrates (NO_3) dans les eaux de surface de la province de Taza. Nous explorons l'efficacité des réseaux de neurones, de la chaîne de Markov, ainsi que de la régression linéaire pour établir des liens entre la concentration en nitrates et d'autres indicateurs de qualité de l'eau. Les résultats révèlent que l'utilisation des paramètres mesurés s'avère pratique pour modéliser la concentration en nitrates. Les méthodes des réseaux de neurones et de la régression linéaire démontrent leur capacité à prédire cette concentration avec un niveau de précision satisfaisant. De manière significative, la comparaison entre l'analyse des réseaux de neurones et celle du modèle combinant les réseaux de neurones, la chaîne de Markov et la régression linéaire indique que ce dernier modèle offre les performances les plus remarquables.

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Bayesian Inference for the SIR Model with Skellam Distribution and MCMC

Communication Info

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Keywords:
(1) SIR model
(2) Bayesian inference
(3) Skellam distribution
(4) MCMC

Abstract

Modeling the spread of infectious diseases is crucial for public health. This article proposes an approach based on Bayesian inference [1] to study a Susceptible-Infected-Recovered (SIR) epidemiological model [2]. We utilize the Skellam distribution [3] to model transitions between compartments and employ Gamma distributions as priors for the infection and recovery rates (β and γ, respectively) and a GB_2 distribution for the basic reproduction number (R_0) [4] to determine their posterior distributions. Our methodology utilizes Markov Chain Monte Carlo (MCMC) techniques [5] to perform Bayesian inference. We validate our approach using real-world COVID-19 data and demonstrate that our Bayesian model provides a better representation of disease dynamics and more precise estimates of epidemiological parameters.

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Exploring the Impact of Brownian Motion on Nano-PCM Melting: A LBM Investigation with Buongiorno's Mathematical Model

Communication Info

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Keywords:
(1) Lattice Boltzmann Method
(2) Phase change material (PCM)
(3) Slip-mechanisms
(4) Brownian motion
(5) Nanoparticles

Abstract

This study investigates the numerical analysis of Nano-PCM melting within a square cavity under natural convection, focusing on the impact of Brownian motion on the solid-liquid phase change phenomenon. The investigation utilizes Buongiorno's mathematical model and employs the Lattice Boltzmann method (LBM) to solve the governing equations. Simulations are conducted for a Rayleigh number (Ra) of 10^4. The study evaluates the influence of Brownian motion (N_b) within the range of $0 < N_b < 0.5$, as well as the volume fraction of nanoparticles (ϕ) ranging from 0 to 6%, on the evolution of the melting front. Results indicate that an increase in nanoparticles volume fraction leads to a reduction in Nano-PCM melting time. Furthermore, it is observed that the presence of Brownian motion has a positive effect, particularly when nanoparticles volume fraction set at ϕ = 6%.

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Enhancing Location Model with Outlier Mitigation: Introducing MOM Location Model Framework

Communication Info

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Keywords:
(1) Framework
(2) Location model
(3) MOM
(4) robust covariance

Abstract

Location Model (LM) is designed purposely to handle mixed variables classification (binary and continuous variables) simultaneously [1]. In the LM, binary variables create multinomial cells according to $s = 2^b$. Then, the objects are grouped based on information from continuous variables. The LM has shown great success in methodology and model development and successfully solving classification problems regarding mixed variables [2]. However, the classification procedure based on LM only performs well when data is free from outliers [3]. The outliers affect parameter estimation and lead to a high misclassification rate [4][5]. This paper introduces a framework to mitigate outlier issues in the LM, particularly enhancing the LM. The proposed framework integrates Modified One-Step M- Estimator (MOM) with robust covariance matrix, which resulting new version of LM called MOM location model ($\mathrm{LM}_{\mathrm{MOM}}$). The framework of $\mathrm{LM}_{\mathrm{MOM}}$ is expected to perform better than existing LM, particularly when managing data with outliers.

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Physics-informed neural networks for modeling water flow and solute transport in unsaturated soils

Communication Info

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Keywords:
(1) Unsaturated soils
(2) solute transport
(3) Richards equation
(4) Physics-informed neural networks

Abstract

Modeling water infiltration and solute transport in unsaturated soils is crucial for various engineering challenges. Traditional numerical methods often incur high costs due to complex mesh generation and the need for small step sizes. In this study, we introduce an effective hybrid approach that combines data-driven and numerical techniques. This innovative method, known as Physics-Informed Neural Networks (PINNs) [1], utilizes multiple neural networks to approximate the solutions for water flow and solute concentration. The training process ensures adherence to governing physical laws, as well as initial and boundary conditions.

We conduct one- and two-dimensional numerical experiments to evaluate the proposed PINN approach. Results indicate that the PINN methodology serves as an efficient solver in this context, demonstrating effectiveness even without additional measured data.

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Stochastic Approximation : Concepts, Applications, and Perspectives

Communication Info

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Keywords:
(1) Approximation stochastique
(2) Simulation stochastique
(3) Modélisation probabiliste

Abstract

The session on stochastic approximation provided a comprehensive exploration of the fundamental concepts, practical applications, and future prospects of this method in various fields. We emphasized the importance of stochastic approximation in modeling complex and uncertain phenomena, and its numerous applications in risk management, process optimization, meteorological forecasting, and machine learning [1][2][3][4]. While challenges such as model complexity and convergence issues were acknowledged, we highlighted the growing importance of stochastic approximation in decision-making and problem solving in an increasingly complex and uncertain world. Finally, we encouraged participants to continue researching and collaborating to fully exploit the opportunities offered by stochastic approximation [5][6].

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Stochastic game theory and applications

Communication Info

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Keywords:
(1) Game theory
(2) Stochastic games
(3) Nash equilibrium

Abstract

Game theory, a branch of mathematics and economics, examines the strategic interactions among rational agents aiming to maximize their utility in deterministic scenarios. it was founded by mathematicians John von Neumann and Oskar Morgenstern [4], with john Nash further contributing to its development by introducing Nash equilibrium in 1951[2]. Stochastic game theory, a subset of game theory, models the interaction among decision-makers who can influence their environment. These games were first introduced and studied by Lioyd Shapley in 1953 [1]. In stochastic games, players face potentially different objectives. They must ensure a good payoff today while maintaining a high expected payoff for tomorrow [3]. In this work we will delve into the fundamentals of stochastic games, exploring how to model such games effectively.Furthemor, we will examine the application of Nash equilibrium within the context of stochastic games. Finally, we will explore some applications as in muti agent coordination game [5].

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Volatility Change-Point Estimation in β-ARCH Model

Communication Info

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Keywords:
(1) Change-point
(2) Volatility
(2) β -ARCH model
(4) Hellinger distance

Abstract

The aim of this work is to test and detect abrupt change in the volatility of observations resulting from a particular type of parametric Autoregressive Conditional Heteroscedastic models, known as β-ARCH. We first introduce an estimator for the β-ARCH model parameters, utilizing the Minimum Hellinger Distance (MHD) method. Following this, we suggest a test akin to the Kolmogorov-Smirnov test, aimed at detecting volatility change-point in the β-ARCH framework, along with an estimator to determine the precise location of this change-point. We then investigate the asymptotic behavior of our test statistic when the null hypothesis holds true and confirm the consistency of our change-point location estimator. Ultimately, a simulation experiment is carried out to evaluate the effectiveness of the results.

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Test for Volatility Change in β-ARCH(1) Model and Applications

Communication Info

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Keywords:
(1) Time series
(2) Change-point
(3) Volatility
(4) β-ARCH(1) Model

Abstract

This communication focuses on testing and estimating abrupt change-points in volatility for a specific class of parametric Autoregressive Conditional Heteroscedastic models, referred to as β-ARCH(1). Our methodology begins with the establishment of a β-ARCH(1)'s parameters estimator, based on the Minimum Hellinger Distance (MHD). We then introduce a Kolmogorov-Smirnov type test specifically designed to identify volatility change-points in the β-ARCH(1) model, and construct an estimator for the location of these change-points. The asymptotic distribution of our test statistic under the null hypothesis is thoroughly investigated, and the consistency of our estimator is confirmed. The effectiveness of our proposed methods is demonstrated through a series of simulations, benchmark tests and empirical experiments.

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Efficient Algorithm for Solving Linear Complementarity Problems: Convergence and Performance Analysis with Accelerated Variable Update

Communication Info

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Keywords:
(1) Linear Complementarity
(2) Singular value decomposition (SVD)
(3) Iterative algorithms

Abstract

This article presents an efficient algorithm for solving linear complementarity problems $LCPs$: The algorithm focuses on the $LCP(M, q)$ problem, where M is a square matrix and q is a vector. The proposed algorithm employs an iterative approach with specific variable updates to converge towards a solution that satisfies the complementarity conditions. Techniques such as singular value decomposition (SVD) are utilized to avoid costly matrix inversions and determinants, improving memory consumption and computation time. The convergence and efficiency of the algorithm are demonstrated through experimental results on benchmark problems. The algorithm shows promise for practical applications, offering a reliable and efficient method for solving complex $LCPs$: This research contributes to the advancement of optimization techniques and provides insights into solving linear complementarity problems in diverse domains.
Further exploration and application of this algorithm can enhance problem-solving capabilities and improve computational efficiency in real-world scenarios.

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Family of Geometric Subdivision Schemes on Surfaces with Constant Curvature

Communication Info

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Keywords:
(1) Subdivision scheme
(2) Spherical curve
(3) Hyperbolic curve
(4) Discrete geodesic curvature
(5) G^1-continuity

Abstract

G^1 curves are visually smooth, aesthetic curves. They play an important role in the domain of computer aided design (CAD) and 3D modeling. Interpolatory geometric subdivision schemes is a methodological approach for attaining these curves while mitigating undesirable artifacts. In this paper, we introduce a novel geometric interpolatory subdivision scheme, named the angle-based 6-point geometric scheme, designed for surfaces with constant curvature (Euclidean, spherical, and hyperbolic). This proposed scheme incorporates a tension parameter. We show that the scheme converges if the tension parameter belongs to a specific interval, and yields G^1-continuous limit curves. This allows us to manipulate a whole family of schemes on constant curvature surfaces according to our needs. Numerical tests indicate the possibility of selecting the parameter within a well-defined range to achieve G^2-continuity across all three surface models. Experimental examples are presented to illustrate the convergence and G^1 property of this scheme, accompanied by substantial applications showcasing its effectiveness.

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THE SIXTH EDITION OF THE INTERNATIONAL CONFERENCE ON RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
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About Chika's Numbers

Communication Info

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Keywords:
(1) Chika's numbers;
(2) Prime numbers;
(3) Divisibility theorems.

Abstract

The creation of a real tip, rule or test of divisibility by prime numbers is a very old and very difficult elementary problem. In 2019, a 12-year-old Nigerian boy named Chika Ofili gave a divisibility test by the integer 7 via a new numbers depends on the prime number 7 see [2].

In this document, considered as a continuation of the work due to M. Haddaoui and all see [3], we study the generalization of this Chika's numbers and we give some applications to the new divisibility theorem by prime numbers and we try to give comparison with some tests proposed in [1] and [4].

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A study of fuzzy prime near-rings involving fuzzy semigroup ideals

Communication Info

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Keywords:, ,
(1) prime near-rings
(2) fuzzy group
(3) fuzzy near-rings.

Abstract

In this paper, our major purpose is to give the definition of the notion of the notion of fuzzy left semigroup ideal (resp. fuzzy right semigroup ideal) of a fuzzy near-ring and we prove some of their basic properties which are analogous to those of the classical semigroup theory in the case of near-rings. Also, we show that under some conditions on fuzzy left semigroup (resp. fuzzy right semigroup ideal), the fuzzy near-rings must be a fuzzy commutative rings.

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Existence and reguraliity of solutions for some non-coercive parabolic problems in anisotropic Sobolev spaces

Communication Info

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Keywords:
(1) Anisotropic Sobolev space
(2) Renormalized solutions
(3) Non-coercive operator
(4) Quasilinear parabolic problem

Abstract

In this present paper, we study the existence and regularity of renormalized solutions for the following anisotropic quasilinear and non-coercive parabolic problem

$$\begin{cases} \boldsymbol{u_t + Au + |u|^{p_0-2}u = f - div\phi(x,t,u)} & \boldsymbol{in} \quad \boldsymbol{\Omega \times (0,T)}, \\ \boldsymbol{u = 0} & \boldsymbol{on} \quad \boldsymbol{\partial\Omega \times (0,T)}, \\ \boldsymbol{u(0,t) = u_0} & \boldsymbol{in} \quad \boldsymbol{\Omega}, \end{cases}$$

where $\boldsymbol{Au = -div\, a(x,t,u,\nabla u)}$ is a Leray-Lions operator that satisfying a degenerate coercivity conditions, and the Carathéodory function $\boldsymbol{\phi(x,t,u)}$ verifying some growth condition, with $f \in L^1(Q_T)$ and the initial data $u_0 \in L^1(\Omega)$

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ICRAMCS 2024
THE SIXTH EDITION OF THE INTERNATIONAL CONFERENCE ON RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
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Isogeomertic analysis for generalized stokes problem

Communication Info

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Keywords:
(1) Generalized stokes
(2) NURBS
(3) Isogeometric methods

Abstract

This talk focuses on numerical solution to the generalized stokes equations with mixed Dirichlet–Neumann boundary conditions utilizing isogeometric analysis (IGA) based on non-uniform rational B-splines (NURBS) within the Galerkin method framework. we suggest using different choices of compatible NURBS spaces, which may be considered a generalization of traditional finite element spaces for velocity and pressure approximation. In order to investigate the numerical properties of the suggested elements, some numerical experiments based are discussed.

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Fractional Hankel transform of generalized function

Communication Info

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Keywords:
(1) Fractional Hankel transform
(2 Distribution
(3) Testing function space

Abstract

In this communication, we introduce the fractional Hankel transform in the space of test functions $\mathcal{H}_{\mu}$ when $\mu\geq-\frac{1}{2}$, and we prove some of its properties. In addition, we define this transform in slowly growing distributions space $\mathcal{H}_{\mu}^{\prime}$ when $\mu\geq-\frac{1}{2}$,i.e., in dual space of test functions space. As application, some examples are given to illustrate the theoretical results.

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STUDY OF QUOTIENT NEAR-RINGS WITH ADDITIVE MAPS

Communication Info

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Keywords:
(1) 3-prime near-rings
(2) Prime ideals
(3) Additive Maps

Abstract

We consider N to be a 3-prime field and P to be a prime ideal of N. In this paper, we study the commutativity of the quotient near-ring N/P with left multipliers and derivations satisfying certain identities on P, generalizing some well-known results in the literature. Furthermore, an example is given to illustrate the necessity of our hypotheses.

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An extended deep learning method for the Navier Equation

Communication Info

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Keywords:
(1) Navier Equation
(2) Schwarz domain decomposition method
(3) extended deep learning methods

Abstract

This article deals with the Navier equation for simulating the elastic behavior of solids. We propose to solve this equation using a combination of domain decomposition method and meshless method trained with artificial neural networks. The domain decomposition technique employed to solve the Navier partial differential equation is the Schwarz wave relaxation method. This method involves a parallel implementation of the meshless method and will be trained using a specific neural network approach. Finally, we present several numerical test cases to validate the effectiveness of our methods.

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April 25-26-27, 2024 | Marrakech, Morocco

Feature Selection for Binary and Multi-Class Classification Problems

Communication Info

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Keywords:
(1) Bayesian Statistics
(2) Feature Selection
(3) Classification Problem

Abstract

The Feature selection has become a critical step in most data mining applications to mitigate the curse of dimensionality in high-dimensional datasets. Without direct input from the target variable, filter methods evaluate the importance of features as a pre-processing operation to the learning algorithm and select the best feature subsets through some information metrics. Filters are known to be more computationally efficient than wrapper and embedded methods. In this talk, a Bayesian approach namely, the relative belief ratio [1] will be used as a filter method in binary and multi-class classification problems. The relative belief ratio is used as a filter method to rank features based on their importance in relation to a binary and multi-class target variables. Several benchmark data sets are used to demonstrate the applicability of the proposed method.

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THE SIXTH EDITION OF THE INTERNATIONAL CONFERENCE ON RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
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Prediction of Fractional-Order Derivatives Using Neural Networks

Communication Info

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Keywords:
(1) Fractional derivatives
(2) Deep learning
(3) PINNs.

Abstract

We analyze an epidemiological model through the lens of neural networks that enable us to identify data-driven fractional differential operators. We suggest a fractional coronavirus disease model introducing unreported cases. First, under suitable assumptions, we prove the existence of a solution for the considered system. Moreover, we address the local stability of the free-disease and endemic equilibrium points in terms of the basic reproduction number. Secondly, we propose an approach allowing to estimate the fractional-order derivative, with the aim of providing the best approximation of the real COVID-19 dynamics. The main novelty of our proposed approach is its use of Physics-Informed-Neural-Networks (PINNs) for estimating the fractional orders. On the other hand, to validate our results, we conduct numerical simulations illustrating the local stability of the disease dynamics as well as the effectiveness of our proposed method providing the best approximation of the the fractional derivative parameters.

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Dialect Discovery: Employing Feature Selection Methods to Uncover Moroccan Dialectal Arabic.

Communication Info

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Keywords:
(1) Moroccan Dialect Arabic,
(2) Dimensionality Reduction,
(3) Comparative Analysis,
(4) NLP
(5) Dialect Identification.

Abstract

In the field of Natural Language Processing, this study tackles the intricate challenge of deciphering Moroccan Arabic (Darija) within a multilingual environment using automated language processing techniques. It employs various feature selection methods, including TF-idf, CBOW, and Word2Vec, along with machine learning algorithms like LASSO decision trees. The research aims to deepen our understanding of Moroccan Arabic's nuances and distinctive linguistic features by leveraging semantic methodologies and static feature selection techniques. Principal component analysis (PCA) and singular value decomposition (SVD) are utilized for dimensionality reduction, contributing to the accurate detection of Moroccan Arabic dialects. The best and stable results are found with the XGBOOST algorithm employing classical extraction methods and SVD dimension reduction, ensuring reasonable execution time. Overall, the study seeks to uncover the intricacies of Arabic dialects and advance natural language processing in diverse, multilingual societies.

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Spectral clustering graph based for gene selection

Communication Info

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Keywords:
(1) Mutual Information
(2) Spectral clustering
(3) Gene selection

Abstract

Gene selection in the context of cancer-related microarray dataset is a crucial task in scientific research. This process aims to identify the most relevant genes associated with specific types of cancer, such as Leukemia and Colon cancer, in order to improve understanding of the mechanisms involved and the development of more accurate diagnostics. However, gene selection poses specific challenges for cancer microarray datasets. One of the main difficulties lies in the high dimensionality of these datasets, where thousands of genes may be measured simultaneously. Robust gene selection methods are therefore required, capable of distinguishing relevant genes from the many unimportant variables. We propose a new hybrid method, known as MISC approach (Mutual Information Spectral Clustering), that combines Mutual Information and Spectral Clustering techniques. In the first step, the filter phase, Mutual Relevance Information is used to evaluate genes and select the best rated ones. In the wrapper phase, we construct the graph linking these genes and apply spectral clustering to obtain K clusters. To evaluate these clusters, we rank them according to their centrality and select the one with the best score. Finally, a forward selection technique is applied to obtain a high subset of relevant genes.
Experiments conducted on cancer microarray datasets show that the suggested MISC approach effectively identifies and selects more relevant features than other gene selection methods.

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Optimizing Breast Cancer Diagnosis through Lightweight Deep Learning Techniques

Communication Info

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Keywords:
(1) Breast Cancer
(2) Convolutional Neural Networks
(3) Computer vision
(4) Edge detectors
(5) Thermographic images

Abstract

Addressing breast cancer remains a paramount concern for women worldwide, with approximately 1 in 40 women facing the risk of mortality from this disease annually [1]. Early detection significantly reduces both the disease's severity and mortality risk, offering potential non-surgical treatment avenues [2]. This study aims to pioneer a fresh approach to breast cancer detection utilizing thermographic imagery, particularly tailored for women in resource-limited regions. Through the integration of mobile technology, the proposed method seeks to empower women in these contexts to self-screen using their smartphones. Centered on MobileNet v2 and attention mechanisms, the approach prioritizes a lightweight framework, promising enhanced accessibility and affordability, especially in underserved areas. Furthermore, a comprehensive evaluation of various edge detection algorithms was conducted to gauge their compatibility with the proposed model. Promisingly, the findings demonstrate the superior performance and accuracy of the proposed model compared to existing methodologies.

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Advanced Ensemble Learning with Efficient SFLA-Enhanced GANs for Imbalanced Datasets

Communication Info

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Keywords:
(1) Imbalanced Data
(2) Generative Adversarial Network
(3) Shuffled frog Leaping Algorithm
(4) Classification
(5) Ensemble Learning

Abstract

The widespread issue of data imbalance in classification tasks presents a significant challenge, as minority class instances are often overshadowed by the majority class [1]. To combat this, this study introduces a stacking ensemble classifier based on a Generative Adversarial Network [2], enhanced by the Shuffled Frog Leaping Algorithm [3]. The core innovation of this approach is the utilization of SFLA to optimize the GAN's generative process, thereby producing highly representative synthetic instances of the minority class that enhance sample authenticity. Through iterative interactions with the stacking ensemble, GAN refines these instances to closely resemble misclassified samples, thereby improving the ensemble's ability to discriminate. This adaptive integration of SFLA and GANs leads to a more robust ensemble classifier.

Empirical evaluations demonstrate this method's superior performance compared to traditional sampling techniques [4], representing a significant advancement in addressing the challenges of imbalanced data.

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April 25-26-27, 2024 | Marrakech, Morocco

Modélisation Prédictive de la Réussite Scolaire à l'aide des Outils de Datamining: Cas d'une Ecole du Secondaire

Communication Info

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Keywords:
(1) Data Mining
(2) ETL
(3) Machine Learning
(4) Modélisation prédictive

Abstract

Cet article présente une analyse approfondie du développement d'un modèle prédictif novateur dans le domaine de l'éducation [1]. L'objectif principal est de créer un modèle capable d'estimer les taux de réussite dans différentes filières en se basant sur les performances académiques passées des élèves [2]. En utilisant les résultats de deux sessions scolaires précédentes, ce projet vise à fournir un outil d'aide à la décision pour les élèves, les enseignants et les conseillers pédagogiques afin d'améliorer les résultats scolaires et de guider les choix de carrière [3]. L'étude a suivi toutes les étapes d'un processus standard de Data Mining [4], débutant par la collecte de données réelles. Après cette première étape, les données brutes ont été soumises à un processus de prétraitement spécifique à la solution proposée. Ensuite, plusieurs algorithmes Machine Learning [5], notamment la régression linéaire, Random Forest, SVM (SVR) et Decision Tree, ont été comparés via une validation croisée, où Random Forest a démontré la meilleure performance.

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Leveraging Data Augmentation Techniques for Deep Learning Algorithms in Image Database

Communication Info

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Keywords:
(1) Deep learning
(2) Data augmentation
(3) Overfitting
(4) Image

Abstract

In recent years, deep learning has become an extremely interesting topic in the field of artificial intelligence, especially in image processing. New theories, algorithms, and successful applications are gradually contributing to the explosive development of this area[1]. However, since deep learning algorithms typically employ a large number of parameters, they suffer from a serious overfitting problem[2], especially when the database is not large enough. In this circumstance, the need not only for high performance but also accessibility and cost-effectiveness of deep learning techniques becomes an urgent concern. To solve this problem, we propose data augmentation, which is a process of creating new samples through data generation situations such as rotations, shifts, and flips. It is proposed as a potential solution to the aforementioned challenge[3]. The central idea is to adapt samples, which already exist in the database, into a variety of possible forms to enrich the database itself. This solution relieves the problem in practice because it slightly reduces the reliance of performance on the size of the database. In our study, we applied different critical data augmentation algorithms images of the Arabic sign Language Dataset.

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Quand les IA rédigent les PFE : Nouveaux défis pour l'évaluation académique

Communication

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Keywords:
(1) Évaluation
(2) PFE
(3) Plagiat
(4) Intelligence artificielle
(5) Enseignement supérieur

Abstract

L'évaluation des projets et travaux des étudiants a toujours été un pilier essentiel de l'enseignement supérieur, servant à mesurer la compréhension des concepts, la créativité et la capacité de résolution de problèmes des apprenants. Toutefois, cette tâche cruciale des enseignants (Kaaouachi, 2007), a été confrontée à de nouveaux défis et opportunités à l'ère de la technologie (Duplàa, 2011) de l'intelligence artificielle. En particulier, l'introduction de systèmes d'IA conversationnelle générative, capables d'assister les étudiants dans leurs tâches académiques, a soulevé des questions complexes quant à l'intégrité, à l'authenticité (test de Turing) (Le Blanc, 2014), ainsi qu'à la méthodologie d'évaluation des livrables soumis par les étudiants.

Cette étude vise à explorer ces questions en se penchant sur l'évolution des taux de plagiat des Projets de Fin d'études "PFE" d'une école d'Ingénieurs au Maroc, dans le contexte de l'évaluation des livrables des étudiants depuis l'introduction des logiciels d'IA conversationnelle. Nous analyserons les données recueillies au fil des années, sur la période des quatre dernières années avec un échantillon de quatre filières dans des domaines diversifiés, pour identifier les tendances et les variations des taux de plagiat. De plus, nous examinerons comment l'utilisation de l'IA conversationnelle a influencé les taux de plagiat et complexifié la tâche des évaluateurs (enseignants), ce qui entrainera des implications pour l'intégrité académique (Vieyra et Weaver, 2016).

En conclusion, nous cherchons à répondre aux questions cruciales concernant les fluctuations des taux de plagiat au fil du temps et à identifier les filières ou les années où les effets de l'IA conversationnelle se font particulièrement sentir. Cette démarche analytique nous aidera à éclairer les implications de cette technologie, en constante évolution, dans une éventuelle modification des méthodologies d'évaluation en particulier (Millet, 2023).

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Individual filters in the classification task

Communication Info

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Keywords:
(1) Feature selection
(2) Filters
(3) High-dimensional data

Abstract

Feature selection is an important preprocessing step in high-dimensional classification data, it's the process of identifying and keeping only the most relevant features, which can improve learning accuracy and reduce the calculation time.
In feature selection, filter methods play a crucial rule so they evaluate individual features independently, they are computationally efficient and can be used to quickly identify a subset of relevant features.

The aim of this study is to review how filters work, to compare their accuracy when combined with a classification method, then from the experimental results we recommend filter methods that perform well on many data sets.

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ICRAMCS 2024

1. THE SIXTH EDITION OF THE INTERNATIONAL CONFERENCE ON RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE

April 25-26-27, 2024 | Marrakech, Morocco

Les méthodes ensemblistes

Application à la prédiction de l'insuffisance cardiaque

Communication Info

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Mots clés:
(1) Méthode ensembliste
(2) Bagging
(3) Boosting

Résumé

Les Méthodes Ensemblistes sont des algorithmes d'agrégation qui se basent sur des stratégies aléatoires (Bagging [1], RF [2]) ou adaptatives (Boosting) [3]. L'objectif principal de ces méthodes consiste à améliorer l'Accuracy des modèles de base et résister au phénomène de sur-ajustement [4].

Classiquement, la meilleure Méthode Ensembliste est souvent expliquée par l'analyse de leur biais-variance. Ainsi le Bagging permet de réduire la variance tandis que le Boosting permer de minimiser le biais. Ces méthodes sont utilisées dans le cas des modèles instables et non-linéaires [5]. Cette famille, présentée dans un contexte de classification supervisée, permet d'agréger des prédicteurs de base en un seul modèle.

Dans la partie pratique, on a montré la performance des Méthodes Ensembliste en utilisant un ensemble de données contenant différentes caractéristiques des patients pour prédire les insuffisances cardiaques.

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

April 25-26-27, 2024 | Marrakech, Morocco

Navigating Turnover: A Transparent Approach with eXplainable Artificial Intelligence

Communication Info

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Keywords:
(1) Human Resources
(2) Turnover
(3) Explainability

Abstract

Companies are facing many challenges associated with implementing Artificial Intelligence (AI) into the decision making process to optimize both opportunities and risks [1]. The employee turnover is an important risk that has being high recently, impacting organizational performance [2]. Many researchers have endeavored to help companies in their human resource management endeavors by categorizing employees and examining the relationship between various variables and Turnover Intention to make predictions and be able to take the right action at the right moment [3] [4]. However, a notable gap in these efforts has been the lack of explicability regarding how the models arrive at their predictions. The aim of this research is to highlight the importance of identifying the variables used by employing eXplainable Artificial Intelligence (XAI) methodologies [5] in the context of employees turnover.

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Artificial Intelligence Applications in Supply Chain Management (SCM) : A bibliometric Analysis

Communication Info

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Keywords:
(1) Bibliometric
(2) Artificial intelligence
(3) Machine learning
(4) Deep learning
(5) Supply Chain 4.0

Abstract

The Supply Chain 4.0, an integral component of Industry 4.0, represents an innovative digital transformation in how companies manage their operations [1] [2]. This transition, fueled by technologies such as artificial intelligence, yields significant benefits in efficiency, proactivity, and adaptability [3]. This study utilized bibliometric analysis of 259 documents from 2016 to 2023 sourced from the Scopus database to investigate the connections between AI-ML techniques and their applications in Supply Chain Management (SCM), while also examining keywords, authors, publications, and sources. The keywords included in this analysis were "artificial intelligence", "machine learning", "deep learning", and "Supply Chain 4.0". The primary source with the highest number of documents is "Lecture Notes in Networks and Systems" [4], which published 10 articles in 2023. The top-ranked author in this field, Abid Haleem, has published 6 articles on the topic. The most cited paper in this study is [5].

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Elevating Retail Efficiency: Predictive Analytics for Enhanced Product Preservation and

Communication Info

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Keywords:
(1) Product Lifespan
(2) Efficiency Optimization
(3) Consumer Satisfaction
(4) Data mining
(5) Loyalty Program

Abstract

Deploying a novel hybrid methodology[1], our work pioneers the analysis of customer purchasing behaviors within supermarket settings to optimize product preservation and placement strategies[2].
Through the integration of loyalty program data[3], we unveil intricate patterns in consumer preferences, providing actionable insights for retail operations.
This approach not only enhances the accuracy of product placement but also addresses critical preservation conditions[4], enabling supermarkets to minimize waste and tailor offerings to consumer needs more effectively.
Our findings underscore the potential for predictive analytics in revolutionizing retail merchandising[5], offering a blueprint for sustainable and consumer-centric retail practices.

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THE SIXTH EDITION OF THE INTERNATIONAL CONFERENCE ON RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
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Application of machine learning in intelligent fish aquaculture

Communication Info

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Keywords:
(1) Machine Learning
(2) nash-sutcliffe coefficient
(3) grey model

Abstract

Among the background of developments in automation and intelligence, machine learning technology has been extensively applied in aquaculture in recent years, providing a new opportunity for the realization of digital fishery farming. In the present communication, the machine learning algorithms and techniques adopted in intelligent fish aquaculture in the past five years are expounded, [1] and the application of machine learning in aquaculture is explored in detail, including the information evaluation of fish biomass, the identification and classification of fish, behavioral analysis and prediction of water quality parameters. [2] Further, the application of machine learning algorithms in aquaculture is outlined, and the results are analyzed. Finally, several current problems in aquaculture are highlighted, and the development trend is considered. [3]

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

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Prediction of agricultural plant yields using machine learning

Communication Info

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Keywords:
(1) Machine learning

Abstract

The prediction of agricultural plant yields plays a crucial role in optimizing agricultural practices, resource allocation, and food security. Traditional methods often rely on historical data and expert knowledge, which may not fully capture the complex interactions between various environmental factors and crop growth.

In recent years, machine learning (ML) techniques have emerged as powerful tools for yield prediction, leveraging large datasets and advanced algorithms to uncover intricate patterns and make accurate forecasts. This paper provides an overview of recent advances in ML-based approaches for predicting agricultural plant yields. We discuss various factors influencing yield prediction, including weather conditions, soil characteristics, crop types, and management practices. Additionally, we review different ML algorithms employed in yield prediction, such as regression models, ensemble methods, and deep learning architectures. Furthermore, we highlight challenges and future directions in this field, including data scarcity, model interpretability, and scalability issues. Overall, ML-based yield prediction holds great promise for enhancing agricultural productivity and sustainability in the face of evolving environmental conditions and global food demand.

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AI-Enhanced ECG Diagnosis System for Acute Myocardial Infarction with RBBB: Constant-Q Transform and ResNeXt50 Integration

Communication Info

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Keywords:
(1) AMI
(2) RBBB
(3) CQT
(4) ECG
(5) ResNeXt50

Abstract

This study proposes an innovative ECG diagnostic system that combines signal processing techniques and deep learning models to improve the accuracy of detecting acute myocardial infarction (MI) and MI associated with right bundle branch block (RBBB) [1]. By integrating the Constant-Q Transform (CQT) with a pre-trained model, the system achieves impressive performance, with 99.89% accuracy and a minimal training loss of 0.0019% after 100 epochs [2]. The use of 10-fold cross-validation further strengthens the credibility of these results [3]. This research contributes to the advancement of ECG-based diagnostic systems, offering potential benefits for patient care in cardiovascular diseases, which are a leading cause of global mortality [4]. The study addresses the challenges in diagnosing acute myocardial infarction (AMI) and right bundle branch block (RBBB) using electrocardiogram (ECG) changes [5]. It explores the use of artificial intelligence (AI) and deep learning techniques to improve the accuracy of diagnoses in remote or urgent settings.

Recent research in improving MI detection using 12-lead ECGs faced complexities in noise reduction and model architectures, hindering progress. This study simplifies the diagnostic process by consolidating data from all 12 ECG leads, addressing noise issues, and transforming 1D ECG signals into a 2D time-frequency representation using the CQT algorithm. These representations are then utilized with a pre-trained ResNext50 CNN model.

Our contributions encompass simplifying data complexity, implementing noise removal, and employing advanced signal representation techniques. This innovative approach aims to enhance MI diagnosis, potentially leading to improved patient outcomes and reduced risks associated with misdiagnosis, ultimately contributing to more effective management of cardiovascular diseases.

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Evaluating the Effects of Different Word Embedding Techniques on the Performance of Sentiment Analysis Models in Moroccan Dialect

Communication Info

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Keywords:
(1) NLP
(2) ASA
(3) Word Embeddings
(4) MAC

Abstract

This investigation explores the influence of diverse word embedding techniques on the accuracy of sentiment analysis models applied to the Moroccan Arabic Comments (MAC) dataset, a collection of comments in the Moroccan dialect (Darija). The study aims to determine how variations in word embedding strategies can modify the effectiveness of sentiment classification when integrated with three widely recognized models: K-Nearest Neighbors (KNN), Support Vector Machine (SVM), and Naive Bayes. By applying a consistent dataset but varying the embedding methods, this research aims to highlight the changes in performance among the models, thereby identifying the most efficient word embedding approach to boost sentiment analysis accuracy in the context of Darija. This approach not only sheds light on the compatibility of word embedding techniques with different models but also provides critical insights into optimizing sentiment analysis for the Moroccan dialect, contributing to the advancement of natural language processing in dialectal languages.

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April 25-26-27, 2024 | Marrakech, Morocco

Mapping the Evolution: A Bibliometric Analysis of Artificial Intelligence's Impact on the Insurance Industry

Communication Info

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Keywords:
(1) insurance sector
(2) Artificial Intelligence(AI)
(3) Bibliometric analysis

Abstract

The insurance industry is undergoing substantial changes, marked by challenges and opportunities driven by the pervasive use of artificial intelligence (AI) technologies[1]. AI, notably machine learning, has emerged as a transformative force, redefining traditional processes and revolutionizing operational paradigms within insurers [2]. This research aims to elucidate the fundamental domains and prevailing trends characterizing the implementation of AI in the insurance sector through a comprehensive bibliometric analysis of 282 articles sourced from the Scopus database. The selected articles span the period from 2013 to 2023, and the analysis employed the Bibliometrix R package, complemented by the biblioshiny web interface [3].

The results indicate a notable surge in publications, with a discernible exponential growth trend, particularly evident since 2017. This growth underscores the dynamism of the field, affirming that AI's application in the insurance sector is a burgeoning area of study poised for continuous expansion and harboring a positive outlook for future developments. Concurrently, an exploration of the most cited sources reveals a focal point on critical concerns associated with the escalating integration of artificial intelligence in decision-making processes within contemporary society [4][5].

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Gene Selection Approaches in Microarray Data Classification: A Comprehensive Review

Communication Info

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Keywords:
(1) Gene Expression Data
(2) Feature Selection
(3) Classification

Abstract

Over the last decades, the advancements in DNA microarray technology and gene expression studies have enabled scientists to study the activity of thousands of genes simultaneously, leading to a significant revolution in our understanding of gene expression patterns [1],[2]. However, in addition to its cost, the primary challenge associated with this technology is the generation of high-dimensional data (comprising a large number of genes) from relatively small sample sizes [3],[4], making the application of traditional Machine Learning tools quite challenging. To address this challenge, dimension reduction techniques, specifically feature selection, are commonly employed as a preprocessing step. These techniques facilitate the elimination of irrelevant and redundant features while identifying and keeping the most relevant ones. In this context, various genes selection approaches have been proposed, each with its ad-vantages and disadvantages. In this work, we intensively review approaches developed over the past five years.

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ICRAMCS 2024

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

April 25-26-27, 2024 | Marrakech, Morocco

Predicting stock price movement based on social media and stock datasets with Deep learning model

Communication Info

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Keywords:
Stock price; Deep learning; LSTM; sentiment analysis

Abstract

The world had known huge changes due to the technology progress during these few last years. The modern human has become very dependent on the digital tools, and this applies to daily life and to most existing fields of work therefore to the stock market.
The idea of the study is to predict the movement of the stock price based on the social and stock datasets[1], [2], using LSTM[3] model, feature engineering and preprocessing pipeline where sentiment analysis[4], [5] is used. The focus is on one of the stocks of the dataset from Kaggle, titled "Stock Tweets for Sentiment Analysis and Prediction" which contains a number of most watched stock tickers on Yahoo FInance from 30-09-2021 to 30-09-2022.

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Enhancing medical image feature extraction using multimodal fusion networks

Communication Info

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Keywords:
(1) Feature extraction
(2) Multimodal fusion network
(3) Medical image
(4) Deep learning

Abstract

Multimodal medical image fusion networks aim to extract and combine complementary data from various imaging modalities, thereby boosting the precision of medical image segmentation and diagnosis. In the literature, many feature fusion methods were proposed. These include self-supervised learning to reduce subjective bias, progressive fusion networks for robust interconnection between modalities[2], a dilated residual attention network for multi-scale feature extraction[3], and multi-modal image synthesis[4]. The findings of the previous studies have demonstrated that multimodal fusion networks have a better performance compared to current methodologies, with enhancements ranging from 7.8% to 25.2%, and 19.7% to 48.2% respectively for the tasks of action recognition and object detection [5]. In this study, we delve into the utilization of Multimodal Fusion Networks in medical imaging, particularly emphasizing their efficacy in enhancing the efficiency of diagnostic processes. Furthermore, we examine the possible challenges and limitations associated with medical image data integration.

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ICRAMCS 2024
THE SIXTH EDITION OF THE INTERNATIONAL CONFERENCE ON RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
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Predicting Academic Performance: Exploring Emotional States and Active Engagement in Online Learning through LSTM Analysis

Communication Info

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Keywords:
(1) Emotional state analysis
(2) Natural language processing
(3) Learner performance
(4) Online learning

Abstract

Understanding the complex relationship between emotional states, active participation (including discussions posted, replies posted, and connection time), and academic performance is essential in online education [1]. This study utilizes Long Short-Term Memory (LSTM) networks to analyze learners' emotional states and their level of engagement on the Moodle platform. Conducted with future computer science teachers at RCETP in Oujda, Morocco, the research aims to reveal correlations between emotional states, participation, and academic success. Significant findings include a positive but weak correlation between emotional states and academic performance (r = 0.610), a slightly significant correlation for posted discussions (r = 0.398), and a moderate correlation for posted responses (r = 0.539), while connection time showed a weak positive correlation (r = 0.316). These insights improve online learning, enhance personalization, and highlight LSTM's potential in emotional state analysis for better education [2].

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How AI is fostering integration of renewable energy in Morocco? What will be the impact on the reserve margin?

Communication Info

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Keywords:
(1) Renewable Energy Integration
(2) Reserve Margin
(3) Smart Grid Management
(4) Energy Mix
(5) Grid Stability

Abstract

Since 2009, Morocco has developed its own strategy of renewable energy. The leading projects were installed in Ouarzazate (CSP technology with a capacity of 580 MW).
Nowadays, Morocco has installed more than 4 GW capacity of renewable energy by the end of 2023, which represent more than 36% of the energy mix. With the following split: Wind with more than 17%, Hydro with more than 10%, Solar CSP with more than 4% & Solar PV with more than 4%, , few years left to achieve the objective of 52% of the Energy Mix by 2030. However, integration of renewable energy into the power grid is still a challenge; in fact, the reserve margin is not increasing significantly with the renewable energy, the impact remains under 35% ranked as follows: Wind, Hydro then Solar CSP & Solar PV.
AI is bringing suitable technologies, through advanced sensors and monitoring systems, to manage the variability of renewable energy sources and its impact on the reserve margin.

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Video captioning and tagging approaches

Communication Info

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Keywords:
(1) Video tagging
(2) Video captioning
(3) 3D Convolutional Neural Network (CNN)

Abstract

Video tagging and captioning are crucial for efficient content retrieval, comprehension, and accessibility in video analysis. Recent advancements in deep learning have revolutionized various computer vision tasks. This paper explores deep learning models for video tagging and captioning, employing TSCN and 3D CNN architectures for tagging and an LSTM-based encoder-decoder model for captioning. Evaluation on MSR-VTT and ActivityNet Captions datasets demonstrates the effectiveness of our proposed models, achieving higher precision, recall, and F1-scores for tagging, as well as improved BLEU, METEOR, and CIDEr scores for captioning. These results underscore the potential of deep learning in accurately predicting video tags and generating coherent captions, with implications for video analysis applications. Future research may focus on refining temporal modeling and multimodal fusion techniques to further enhance performance.

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Proposed CRISP-DM and Video dataset Meta Model in Video Object Detection

Communication Info

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Keywords:
(1) Model Driven Engineering
(2) MDE
(3) Meta-Modeling
(4) Dataset
(5) Video dataset

Abstract

Object detection is a fundamental task in computer vision and plays a pivotal role in various real-world applications, including autonomous vehicles, surveillance systems, medical imaging, and industrial automation. Video dataset quality represents the key stone of accurate object detection models. These datasets should be well prepared in order to reach accurate and to the point detection results. Dataset quality is the purpose of Cross-Industry Standard Process for Data Mining (CRISP-DM) for effective and systematic data utilizing data preparation stage. The main purpose of our paper is to propose a universal and a unique meta-modeling, Applying Model Driven Engineering(MDE), for CRISP-DM method, Video Object detection dataset and data preparation. Our paper will be to fill in the gap between data science and Model Driven Engineering by presenting the first and the unique study to model all these concepts.

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April 25-26-27, 2024 | Marrakech, Morocco

A comparative assessment of ARIMA, LSTM and Fb-Prophet models to forecast daily ozone concentration in Tangier area

Communication Info

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Keywords:
(1) air quality forecasting
(2) Ozone (O3)
(3) Long Short-Term Memory (LSTM),
(4) ARIMA
(5) Prophet

Abstract

Ozone (O3) from the troposphere is one of the substances that has a strong effect on air pollution. Prediction of this pollutant can lead to positive improvements in air quality. This work compares the Auto-Regressive Integrated Moving Average (ARIMA) as a classic statistical method for time series forecasting, with deep learning approaches. Given that long-short-term memory (LSTM) technique is an extremely powerful algorithm, we hybridized it with the Fb-Prophet and ARIMA method to enhance the model. These approaches are tested using databases measured by the National Direction of Meteorology from January 2010 to April 2014 in Tangier. Making use of multiple accuracy metrics, the models' efficiency is investigated. Empirical findings reveal the superiority of the hybrid model by providing forecasts that are more accurate with an index of agreement equal to 0.98.

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April 25-26-27, 2024 | Marrakech, Morocco

seismic vulnerability of existing buildings in the Casablanca metropolis

Communication Info

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Keywords:
(1) Seismic vulnerability
(2) Reinforcement
(3) Pushover

Abstract

After the earthquake of September 8, 2023 that occurred in the region of Al Haouz in Morocco, it clearly appears that the material damage could have been more catastrophic if a large city would be affected by such a disaster.
In this work we propose to study in detail the different constructions of the metropolis of Casablanca, we will list the different neighborhoods according to their age, their method of construction and their vulnerability to a large magnitude earthquake.
Secondly, we will propose methods of strengthening by studying their financial impact which will be compared to the financial impact of such a disaster if nothing has been done to confront it.

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April 25-26-27, 2024 | Marrakech, Morocco

The Role of Emerging Technologies in Smart City Development

Communication Info

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Keywords:
(1) Smart city's dimensions
(2) Quality of life
(3) Internet of Thing
(4) Big Data

Abstract

New technologies can be applied to smart city development to enhance environmental quality, economic vitality, and overall quality of life. The use of information and communication technology (ICT) in smart cities allows for more efficient public services and economic growth [1]. Additionally, the integration of the Internet of Things (IoT) and intelligent machine learning technologies can improve various aspects of smart cities, such as traffic management, accident prevention, and waste management [2]. Furthermore, the use of IoT technology, Big Data, and Artificial Intelligence (AI) can collect environmental data and make time series predictions, enabling local authorities to make informed decisions on urban actions that impact citizens [3]. The concept of smart cities also involves the use of drones and IoT to enhance connectivity, energy efficiency, and service quality [4]. By implementing smart solutions and sustainable urban development practices, cities can meet the demands of citizens while protecting the environment [5].

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Comprehensive comparative study of task offloading optimization methods in fog computing environment

Communication Info

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Keywords:
(1) Fog computing
(2) Task offloading
(3) Quality of service
(4) Energy constrains
(5) Multi-objective optimization.

Abstract

In the Internet of Things (IoT) sector, fog computing has recently garnered increased attention. A few publications include empirical comparisons of the strategies, and several others provide summaries of the approaches. We compare various task offloading optimization techniques in a fog computing environment in this work. To pave the way for further developments in the subject, the study also addresses the difficulties and potential avenues for future research in task offloading optimization. This work advances our knowledge of the state-of-the-art in task offloading optimization within the dynamic framework of fog computing by combining a wide range of approaches and empirical findings. With a defined task offload design and particular learning objectives, these comparison results give readers insights on how to improve work offloading.

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Improving Aquaponics Efficiency with Apache Spark and Kafka

Communication Info

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Keywords:
(1) Aquaponics system
(2) Internet of things
(3) Big Data tools
(4) Apache KAFKA
(5) Apache SPARK

Abstract

Several research provides to monitoring and controlling the aquaponics system [1]; it is a closed-loop ecosystem that combine aquaculture (fish farming) and hydroponics (soil-less plant growing); by cloud computing technology associated with the Internet of Things (IoT) and smart sensing. A perfect run time of the system produces healthy and organic food characterized by low consumption of water and chemical fertilizers that can ensure food security and sustainability. This paper aims to develop our proposed aquaponic system based on IoT technologies [2] by centralizing our endeavor to integrate into the previous architecture the technologies of data collecting and processing offered by Big Data tools: Apache Kafka [3][4], and Apache Spark [5], as well as the prediction of any anomaly in the system.

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Smart Task Offloading in Vehicular Fog Computing: A Hybrid Deep Learning and Semi-Markov Decision Process Strategy

Communication Info

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Keywords:

(1) Vehicular Fog Computing
(2) Deep Learning
(3) semi-Markov Decision Process

Abstract

By integrating vehicles with computational capabilities and advanced communication technologies they can function as mobile fog nodes, allowing for task offloading, local data processing, and improved network performance [1] [2]. In dynamic environments of vehicular fog computing, the strategic positioning of vehicles at the network edge facilitates processing and decision-making, contributing to the efficiency of the system [3]. However, the complexity arises when determining optimal task offloading points that requires novel solutions to enhance decision-making processes [4] [5]. In response to these challenges, this work proposes a hybrid approach that combines the power of deep learning and the semi-Markov Decision Process techniques. This combination aims to minimize both task offloading delay and energy consumption, providing an innovative solution to the mobility of fog nodes of Vehicular Fog Computing.

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ICRAMCS 2024

THE SIXTH EDITION OF THE INTERNATIONAL CONFERENCE ON RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
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Transforming Cybersecurity: An Innovative SIEM Framework with Proactive and Adaptive Features Utilizing Predictive Analytics

Communication Info

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Keywords:
(1) SIEM
(2) IA
(3) ML

Abstract

Given the dynamic nature of the cybersecurity landscape, this proposal describes the development of a Security Information and Event Management (SIEM) framework.[1] The envisaged framework seeks to redefine and amplify the capabilities of existing SIEM systems by integrating analysis, real-time threat detection and adaptive response functions. [2] Using state-of-the-art technologies, this architecture establishes a flexible modular infrastructure suitable for deployment in a variety of organizational environments. [3] In addition to addressing current security challenges, the proposed SIEM framework anticipates future threats through the integration of machine learning and predictive analysis algorithms. By taking a proactive stance in security monitoring, this design sets a standard for SIEM solutions, enabling organizations to effectively protect their digital assets. [4] [5]

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Taxonomy of attacks against cryptographic protocols

Communication Info

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Keywords:
(1) Cryptographic protocols
(2) Attacks
(3) Classification of attacks

Abstract

Cryptography plays a critical role in securing digital communications, but it is not immune to malicious attacks. Based on the different types of attacks that target cryptographic protocols, we can categorise them according to the type of cryptography used - symmetric or asymmetric. This paper provides a comprehensive classification of attacks against both symmetric and asymmetric cryptography, highlighting the different vulnerabilities associated with each type. Understanding these attack vectors is essential for developing robust security measures to protect sensitive information in the ever-evolving landscape of digital communications.

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Collaborative Algorithmic Decoding: A Fusion of the Hartmann Rudolph Algorithm with a Decoder that exploits Syndromes and Hash Functions

Communication Info

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Keywords:
(1) Hartmann and Rudolph
(2) HWDec/HSDec
(3) Linear code
(4) Error Correcting Codes

Abstract
Given the increasing importance of digital communication, with a growing volume of exchanged data and unreliable communication channels, ensuring the reliability of data transmitted upon reception has become essential. As a result, channel coding is emerging as an indispensable tool for detecting and correcting errors on computer networks, telecommunications systems, and data storage. In this paper, we present a concatenation of Hartmann and Rudolph (HR)[1] partially exploited and a decoder based o n hash techniques and syndrome calculation [2, 3] to decode linear block codes.

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THE SIXTH EDITION OF THE INTERNATIONAL CONFERENCE ON RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
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Les courbes elliptiques et la cryptographie

Communication Info

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Keywords:
(1) Courbe elliptique
(2) Chiffrement
(3) problème du logarithme discret
(4) Clé publique
(5) Clé privé

Abstract

Cet exposé traite de l'étude des courbes elliptiques sur un corps fini et de leurs applications cryptographiques. Dans un premier temps, nous avons défini les courbes elliptiques $E(F_q)$ sur un corps fini par leurs équations, puis nous avons étudié la classification des éléments dans ces courbes elliptiques. De plus, en utilisant la courbe elliptique $E(F_q)$ pour introduire des schémas cryptographique qui sont basés sur le problème du logarithme discret, et ils offrent une sécurité forte et sont très difficiles à résoudre. Enfin nous avons donné des exemples de cryptographie basés sur les courbes elliptiques sur un corps fini.

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New results of a Decoder of Linear Block Codes based on Ensemble Learning Methods

Communication Info

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Keywords:
(1) Error correcting codes
(2) Decoding algorithms
(3) Channel coding
(4) Communication Systems

Abstract

Error-correcting codes are used to correct errors partially or completely as much as possible, while ensuring high transmission speeds. Various machine learning models have been employed for error correction. Ensemble learning methods involve combining predictions from multiple models to improve overall performance and robustness. In this context, we have successfully designed, tested, and validated our decoder EL-BoostDec (hard decision decoder based on the ensemble technique - Boosting), which relies on computing the syndrome of the received word and using ensemble learning techniques to identify the corresponding correctable error. The results obtained with EL-BoostDec are very promising in terms of the binary error rate (BER) it offers. In this study, we present a comparison of EL-BoostDec with some competitors and introduce new results of EL-BoostDec when applied to new linear codes, especially double-circulant codes.

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Steel-Concrete Interface analysis in Large-Scale Structures

Communication Info

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Keywords:
(1) Composite
(2) steel-concrete
(3) interface
(4) stress

Abstract

Composite structures must meet a comprehensive range of requirements beyond mere mechanical strength. In reinforced concrete, as cracking occurs, stress gradually redistributes between the steel and concrete components through their interface. This redistribution profoundly influences the final cracking state and necessitates inclusion in modeling efforts. While various numerical models exist to capture the steel-concrete connection's influence, their current applicability to large-scale structures is limited due to challenges such as mesh complexity and computational expenses.[1-2]
In this study, we consistently assume a perfect combination (equal displacement) between steel and concrete. One approach involves treating the steel-concrete interface as a distinct material, introducing a new "steel-concrete interface" material. Another method incorporates zero-thickness finite elements between the steel and concrete meshes to depict their interactions.
Our proposed approach aims to develop a novel finite element model for bonding between steel and concrete. This model should accurately represent the physical phenomena at their interface while also being compatible with the modeling constraints inherent in large-scale structures.

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Pore-scale simulation of microbial decomposition of organic matter in soil.

Communication Info

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Keywords:
(1) Modeling microbial activity
(2) Transformation-diffusion processes
(3) Pore-scale dynamics

Abstract

Accurately simulating soil microbial activity at the pore scale is essential for understanding soil function, optimizing agricultural practices, and promoting environmental conservation.
Our presentation outlines two numerical approaches: one involves modeling pore space using a graph of geometric primitives [1] or regions from the curvilinear skeleton [2], followed by diffusion and transformation simulation on the graph; the second approach directly models dynamics on voxels of the image capturing the pore space.
We present comparison results of diffusion and microbial activity using the expensive accurate simulation based on the Lattice Boltzmann method on a 3D image of a real soil sample [3].

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Phase diagram of the RbF-RbI binary system calculated via the Calphad method

Communication Info

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Keywords:
(1) Calphad method
(2) Phase diagram
(3) RbF-RbI

Abstract

Molten salts have been extensively employed as heat transfer and storage mediums in nuclear power and concentrated solar power applications, owing to their numerous advantages such as high thermal stability, significant heat capacity, and cost-effectiveness. The RbI-RbF system is among the salts utilized for energy storage purposes. In this paper, the RbF-RbI binary system was computationally investigated. Experimental data including phase [1] diagram and thermodynamic information [2] are used as input data for the CALPHAD assessment [3] . The liquid and solid solutions are treated as substitutional solutions and the solid solutions with a Redlich-Kister polynomial [4] using the Thermo-Calc software package [5] . Our calculations are in good agreement with the phase diagram data and experimental thermodynamic data available in the literature.

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Exploring the Effects of SCW-ITSPy on the development of Python Skills

Communication Info

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Keywords:
(1) Python
(2) Parson’s puzzle
(3) Computer Science Education
(4) Programming exercises.

Abstract

Learning Python is hard for many students, and some even quit their classes [1]. To make it less frustrating, a technique called Parsons Problems helps students solve problems less frustratingly. Parsons Puzzles, show correct code in a mixed-up order, and students have to put it in the right sequence [2, 3, 4].
This paper explores a novel intelligent tutoring system called Semi-Code Writing for learning Python (SCW-ITSPy) [5], a unique learning tool seamlessly blending Parsons Puzzle with coding exercises for an engaging educational experience. SCW-ITSPy is different because it creates distractors based on common student mistakes, making learning better. The article evaluates the effectiveness of SCW-ITSPy by examining how students interact with the tool. It investigates the impact of SCW-ITSPy on students' learning experiences, focusing on how it contributes to their thinking process. The study aims to understand the extent to which SCW-ITSPy enhances students' problem-solving skills and promotes a deeper understanding of coding concepts.

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Assessing wetland vulnerability using artificial intelligence technologies

Communication Info

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Keywords:
(1) Artificial intelligence
(2) Machine Learning
(3) Wetlands
(4) Climate Change
(5) Vulnerability
(6) Water environments

Abstract

According to the definition derived from the International Convention on Wetlands (Ramsar), wetlands are areas that cover a wide range of habitat types, including floodplains, marshes, streams, estuaries and offshore coastal areas. [2] Those wetlands help us to prepare for and recover from the impacts of climate change, and the ecosystem services they provide are undeniable [7, 4, 6, 5].
Nevertheless, according to the IPCC report (2007), wetlands are among the most vulnerable ecosystems to climate change, with degradation and loss occurring faster than any other ecosystem. [3]. Hence, assessing wetland vulnerability is of utmost importance. And since the literature review as a research method is more relevant than ever [1], this work contributes to develop a general vision of the methods used to assess wetland vulnerability in different contexts. As novel technologies, Artificial Intelligence and Machine Learning have important applications in water environments [5].

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Agile project cost estimation using machine learning: literature review

Communication Info

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Keywords:
(1) Cost Estimation
(2) Agile
(3) Machine Learning

Abstract

A survey conducted by GoodFirms [1] in 2020 revealed that 84.6% of software projects are developed using the Agile & Scrum methodology, while only 5.8% use the classical waterfall methodology. This huge adoption of agile is related to the challenge that Software development companies face in adapting to customer requirements, which drives the need for more flexible and iterative approaches like Agile. This paper presents a literature review of Agile project cost estimation models, encompassing both non-algorithmic models like Expert Judgment [2] and Analogous Estimating [3], and algorithmic models like COCOMO [4], Function Point Analysis, and Putnam's Model [5]. The review provides insights into the current state of research and potential future directions for Agile project cost estimation, particularly focusing on the integration of machine learning techniques.

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Analyzing the Impact of Deep Q-Networks and Machine Learning Adversarial Attacks on Gait Recognition Accuracy

Communication Info

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Keywords:
(1) Deep learning-based gait recognition systems
(2) Adversarial attacks
(3) Deep Q-Networks
(4) Adversarial Machine Learning (AML) techniques

Abstract

In a world where deep learning-based gait recognition systems [1] are increasingly integral to security applications, ensuring their resilience against adversarial attacks [2] is crucial. Our study employs a combination of Deep Reinforcement Learning (DRL) [3], with a focus on Deep Q-Networks (DQN)[4], and Adversarial Machine Learning (AML) techniques [5] to execute and analyze complex adversarial attacks on gait recognition systems. By developing adaptive adversarial examples and implementing evasion and poisoning strategies, we assess the vulnerabilities inherent in these systems. Our methodologies are validated using two significant datasets: the CASIA Gait Database: Dataset B and the OU-ISIR Treadmill dataset B -Clothes variation-. The experimental outcomes demonstrate a notable decline in the accuracy of gait recognition systems, affirming the efficacy of our proposed adversarial interventions. The implications of our work are twofold: highlighting the susceptibility of gait recognition systems to adversarial attacks and providing a foundation for future enhancements in their defensive capabilities.

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A novel approach for dose distribution comparison in radiotherapy

Communication Info

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Keywords:
(1) Radiotherapy
(2) Dose distribution comparison
(3) Image alignment

Abstract

Dose distribution comparison is a vital process in several medical applications, such as radiotherapy. Many tools have been implemented to accomplish this task effectively, including the Gamma analysis technique, which is considered the gold standard method for 2-D dose distribution comparison in radiotherapy quality assurance [1]. However, this technique suffers from several disadvantages, namely inaccuracies in computing the gamma index for steep dose gradient regions and the complexity in interpreting 3-D gamma analysis results [2]. This work aims to provide a novel technique for 2-D and 3-D dose distribution comparison that eliminates the resolution dependency of the comparison outcomes, which is the main limitation of the gamma analysis. The developed algorithm is based on the image alignment principle, wherein a transformation matrix is computed to transform the first dose distribution onto the coordinates system of the second distribution. The keypoints used for computing the transformation matrix are extracted from isodose contours, and their descriptors are determined [3-4]. Then, the keypoints of both distributions are matched using an approach that preserves the order of the contour's keypoints. The matched keypoints are used to compute the transformation between the compared distributions [5]. The dose disparity is determined by computing the slope between the transformed distribution and the other one. The algorithm was validated by performing the linearity, accuracy, and precision test using 175 dose distribution pairs, and yielded promising outcomes for future use.

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PSL(3,4) as the Automorphism Group of a Class of three Binary Codes with Dimension 9

Communication Info

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Keywords:
(1) binary linear code
(2) self-orthogonal code
(3) automorphism group

Abstract

In this article, we showcase PSL(3,4) as the automorphism group for a specific class of linear binary codes with dimension 9. The demonstration involves leveraging the action of the group PSL(3,4), represented by invertible matrices of size 9 by 9 up to isomorphism, on the vector space F_2^9. Additionally, we establish that these codes exhibit a self-orthogonal property.

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THE SIXTH EDITION OF THE INTERNATIONAL CONFERENCE ON RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
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Hidden Markov Chains: Review

Communication Info

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Keywords:
(1) HMC
(2) PMC
(3) TMC

Abstract

Here, we present some methods of Markov, that we can use to segment images.
Generally, the Markov models are divided in two categories: classical and recent.

Our study focuses on classical hidden Markov chain, recent pairwise Markov chain and triplet Markov chain. We present each model, his laws, his parameters and his uses case.
We compare these models between them, we carry on a comparison between Hidden Markov Chain (HMC) [1] and Pairwise Markov Chain (PMC) [1]. Moreover, we compare Hidden Markov Chain and Triplet Markov Chain (TMC) [1][2].

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Investigation de l'érosion des routes à l'aide de l'intelligence artificielle : Une étude de cas à Kénitra

Communication Info

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Keywords:
(1) Erosion routière
(2) Machine learning
(3) Variables climatiques

Abstract

L'érosion au niveau des routes est une menace majeure pour les infrastructures et la sécurité publique. Cette étude propose une analyse des phénomènes de l'érosion routière et se focalise sur ses causes et ses effets. L'étude présente une nouvelle méthode pour identifier l'érosion des routes en utilisant l'intelligence artificiel pour la prédire et la prévenir. L'accent est mis sur la région de Kenitra. A travers l'exploitation d'un ensemble de données géo-spatiales, d'informations météorologiques et d'archives locales sur l'érosion, nous avons créé un modèle prédictif basé sur le Machine Learning pour identifier les points chauds de l'érosion et déterminer les taux d'érosion. La région de Kenitra présente un terrain diversifié et une infrastructure routière étendue. Nous avons utilisé un puissant algorithme de machine learning, Random Forest (RF), pour analyser les données sur l'état des routes, les caractéristiques du terrain et les données hydrologiques. Cela nous a permis de montrer les intéractions multiples entre les facteurs climatiques et les processus d'érosion des routes. Les résultats ont indiqué que le modèle RF avait une grande précision

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La conception et l'évaluation d'outils d'apprentissage intéractifs pour l'algorithmique au primaire

Communication Info

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Keywords:
(1) Scratch
(2) MIT
(3) Programming
(4) algorithmic
(5) Resource
(6) Primary education

Abstract

This paper examines the integration of Scratch programming software into primary education to enhance learning experiences and foster essential programming skills. It investigates gender differences in programming attitudes, explores Game-Based Learning (GBL) in the Curriculum for Excellence (Cfe) in Scotland, and addresses the design of algorithmic resources in France. Through qualitative analysis, it assesses the effectiveness of Scratch in teaching and learning, contributing to improvements in primary education and programming curriculum.

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An automated Residual U-shaped network for Retinal Vessel Segmentation using Grey wolf optimization.

Communication Info

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Keywords:
(1) Retinal vessel segmentation (RVS)
(2) Grey Wolf Optimization (GWO)
(3) Residual U-Net network

Abstract

Retinal Vessel Segmentation (RVS) plays a crucial role in computer-aided diagnosis systems for various retinal diseases such as diabetic retinopathy, high blood pressure, and glaucoma [1]. Accurate segmentation of retinal vessels from fundus images is essential for early disease detection and monitoring [2]. However, this task poses significant challenges due to the complex nature of retinal vasculature, including variations in vessel width, tortuosity, and branching patterns, as well as the presence of noise in retinal images [3]. Recent advancements in deep learning (DL) have shown promising results in retinal vessel segmentation. Particularly, models based on Deep Convolutional Neural Networks, such as the Residual U-Net (ResU-Net) architecture [4], have achieved remarkable performance in this domain. However, designing optimal segmentation models manually is non-trivial and time-consuming, requiring expert knowledge. In this study, we introduce a novel optimization approach that utilizes Grey Wolf Optimization (GWO) [5] to automatically design lightweight U-shaped (encoder-decoder) network models for RVS. The proposed approach aims to search for the optimal U-shaped network and its corresponding hyperparameters in order to enhance the performance of retinal vessel segmentation while minimizing computational costs. We evaluated our method using the well-known DRIVE dataset and compared its performance to the baseline ResU-Net model. In our methodology, we apply Contrast Limited Adaptive Histogram Equalization (CLAHE) enhancement and data augmentation techniques

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Electro-osmotic flow of non-Newtonian nano-blood in stenosed artery induced via periodic body acceleration and pulsatile pressure gradient

Communication Info

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Keywords:
(1) Blood flow
(2) Stenosed artery
(3) Non-Newtonian

Abstract

The study of blood flow in diseased arteries has been an important area of research in recent years[1,2]. The most common arterial lesion in humans is stenosis/atherosclerosis generated by the accumulation of a cholesterol plaque inside the vessel wall [3,4]. The current work investigates the unsteady, laminar and two-dimensional pulsatile flow of blood through an artery with stenosis containing gold nanoparticles in the presence of body acceleration. Motivated by the electromagneto-hemodynamics effects, a uniform magnetic and electric field was applied in the radial and axial direction to the blood flow, respectively. A radial coordinate transformation is used to immobilize the effect of the vessel wall. The governing nonlinear partial differential equations of the present flow together with prescribed boundary conditions are discretized by employing explicit finite difference scheme. A computer code is developed, in order to solve these algebraic equations. Comprehensive solutions were presented for gold nanoparticles in the blood flow.

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Simulation of blood flow in a carotid bifurcation artery

Communication Info

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Keywords:
(1) Carotid artery
(2) Blood flow
(3) Hemodynamic

Abstract

Simulation of blood flow in a carotid bifurcation helps to better understand the hemodynamic phenomena that occur at this critical point of the vascular system. In the present study, a numerical analysis of blood flow in a bifurcation of the carotid artery has been constructed. This simulation is based on the finite volume method to give an approximate solution to the Navier-stokes equations, in order to determine the distribution of different flow parameter, including velocity, pressure and shear stress. Blood is assumed to be pulsatile and non-Newtonian fluid using Carreau model to characterize its rheology [1]. Biochemical and mechanical interactions between blood and vascular tissue are neglected in this work [2]. To consider the hemodynamic blood flow in the carotid bifurcation under real flow conditions, the inlet velocity was chosen to be a time-varying periodic profile [3][4] . The results of these studies can help doctors to diagnose and treat arterial diseases.

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Facteurs d'acceptation ou de rejet des technologies dans l'enseignement supérieur : Approche basé sur des modèles prédictifs

Communication Info

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Keywords:
(1) TIC
(2) Facteurs d'acceptation
(3) Enseignement supérieur
(4) TAM
(5) UTAUT

Résumé

Les TIC ont envahi presque tous les domaines de notre vie quotidienne comme la gestion, le transport, la communication, la santé, l'agriculture, le divertissement, le travail … Le système éducatif est parmi les domaines les plus affectés par ce changement, et surtout les méthodes d'enseignement et d'apprentissage où Les TIC ont apporté des changements irréversibles en éducation.

Dans ce contexte cet article s'intéresse à la détermination des facteurs d'acceptation et de rejet des TIC par les étudiants de l'enseignement supérieur. A travers une analyse de revue de littérature j'inclus l'approche de Markus (1983), Le modèle de RAM (1987) de Joshi (1991), qui signalent la résistance aux technologies. J'aborde également La théorie de la diffusion de l'innovation de Everett Rogers (1962), l'acceptabilité/Utilisabilité de Jakob Nielsen (1993), Le TAM de Davis (1989) et l'UTAUT de Venkatesh (2003).

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Designing the Future of Energy: Decentralized Trading Systems via Solana Blockchain Architecture

Communication Info

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Keywords:
(1) Decentralized energy trading
(2) Solana blockchain
(3) Smart contracts
(4) Peer-to-peer transactions
(5) Renewable energy adoption

Abstract

This article introduces an architectural plan for a decentralized energy trading network that utilizes the Solana blockchain's fast throughput, reduced latency, and improved security to fulfill the need for sustainable energy solutions [1]. This architecture is meant to enable peer-to-peer energy transactions directly without intermediaries, ensuring fair access to energy supplies. The architecture prioritizes incorporating smart contracts for automated transactions, real-time analytics for optimizing resources, and decentralized management to encourage the adoption of green energy. Our goal is to empower consumers in the energy market and stimulate the creation of sustainable energy communities by detailing this architecture. This architectural approach sets the foundation for future research in energy system transformation, emphasizing a direction towards sustainable, efficient, and democratized energy delivery [2]. Our contribution significantly advances the field by demonstrating how Solana's blockchain can uniquely meet the energy sector's demands for scalability, speed, and security, offering a robust platform for the decentralized energy market [3]. Moreover, by integrating advanced smart contracts and analytics, we present a comprehensive solution that not only promotes the adoption of renewable energy but also ensures a more efficient and equitable energy distribution system, underscoring the added value of our work in fostering sustainable energy landscapes.

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Authors, Title Journal, Volume, Year, Pages.

The generalized Riemann problem

Communication Info

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Keywords:
(1) the generalized Riemann problem
(2) asymptotic expansion
(3) hyperbolic systems

Abstract

We consider the generalized Riemann problem for non linear hyperbolic systems of conservation laws. We show in this exposed that we can find the entropy solution of this problem in the form of an asymptotic expansion in time and we give an explicit method of construction of this asymptotic expansion. Finally, we define from this expansion an approximate solution of the generalized Riemann problem and we give error bounds.

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Optimizing hyperparameters of Convolutional Neural Networks through Particle Swarm Optimization for the classification of breast cancer in mammography

Communication Info

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Keywords:
(1) Particle swarm optimization
(2) Hyperparameter optimization
(3) Convolutional neural networks (CNNs)
(4) Deep learning
(5) Image classification

Abstract

Breast cancer is among the most common cancers that affect women globally and has a significant death rate. Although medical imaging is still a reliable method for detecting breast cancer, the process of manually analyzing images takes a long time. In this work, a novel deep learning method for improved mammography-based breast cancer detection using convolutional neural networks (CNNs) is presented. Even though CNNs are widely used for image classification, it is still difficult to precisely determine architectures and hyperparameters. In this work, we created a highly accurate CNN model specifically designed for mammography-based breast cancer detection. The Particle Swarm Optimization (PSO) technique is used in our suggested strategy to determine the best CNN designs and hyperparameters. After testing on the DDSM and MIAS datasets, the CNN model combined with PSO demonstrated remarkable success rates of 98.23% and 97.98%, respectively. Our proposed CNN model was shown to have greater accuracy when compared to previous studies. As a result, this automated approach makes it easier to develop CNN models for the classifying of mammograms, highlighting its potential as a reliable tool for breast cancer prediction.

References

Optimizing Facial Recognition: A Comparative Analysis of Transfer Learning Models on the Georgia Tech face database

Communication Info

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Keywords:
(1) Face Recognition
(2) Transfer Learning Models,
(3) MobileNetV2
(4) ShufflenetV2
(5) SNet
(6) EfficientNet
(7) GT Face Database
(8) Facial Feature Extraction
(9) Computational Efficiency
(10) SQL Database
(11) Model Selection,
(12) Facial Recognition Applications,
(13) Feature Vector Analysis,
(14) MTCNN,
(15) Model Comparison

Abstract

This study presents a meticulous examination of the efficacy of four transfer learning models—MobileNetV2, ShufflenetV2, sNET, and EfficientNet—in facial recognition, using the GT Face Database. Our methodology diverges from conventional practices by applying each method individually to extract feature vectors. These vectors, representing intricate facial features, are systematically stored in an SQL database, establishing a structured foundation for subsequent comparative analysis.

The GT Face Database, capturing 50 individuals in various conditions—expressions, lighting, poses, and occlusions—provides a comprehensive evaluation platform. Each model undergoes rigorous scrutiny to discern its ability to capture nuanced facial features under diverse circumstances. The resulting feature vectors are not only essential for facial recognition but also serve as a repository for comprehensive model comparison.

Preliminary results, evaluated on key metrics such as accuracy, precision, recall, and F1-score, offer insights into the comparative strengths and weaknesses of MobileNetV2, ShufflenetV2, sNET, and EfficientNet. This in-depth analysis aims to determine the optimal model for diverse facial recognition applications, considering factors like computational efficiency, accuracy, and adaptability to varying conditions.

Through the systematic exploration of the entire spectrum of transfer learning models, this study contributes valuable findings to the field of facial recognition, aiding practitioners in informed model selection for their specific application scenarios.

Facial Expression Recognition Based on pretrained Architectures in artificial intelligence

Communication Info

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Keywords:
(1) Deep Learning
(2) FER-2013
(3) Machine Learning

Abstract

Facial Expression Recognition (FER), also known as Facial Emotion Recognition, constitutes an actively discussed subject within the realms of computer vision and machine learning. It extends its influence into numerous disciplines, including education, psychology, human-computer interaction, and marketing research. The efficient recognition of facial expressions holds significant importance in addressing various challenges [1], [2], [3]. This study undertakes a comprehensive exploration of facial emotion detection, employing the FER 2013 dataset. The study involves experimentation with four distinct convolutional neural network architectures: ResNet-V2, MobileNet-V3, Sequential, and Inception-V3. The primary objective is to categorize seven distinct emotions, namely anger, fear, disgust, happiness, surprise, sadness, and neutrality. The outcomes of the experiments conducted on the FER-2013 Dataset reveal that the fine-tuned MobileNet-V3 model outperforms the other methods in terms of performance.

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Distributed and federated learning for IoT data analysis

Communication Info

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Keywords:
(1) IoT
(2) Cloud Computing
(3) Federated Learning
(4) Distributed Learning

Abstract

The Internet of Things (IoT) and data are closely linked and used in many different contexts. The IoT is a network of physical objects, cars and devices combined with sensors and software to share data [1]. These devices frequently collect large volumes of data which are stored in the cloud for analysis [2]. Managing data dispersed over several sites, confidentiality and security present challenges for data analysis. Two new approaches tackle these problems by enabling models to be learned without sharing raw data are Federated Learning (FL) which devices collaborate to analyze data while keeping personal information [3] and Distributed Learning (DL) for reducing the communication and latency [4]. In this paper, we present a detailed study on the effectiveness of FL and DL for analyzing data close to its sources, guaranteeing data security, less latency and response time.

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Candidate document retrieval for cross-lingual plagiarism: State of the art

Communication Info

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Keywords:
(1) Candidate document retrieval
(2) Cross-language plagiarism detection

Abstract

High availability of resources in multiple languages poses a major challenge in the field of plagiarism detection, particularly when it comes to identifying similarities between documents written in different languages [1],[2]. In this context, "candidate document retrieval" is crucial, involving retrieving potential plagiarism candidates from various sources and languages for comparison with suspect documents to detect unauthorized content use [3],[4]. In this paper, a comprehensive comparative analysis is conducted on the various techniques and datasets used to facilitate candidate document retrieval. This analysis aims to assess the effectiveness and relevance of different approaches and datasets available, highlighting their respective advantages and limitations.

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Impact of SAP ERP on Management Control in the Electrical Sector of ONEE in Morocco: An Exploratory Study

Communication Info

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Keywords:
Enterprise resource planning (ERP) systems;
Organizational impact;
Management control;
Cost calculation

Abstract

In an increasingly connected world, amidst an economic landscape disrupted by the advent of new information and communication technologies (ICT), the integration of management information within Enterprise Resource Planning (ERP) systems is becoming widespread, and management control is now primarily conducted in an ERP environment in large enterprises. The purpose of the current research is to explore the impact of SAP ERP software on management control concepts and tools, as well as on the role and function of controllers. Additionally, the study aims to examine whether ERP contributes to the evolution of the activities profile of management controllers within the ONEE-Electricity Branch in Morocco. Data was collected via semi-structured interviews with 25 executives from the General Management and Regional Directorates of the organization. Following a content analysis approach, the interviews data, which encompasses both technical competencies and human skills, were thematically analyzed with the aim to describe the tools of management control and the behaviors of management controllers within an ERP environment in the observed case. The results revealed a reasoned view of the evolution of management control following the introduction of ERP systems. Based on the results, the current study offers a discussion of the notion of contingency regarding management control characteristics in relation to ERP systems in the Moroccan context, aiming to facilitate digital transition.

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Insights on Banking Fraud in Morocco: AI and Machine Learning Solutions

Communication Info

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Keywords:
(1) Credit card
(2) E-commerce
(3) Artificial intelligence
(4) Machine learning
(5) Bank fraud

Abstract

Credit card [1], usage has increased dramatically in recent years, both for traditional and online purchases, mostly due to advancements in communication and e-commerce [2] systems. On the other hand, as this payment method becomes more and more popular, fraud related to it has skyrocketed. Every year, unauthorized credit card transactions result in significant losses for companies and individuals. With the growing volume of data to be processed, human employees are simply unable to manage it efficiently. Faced with this challenge, Moroccan banks are increasingly turning to the use of artificial intelligence (AI) [3], machine learning [4] and data processing methods to combat bank fraud [5]. The aim of this work is to carry out a state-of-the-art study to determine the different types of fraud existing in the banking sector [6], as well as the challenges associated with their detection and the techniques used to counter them. In addition, a comparative study of machine learning work in the banking sector will be carried out to identify best practices and the most effective

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Image noise removal by game theory approach involving nonlocal fractional derivatives

Communication Info

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Keywords:
(1) Non-local operator
(2) fractional derivatives
(3) image denoising

Abstract

In this paper we propose a game theory approach to restore noisy images using an optimization problem with two regularizers. In other words, we define two players: the first handles the intensity with TV regularizer while the second utilises the non-local operator as a second regularizer, until we obtain the so-called Nash equilibrium. Finally, we test this method by illustrating some numerical simulations, and comparing it with other existing methods in literature.

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Analysis and numerical simulation of a time-fractional contact problem with thermo-viscoelasticity

Communication Info

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Abstract

The aim of this research is to examine a quasistatic frictional contact problem, specifically addressing the interaction between a thermo-viscoelastic body and a thermally conductive foundation. Our study employs a fractional Kelvin-Voigt model to depict displacement behavior in the constitutive relation. Furthermore, the heat conduction aspect is characterized by a time-fractional derivative parameter linked to temperature. The contact is formulated using the Signorini condition, representing a version of Coulomb's law for dry friction. We formulate a variational approach for the problem and establish the existence of its weak solution through a combination of techniques, including the theory of monotone operators, Caputo derivative, Galerkin method, and the Banach fixed point theorem. To illustrate the efficacy of our methodology, we integrate various numerical simulations that highlight the performance of the proposed approach

Keywords:
(1)Fractional Thermo-viscoelastic constitutive law,
(2)Contact with Friction,
(3) Caputo derivative and Galerkin method,
(4)Banach fixed point theorem,
(5)Numerical simulations.

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The relationship between the $\mathcal{F}$-topology on $Spec(\prod_{i\in I} R_i)$ and $\beta(I)$

Communication Info

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Keywords:
(1) Ultrafilter;
(2) Zariski topology;
(3) Zero-dimensional ring.

Abstract

Let R be a ring and $R_{i_{\{i\in I\}}}$ a family of quasi-local rings. This communication explores the ultrafilter topology on $Spec(R)$, initially introduced by M. Fontana and K. A. Loper in [2]. The subsequent work by S. Garcia-Ferreira and L. M. Ruza-Montilla in [4] extends this concept to the context of $\mathcal{F}$-limits. The focus of this section is to establish the connection between the $\mathcal{F}$-topology on $Spec(\prod_{\{i\in I\}} R_i)$ and the space $\beta(I)$.

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On the Comparative Study of the Supervised Machine Learning Models.

Communication Info

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Keywords:
(1) Machine learning
(2) Algorithm
(3) Naira redesign

Abstract

This paper empirically compared the performance of three supervised machine learning models which are Multinomial Logistic Regression (MLR), Multilayer back propagated Neural Networks (MNN) and Multinomial Decision Trees (MDT) based on a tested data set for the opinion of Nigerian citizens during the period of naira redesign policy using classification matrix criterion. About 600 copies of questionnaires on the opinion of Nigeria citizens on their individual welfare at the period of naira redesign. The result showed that, ANN outperformed other models with 94.4% correct classification rates, followed by the MLR with correctly classification rates of 93.5% and lastly by MDT with correct classification rates of 90.0%. However, this results agree with some related literatures like [1,2,3,4,5]

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First-order viability result for Carathéodory non-convex differential inclusion in Banach

Communication Info

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Keywords:
(1) viability
(2) measurable multifunction
(3) selection
(4) Carathéodory multifunction

Abstract

This paper deals with the existence of solutions to the following differential inclusion:

$$(1)\begin{cases} \dot{x}(t) \in F\big(t, x(t)\big) \text{ a. e on } [0, T[\\ x(0) = x_0 \\ x(t) \in K \text{ for all } t \in [0, T], \end{cases}$$

where $F : [0, T] \times K \to 2^E$ is a is a non-convex and non-compact multifunction and K is a closed subset of a separable Banach space E.

The aim of this work is to establish, for any fixed $x_0 \in K$, the existence of an absolutely continuous function $x(.) : [0, T] \to K$ satisfying (1).

Where $F : [0, T] \times K \to 2^E$ be a multifunction measurable with respect to the first argument and uniformly continuous with respect to the second argument. It extends the main result of Duc Ha [2].

Different extensions of the result of Duc Ha [2] have been investigated by many authors in the case of functional differential inclusions or semilinear differential inclusions. See M. Aitalioubrahim[1], V.Lupulescu and M. Necula [3,4] and the references therein.

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Tuberculosis and HIV\AIDS Co-dynamics: A Mathematical Model and Sensitivity Analysis

Communication Info

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Keywords:
(1) Coinfection
(2) Mathematical Model
(3) Tuberculosis, HIV
(4) Sensitivity Analysis

Abstract

The study's aim is to investigate the role of treatment at any stage of infection in reducing the expansion of both Tuberculosis and HIV infection in the community. For this, we formulate and analyze a new non-linear compartmental system to study the dynamic of the diseases. The results indicate that the endemic equilibrium point for sub-models is locally and globally asymptotically stable whenever the basic reproduction number is over than 1 and unstable otherwise. A sensitivity analysis is performed in order to discover the parameters having an important impact on the reproduction number. Finally, the effect of variable transmission probalities, treatment rates, and the stability of the co-infection endemic equilibrium point are indicated through a numerical simulation of the full model via MATLAB.

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A Fractional-Order Variation Model for Color Image Blind Deconvolution : A Game Theory Approach

Communication Info

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Keywords:
(1) Blind Deconvolution
(2) Fractional-Order Derivative
(3) Nash Equilibrium

Abstract

Image restoration is essential for recovering images degraded by various factors such as motion and sensor blur, defocusing, optical issues, atmospheric effects, and noise. A key challenge is the unknown nature of both the original image and the blur kernel (PSF), complicating effective restoration. This process is vital in areas like sensing, medical imaging, astronomy, remote sensing, and forensic investigations.

This paper introduces a novel blind image deconvolution technique leveraging Nash game theory, enabling the restoration of linearly degraded images without prior knowledge of the image or PSF. The method frames deconvolution as a two-player game, with roles assigned to image deblurring and PSF estimation, aiming for a Nash equilibrium as the optimal restoration strategy.

Additionally, we enhance this approach by incorporating fractional-order derivatives, aiming to improve the accuracy and robustness of image restoration. This advancement holds promise for the future of blind image deconvolution, expanding its application and effectiveness across multiple fields.

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