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THE EIGHTH INTERNATIONAL CONFERENCE ON COMPUTATIONAL MATHEMATICS AND ENGINEERING SCIENCES (CMES-2024), ŞANLIURFA/TÜRKİYE, MAY 17-19, 2024

The **Eighth International Conference on Computational Mathematics and Engineering Sciences (CMES-2024)** will be held in Harran University from **17- to 19 May 2024 in Şanlıurfa, Türkiye.** It provides an ideal academic platform for researchers and professionals to discuss recent developments in both theoretical, applied mathematics and engineering sciences. This event also aims to initiate interactions among researchers in the field of computational mathematics and their applications in science and engineering, to present recent developments in these areas, and to share the computational experiences of our invited speakers and participants.

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MESSAGE FROM THE GENERAL CHAIRS

Dear Conference Attendees,

We are honored to welcome you to the **Eighth International Conference on Computational Mathematics and Engineering Sciences (CMES-2024)** at Harran University from 17 to 19 May 2024 in Şanlıurfa City, Türkiye.

CMES, founded in 2016 at Faculty of Science and Techniques Errachidia Moulay Ismail University Morocco is an annual intarnational conference, which was very successful in the past years by providing opportunities to the participants in sharing their knowledge and informations and promoting excellent networking among different international universities. This year, the conference includes 200 extended abstracts, several submissions were received in response to the call for papers, selected by the Program Committee. The program features keynote talks by distinguished speakers such as:

Dumitru Baleanu from Institute of Space Sciences, Magurele-Bucharest, Romania; **Yusif Gasimov** from Azerbaijan University, Azerbaijan; **Naim L. Braha** from University of Prishtina, Kosovo; **Ekrem Savas** from Usak University, Türkiye; **Mehmet Emir Köksal** from Ondokuz Mayıs University, Türkiye; **Amdulla O. Mekhrabov** from Azerbaijan Technical University, Azerbaijan. The conference also comprises contributed sessions, posters sessions and various research highlights.

We would like to thank the Program Committee members and external reviewers for volunteering their time to review and discuss submitted abstracts. We would like to extend special thanks to the Honorary, Scientific and Organizing Committees for their efforts in making CMES-2024 a successful event. We would like to thank all the authors for presenting their research studies during our conference. We hope that you will find CMES-2024 interesting and intellectually stimulating, and that you will enjoy meeting and interacting with researchers around the world.

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Hasan Bulut,

Firat University, Elazig, Türkiye.

Zakia Hammouch,

ENS Meknes, Moulay Ismail University Morocco

TOPICS

Control Theory,
Game Theory,
Applied Mathematics,
Financial Mathematics,
Artificial Intelligence,
Education Sciences,
Engineering Sciences,
Computer Science,
Information Technology,
Geometry and Its Applications,
Analysis and Its Applications,
Statistics and Its Applications,
Algebra and Its Applications,
Topology and Its Application,
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Cryptography and its Applications,
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Defense industry and applications,
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Full version of submitted papers will be published in Special Volumes of reputed journals. Procedure, Guidelines and Checklist for the preparation and submission of papers to the Proceedings of CMES-2024 can be found in the journals websites. The journals in which selected and peer-reviewed full papers of CMES-2024 will be published are as follows:

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3. FRACTAL AND FRACTIONAL JOURNAL [SCI-E],
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https://www.mdpi.com/journal/fractalfract/special_issues/1TAP5BBZ45
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PLENARY & INVITED TALKS

Generalised fractional operators with some applications

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Abstract: We know that fractional calculus deals with the study of so-called fractional order integral and derivative operators over real or complex domains, and their applications. However, a clear definition of a generalized fractional operator is needed. In this talk I will concentrate on solving this important issue and provide some real-world applications.

Keywords: fractional calculus, generalised fractional operators

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ON SOME INVERSE PROBLEMS IN UNTRADITIONAL FORMULATION

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The talk is devoted to the solution of some type of inverse problems. Usually, when solving inverse problems one has to recover the equation or boundary conditions describing the process using given additional conditions. As such conditions usually some signals received from the object may be taken. These signals in mathematical formulation are called spectral data that must satisfy some conditions. The searched objects are some functions, coefficients in the equations or in the boundary conditions.

The problems considered in the talk are different from the traditional ones. Here we consider the inverse problems for some operators and the searched object are not functions as usual but are domains. We try to identify the domain where the process is going on. To solve such problems one meets some serious mathematical problems. The first problem is the choice of additional conditions – spectral data that satisfies all necessary conditions and allows to find the domain. The second problem is to construct a constructive mathematical apparatus that allows to work with functionals of the domains. To do this the space of the domains should be developed with all necessary mechanisms.

In the work the space of the convex bounded domains is constructed and a scalar product is defined there. Then the definition of the s-functions expressed by the spectral data of the Schrodinger operator is given. A scheme is proposed to solve the following inverse spectral problem with respect to domain: Define a domain on the boundary of which the s-functions of the Schrodinger operator are equal to the given functions.

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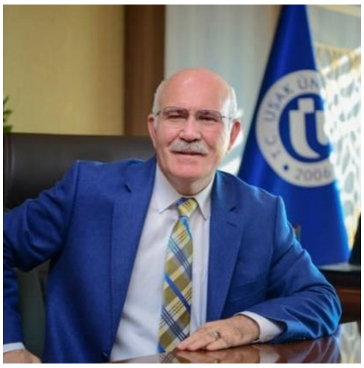

The Secret Behind Western Civilization: Islamic Science

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Abstract

In this study; what is the place of the Islamic Cultural world in the history of sciences? I will try to explain this. I will also explain that Western civilization is the continuation of Islamic civilization under different geographical and economic conditions.

Keywords: Islamic culture; Western civilization

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Fractional Order Thinking and Proportional-Integral-Derivative (PID) Control

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Abstract: The subject of fractional calculus has become very well-known and popular in recent decades. This is because fractional-order models simulate the properties of real systems better than whole order models. Therefore, fractional calculus is used as a powerful and important tool for defining, investigating, analyzing, solving, and understanding many different chemical, engineering, mathematical, physical, statistical, and social problems in real life. In this lecture, the basic concepts of fractional calculus and various common definitions of fractional integration and differentiation are introduced. Various applications in science and engineering are mentioned. In particular, the design of fractional-order proportional integral derivative controllers is emphasized. Mathematical formulations of five design specifications corresponding to the 3D drawing are presented with program implementations. The system design specifications of phase margin, gain margin, phase flatness, low-frequency output noise suppression, and high-frequency noise suppression are considered for designing controllers using the presented 3D graphical method. Each specification is represented by some surfaces that define the boundaries of the permissible parameters of PID control coefficients. The requirements are mapped in the 3D Euclid space by 3D surfaces and/or lines so that the proportional, integral, derivative control coefficients can be optimally chosen to meet the given specifications in an optimum way and to allow trade-off or compromise.

Keywords: Fractional calculus, Fractional order modeling, PID controller, FOPID controller, 3D plots.

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Design and Development of Advanced Magnetic Materials via Computational Material Science for Technological Applications

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Abstract: The presentation will be an overview of the main research thrusts at the "Novel Alloys Design and Development Lab" (NOVALAB) of MetE-METU and at "Novel Materials and Nanotechnologies" Institute of Azerbaijan Technical University (AzTU) in the designing, development and utilizations of advanced multicomponent magnetic materials for technological applications. Fundamental principles and main aspects of ***Computational Materials Science (CMS)*** for ***modeling and simulation based "alloy design***" which has been developed over 45 years by Prof. Mekhrabov, will be presented.

Keywords: Modeling, Simulation, Soft Magnetic Materials, Metallic Glasses, Nanostructured alloys, Glass Formation Ability, Monte Carlo, Reverse Monte Carlo, Molecular Dinamics

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Approximation by modified (p, q)-gamma-type operators

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Abstract
The main object of this paper is to construct a new class of modified (p, q)-Gamma-type operators. For this new class of operators, in section one, the general moments are find; in section two, the Korovkin-type theorem and some direct results are proved by considering the modulus of continuity and modulus of smoothness and their behavior in Lipschitz-type spaces. In section three, some results in the weighted spaces are given, and in the end, some shape-preserving properties are proven.

Keywords: Modified (p, q)-Gamma-type operators; Modulus of continuity; Shape-preserving approximation

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Ritz Method for the Numerical Solution of the Heat Equation

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Abstract

In this paper, we give the numerical solution of the boundary value problem fort he heat equation. The Ritz method have been used to obtain this solution. We solve the numerical examples and errors analysis of the approximation solutions.

Keywords: Ritz method, heat equation, error analysis

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Repel Effects of Heat Transference from Brinkman Fluid under Ferromagnet via Non-Singularized Differentials

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Abstract

When Brinkman fluid exhibits a net and strong magnetization then such Brinkman fluid leads to ferro-magnetized Brinkman fluid with high permeabilities for magneto-strictive flow behavior. This manuscript aims to present the magneto-resistive analytical solutions for the governing equations of ferro-magnetized Brinkman fluid under an effective and powerful approach Atangaan-Baleanu differential operator. The governing equations of ferro-magnetized Brinkman fluid have been constructed from classical to Atangaan-Baleanu differential operators. The analytical solutions are emphasized in terms of magnetized domains for velocity field, temperature and concentration profiles. Integral transforms approach is invoked to tackle the fractional verses classical solutions and ferro-magnetized verses non-ferro-magnetized solutions. Our results investigate that the transfer of heat in the presence of a ferro-magnetic has generated ripples in Brinkman fluid showing several rheological similarities and rheological dis-similarities.

Keywords: Ferro-magnetized Brinkman fluid, Ripple heat transference, Analytical mathematical approach, rheology of Ferro-magnetized Brinkman fluid.

Optimizing a linear function over the set of efficient solutions: Case of the stochastic set-covering problem.

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I. Abstract

The stochastic multi-objective set-covering problem (the probabilistic multi-objective set-covering problem) is very challenging to solve directly. Generating the set of all efficient solutions might be very expensive and unproductive for the decision-maker because, in order to meet their preferences, they have to choose the best-compromised solution from a large list. If their preference is expressed as a linear combination of decision variables, one has to optimize this function over the efficient set of the multi-objective set-covering problem. In this paper, we consider a stochastic environment, i.e., all the parameters are derived from a discrete probability law. Once the problem is converted into a deterministic model, we use the technique presented and developed by (Chaabane and Pirlot 2010). To the best of our knowledge, no similar study has been conducted yet.

Keywords*:* Stochastic multi-objective optimization; Combinatorial optimization; Non-linear optimization; Probabilistic set-covering problem; Efficient solution.

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THE NOVEL NUMERICAL SOLUTIONS OF CONFORMABLE FRACTIONAL BENJAMIN–BONA–MAHONY EQUATION BY USING THE ROBUST CONFORMABLE METHOD

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Abstract

The q-formable homotopy analysis transform method is employed to analyze the conformable fractional Benjamin-Bona-Mahony equation. The numerical solutions to this problem are graphed. The suggested approach has been demonstrated to be successful and consistent based on numerical simulations.

Keywords: Benjamin-Bona-Mahony equation, q-formable homotopy analysis transform method, formable transform.

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$q-$ PARANORMED DIFFERENCE SEQUENCE SPACES

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Abstract

The purpose of this work is to construct the extended versions of Maddox's original paranormed sequence spaces, denoted by the notations $c_0(\nabla_q^2, p)$ and $c(\nabla_q^2, p)$. The spaces $c_0(p)$ and $c(p)$ are linearly isomorphic to these spaces. The Schauder basis for these spaces must then be constructed. Then the topological properties of the $c_0(\nabla_q^2, p)$ and $c(\nabla_q^2, p)$ are studied. Finally, some matrix classes are described.

Keywords: q-calculus; q-second difference matrix; paranormed sequence spaces; matrix transformations

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*Abstract Submission should be prepared only **1 page**.

PARANORMED NARAYANA SEQUENCE SPACES

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Abstract

In the present paper, we construct the extended versions of Maddox's original paranormed sequence spaces, denoted by the notations $c_0(N,p)$ and $c(N,p)$. We investigate the topological structures and establish $\alpha-$, $\beta-$ and $\gamma-$ duals of these spaces. Futhermore, the matrix transformations between these spaces the basic sequence spaces $c_0(p)$ and $c(p)$ are charecterized.

Keywords: Narayana sequence spaces; paranormed sequence spaces; matrix transformations

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*Abstract Submission should be prepared only **1 page**.

ON THE OSCILLATION OF A SECOND ORDER DIFFERENTIAL EQUATION WITH A SUPERLINEAR NEUTRAL TERM

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Abstract

In this work, we focus on a class of second-order functional differential equations containing a superlinear neutral term with both delayed and advanced arguments. By utilizing integral averaging technique, we construct some new oscillation criteria for the considered differential equation. The results obtained in this work generalize and extend some of the known results in the literature. Illustrative examples are also provided to show applicability of the results.

Keywords: Oscillation; second order; neutral differential equations; superlinear.

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Estimates of Bivariate New Kantorovich Type of the Balázs-Szabados Operators Based on q-integers

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Abstract

In this paper, we introduce the bivariate q-kantorovich Balázs-Szabados operators of the tensor product class as follows;

$$R_n^{q_1} R_m^{q_2}\left(f, x, y\right) = \sum_{k=0}^{n} \sum_{l=0}^{m} s_{n,k}\left(q_1, x\right) r_{m,l}\left(q_2, y\right) \int_0^1 f\left(\frac{[k]_{q_1} + q_1^k t}{b_n}, \frac{[l]_{q_2} + q_2^l t}{b_m}\right) d_{q_1,q_2} t, \tag{1}$$

$f : \mathbb{R}_+ \times \mathbb{R}_+ \to \mathbb{R}$ is a continuous function $(x, y) \in \mathbb{R}_+ \times \mathbb{R}_+$ and $b_n = [n]_{q_1}^{\beta_1}, b_m = [m]_{q_2}^{\beta_1}$, $a_n = [n]_{q_1}^{\beta_1 - 1}, a_m = [m]_{q_2}^{\beta_2 - 1}$ are sequences for all $n, m \in \mathbb{N}$ such that $0 < q_1 \leq 1, 0 < q_2 \leq 1$ and $0 < \beta_1 \leq 2/3$ and $0 < \beta_2 \leq 2/3$. As well,

$$s_{n,k}\left(q, x\right) = \frac{1}{\left(1 + a_n x\right)^n} \begin{bmatrix} n \\ k \end{bmatrix}_{q_1} \left(a_n x\right)^k \prod_{s=0}^{n-k-1} \left(1 + \left(1 - q_1\right)[s]_{q_1} a_n x\right)$$

and

$$r_{m,l}\left(q, y\right) = \frac{1}{\left(1 + a_m x\right)^m} \begin{bmatrix} m \\ l \end{bmatrix}_{q_2} \left(a_m x\right)^l \prod_{j=0}^{m-l-1} \left(1 + \left(1 - q_2\right)[j]_{q_2} a_m y\right).$$

Let $e_{ij}(x, y) = x^i y^j$ for $0 \leq i + j \leq 2, i, j \in \mathbb{N}$ be the test functions, we estimate the moments and central moments of these new operators $R_n^{q_1} R_m^{q_2}$.

Keywords: Bivariate q-integer; q-Balázs-Szabados operators; Kantorovich theorem

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NEW EXACT WAVE SOLUTIONS OF THE NEW HAMILTONIAN AMPLITUDE EQUATION THROUGH $(\mathbf{m}+1/G')$-EXPANSION METHOD

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Abstract

In this paper, the new Hamiltonian amplitude equation (NHAE) is considered to investigate the new exact wave solutions via the $(m+1/G')$-expansion method. This model has become very important due to being useful for understanding the behaviors of the traveling waves in the field of applied sciences including fluids, plasmas and optics. The proposed method enables to obtain new complex solutions to NHAE which are also verified by Mathematica. Finally, 3D and 2D graphs are presented for the obtained exact solutions. These solutions are also compared with the results reported in the literature before.

Keywords: $(m+1/G')$-expansion method; new Hamiltonian amplitude equation; Traveling wave solution.

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OSCILLATION OF SECOND ORDER NEUTRAL EMDEN-FOWLER DIFFERENTIAL EQUATIONS

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Abstract

The stıdy of the asymptotic and oscillatory behaviours of solutions of functional Emden-Fowler differential and dynamic equations on time scales is an active and important area of qualitative theory. This rapidly growing interest in examining such equations is motivated by their applications in engineering and natural sciences. In this work, we give some new oscillation criteria that guarantee to be oscillatory of all solutions of second-order neutral Emden-Fowler differential equations. The results obtained are based on the comparisons of a second-order neutral differential equation with the corresponding first-order functional differential inequality and first-order functional differential equation. Some illustrative examples are also provided to show applicability of the main results.

Keywords: Oscillation; second order; Emden-Fowler; neutral differential equations.

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Improved oscillation criteria for third-order half-linear delay differential equations via canonical transform

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Abstract

This paper discusses the oscillatory behavior of solutions to a class of third-order half-linear delay differential equations via canonical transform. Sufficient conditions for all solutions to be oscillatory are established. The results obtained here are new, and they improve and complement many known oscillation criteria in the literature. Examples are provided to illustrate the results and suggestions for future research are included.

Keywords: Oscillation; half-linear differential equations; delay; third-order.

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Applications of the SUPG-YZβ finite element formulation: from mussel-algae interactions to Schnakenberg reaction models

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Abstract

Coupled systems of reaction-convection-diffusion equations can model a wide range of phenomena from science, industry, and nature. Unfortunately, analytical solutions to such systems can rarely be obtained, and, as a result, their analysis usually necessitates the application of numerical techniques. However, when convection dominates the transport process, classical computational tools yield approximations polluted with physically meaningless oscillations, since solutions to such systems can exhibit rapid changes and may have boundary or inner layers. Therefore, this study utilizes a stabilized finite element formulation, the so-called streamline-upwind/Petrov–Galerkin (SUPG) formulation, to eliminate such numerical instabilities without sacrificing accuracy. In order to obtain better approximations around steep gradients, the YZβ shock-capturing mechanism is then incoorporated into the SUPG-stabilized formulation. To demonstrate the robustness of the proposed formulation, which we refer to as the SUPG-YZβ formulation, a number of numerical test experiments are performed, encompassing cross-diffusion systems, the Schnakenberg reaction model, and mussel-algae interactions. The proposed formulation performs quite well without introducing excessive numerical dissipation, according to comparisons with reported studies.

Keywords: Reaction-convection-diffusion, Finite elements, Shock-capturing, SUPG-YZβ.

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SOME NEW ANALYTICAL SOLUTIONS TO THE NONLINEAR MODIFIED QUANTUM ZAKHAROV-KUZNETSOV EQUATION

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Abstract

In this paper, we obtain some new analytical solutions to the nonlinear modified Quantum Zakharov-Kuznetsov equation (MQZKE) by using several powerful analytical schemes. We obtain some important properties of the governing model. Various simulations are also plotted by using Computational package programs.

Keywords: Exponential method; modified Quantum Zakharov-Kuznetsov equation; Complex exponential solution.

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Comparative Analysis of Rankings and Preference Values for Fuzzy Decision-Making Approaches in Reducing Unnecessary Biopsies

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Abstract

Prostate cancer is a significant health concern, and accurate diagnosis plays a crucial role in determining appropriate treatment strategies. However, the high number of unnecessary biopsies in prostate cancer diagnosis poses challenges in terms of patient discomfort and healthcare costs. This study aims to address this issue by employing fuzzy decision-making approaches, including Fuzzy MOORA, Fuzzy TOPSIS, Fuzzy VIKOR and Fuzzy WASPAS, to reduce the number of unnecessary biopsies. The application of fuzzy set theory allows us to handle uncertainties and imprecisions inherent in prostate cancer diagnosis. Fuzzy MOORA is utilized to rank the criteria, fuzzy TOPSIS evaluates diagnostic alternatives, fuzzy VIKOR provides a compromise solution and fuzzy WASPAS determines the weights of criteria. Successful results have been achieved, demonstrating the effectiveness of these methods in reducing unnecessary biopsies. This research contributes to improving the efficiency and accuracy of prostate cancer diagnosis, leading to enhanced patient care, reduced healthcare costs and minimized patient discomfort.

Keywords: Fuzzy set; Fuzzy TOPSIS; Fuzzy VIKOR; Fuzzy MOORA; Fuzzy WASPAS; Multi-criteria decision-making.

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ESTIMATIONS
OF INTEGRAL MAJORIZATION INEQUALITY FOR DIFFERENTIABLE CONVEX FUNCTIONS AND APPLICATIONS

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Abstract

This study aims to estimate integral majorization inequalities by taking third-differentiable convex functions. By using Hölder, Power-mean and Jensen inequalities, we derive some new relations involving integral majorization. Additionally, our study explores various applications in information theory, including estimations for the Csiszár and Kullback–Leibler divergences, Shannon entropy, and Jeffrey's distance.

Keywords: Convex function; Majorization inequality; Hölder's inequality; Power-mean inequality; Jensen's inequality; Information theory.

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A SURVEY ON DIFFERENT STATISTICAL DISTRIBUTIONS USING PYTHON PROGRAMMING

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Abstract

Number of 'data/information' is increasing rapidly around the world and is included in every aspect of our lives. Those interested in data science know the importance of statistical methods and aim to make improvements accordingly. In this study, the importance of 5 popular statistical distribution methods which are normal distribution, gaussian distribution, bernoulli distribution, binom distribution, and poisson distribution were examined. Accordingly, it was aimed to examine the working principles of the selected 5 statistical methods. Results obtained with traditional methods and the scipy library were evaluated using the Python programming language. In this study, run time and error rate of statistical distributions were examined on traditional methods and Python scipy libraries, and their differences were evaluated.

Keywords: Normal distribution, Gaussian distribution, Bernoulli distribution, Binom distribution, Poisson distribution.

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EXPLORING MACHINE LEARNING TECHNIQUES FOR GENDER VOICE RECOGNITION USING LIMITED SPEECH DATA

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Abstract

Voice recognition has gained popularity, leading to extensive research in the artificial intelligence field, primarily utilizing machine learning algorithms. However, determining effective voice recognition algorithms for small datasets remains really hard challenge. This study focuses on the significance of machine learning algorithms in gender voice recognition. The study examines the impact of machine learning algorithms on a dataset of number of 3168 data and 21 features. Machine learning algorithms used in this study are decision tree, xgboost, lightgbm, adaboost, gradient boosting, and k-nearest neighbor. These learning algorithms, especially boosting methods known for their success, were chosen for this study. Experimental results show that machine learning algorithms achieve successful performance rates particularly the Gradient Boosting algorithm. At the end study reached 98.26\% accuracy rate while deep learning approaches in existing literature achieved an accuracy rate of 97\%. As a result of the study, it was seen that a high performance rate was achieved by using machine learning algorithms in small-sized datasets.

Keywords: Voice recognition; Gender; Machine learning; Sound processing.

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On Lacunary Statistical Boundedness of Sequences of Sets

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Abstract The concept of statistical convergence was introduced by Steinhaus [8] and Fast [2], and later reintroduced by Schoenberg [7] independently. Later on it was further investigated from the sequence space point of view and linked with summability theory by Et and Arsalanoğlu [1], Fridy [3], Fridy and Orhan [4], Nuray and Rhoades [5], Salat [6] and many others. In this study we introduce and examine the concepts of Wijsman lacunary statistical boundedness and give some relations between Wijsman lacunary statistical convergence and Wijsman lacunary statistical boundedness.

Keywords. Density, Statistical Convergence, Statistical Boundedness, Sequences of Sets, Wijsman convergence

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On λ-Statistical Boundedness of Sequences of Sets

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Abstract The concept of statistical convergence was introduced by Steinhaus [8] and Fast [2], and later reintroduced by Schoenberg [7] independently. Later on it was further investigated from the sequence space point of view and linked with summability theory by Et and Arsalanoğlu [1], Fridy [3], Mursaleen [4], Nuray and Rhoades [5], Salat [6] and many others. In this study we introduce and examine the concepts of Wijsman **λ-**statistical boundedness and give some relations between Wijsman **λ-**statistical convergence and Wijsman **λ-**statistical boundedness.

Keywords. Density, Statistical Convergence, Statistical Boundedness, Sequences of Sets, Wijsman convergence

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INEXTENSIBLE FLOWS OF CURVES WITH QUASI-FRAME IN GALILEAN SPACE G_3

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Abstract

In this study we research inextensible flows of curve in 3-dimensional Galilean space G_3 with a new aspect. For this research we use a new adapted frame which called quasi-frame in 3-dimensional Galilean space G_3. From this perspective, inextensible curve flows are examined with the help of this frame then important characterizations and results are obtained.

Keywords: Galilean space, inextensible flows of curves, quasi frame.

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ON DIFFERENCES OF BOUNDED VARIATION FUZZY SEQUENCES

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Abstract

Kızmaz [11] first introduced the concept of difference sequence in 1981. Afterwards, Et and Colak [8] generalized the difference sequences and examined some topological characteristics of the resultant sequence spaces. Matloka [13] introduced fuzzy number sequences and gave their basic properties. In this paper, we define the difference of a bounded variation fuzzy sequence by a lacunary sequence and examine some of their properties.

Keywords: Difference sequence; Lacunary sequence; Fuzzy sequence.

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ON LACUNARY STATISTICAL BOUNDEDNESS

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Abstract

In the present paper, we introduce the concept of Δ^f-lacunary statistical boundedness of order β with respect to a modulus function f for sequences of fuzzy numbers and give some relations between Δ^f-lacunary statistical boundedness of order β and Δ^f-statistical boundedness with respect to a modulus function f.

Keywords: Lacunary sequence; Statistical boundedness; Modulus function; Fuzzy sequence.

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ON A COEFFICIENT PROBLEM FOR FUNCTIONS BELONGS TO CERTAIN SUBCLASS OF UNIVALENT FUNCTIONS

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Abstract

Let A denote the family of functions $f(z) = z + \sum_{n=2}^{\infty} a_n z^n$ analytic in the open unit disk $D = \{z: |z| < 1\}$ with the conditions $f(0) = f'(0) - 1 = 0$. If f does not take the same value twice, it is called univalent in D. For $-\infty < t < \infty$ and $\theta \epsilon \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$, the curve expressed by $w = w_0 exp\left(-e^{-i\theta} t\right)$, where w_0 is a nonzero complex number, is called logarithmic θ-spiral. We know that 0-spirals are radial half line. For an analytic function, it is named as θ-spirallike if its range is θ-spirallike. Analytically, $f \in A$ belongs the class of S_θ if and only if $Re\left(e^{-i\theta} \frac{zf\prime(z)}{f(z)}\right) > 0$.

In this study, the extreme points of certain subclasses of spirallike functions. By the applications of extreme point theory, we obtain sharp upper bounds for some nonlinear functionals defined in terms of functions in these classes.

Keywords: Spirallike Functions, Extreme Points, Subordination, Coefficient Estimates

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New Wawe Behaviors For Solutions Of The Truncated M-Fractional Variant Boussinesq System

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Abstract

This manuscript focuses on New wave behaviors for solutions of the truncated M-fractional variant Boussinesq system which refers to a set of nonlinear partial differential equations used to model the behavior of waves in shallow water. This system is a modification or variant of the original Boussinesq equation. The goal of the study is to shed light on the model's underlying mathematical structures and contribute to a better understanding of the system for which is used to model waves in shallow water and electrical signals in telegraph lines based on tunnel diodes.The Sardar sub-equation method which is one of the powerful methods has been considered for finding expotential wave solutions of the system. Some 2D and 3D graphs were presented to explain the physical characteristics of variant Boussinesq system' solution. This algorithm yields new expotential function solutions to the system considered in this paper. Wolfram Mathematica 12 has been successfully used throughout the paper for mathematical calculations.

Keywords the variant Boussinesq system; Truncated M-fractional derivative; the Sardar sub-equation method; Soliton solutions.

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A Collocation Method for Numerical Solution of Linear Integro-Differential Equations by Stancu Polynomials

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Abstract

In this paper, an alternative collocation method has been produced for numerical solution of linear Fredholm and Volterra type integro-differential equations. As the proposed method has been introduced, the Stancu polynomials that are generalization of the Bernstein polynomials and their algebric properties have been used for the proposed method. Some examples of the Fredholm and Volterra integro-differential equations have been considered in order to indicate applicability of the method. Likewise, the numerical results of the proposed method have been presented as tables. Moreover, the numerical results of the proposed method have been compared with the numerical results of the Bernstein collocation method to show the how much the proposed method is efficient.

Keywords: Collocation Method; Stancu Polynomials; linear integro-differential equations; matrix equations.

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APPROXIMATION PROPERTIES OF KANTOROVICH TYPE SAMPLING SERIES IN WEIGHTED SPACES OF FUNCTIONS

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Abstract

In this talk, we study Kantorovich type sampling series in weighted spaces of functions. We investigate the approximation properties of the newly introduced operators, presenting convergence results and providing a quantitative form of the convergence via weighted modulus of continuity.

Keywords: Sampling type series; weighted approximation, Voronovskaja type theorem.

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Analytical Solution of Hirota Equation by Rational Sine-Gordon Method

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Abstract

In this work, we consider the Hirota equation [1-3],

$$iu_t + u_{xx} + 2|u|^2 u + i\alpha u_{xxx} + 6i\alpha |u|^2 u_x = 0$$

The Hirota equation shows the pulses that are physically generated by the help of solitons per unit second in single special fibers. We define the complex form amplitude of the optical field over time with $u = u(x,t)$. Here α is a sufficiently small parameter. Also, and u_t , u_{xx} $|u|^2 u$, u_{xxx} and $|u|^2 u_x$ terms represent linear progression, For this euation, we used an analytical method which is the rational sine-Gordon expansion method [4]. By using the proposed method, some different wave solutions are achieved. We discussed the physical dynamics of all obtained solutions with respect to graphical simulations.

Keywords: The Rational sine-Gordon expansion method; Hirota equation; dark-bright solitary waves

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BLOCKCHAIN APPLICATIONS IN MEDULA SYSTEM

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Abstract

Medical Messenger System has a very important place in today's healthcare industry. The system includes reporting, e-prescription, HIS (Hospital Information Management System), e-medical, and e-pharmacy drug systems. All these systems are open to security and privacy violations; Ensuring the security of the data it contain is mandatory by patient privacy and social security institution payments. There are constant cyber attacks against the Medula System. Cyber attacks will cause e-signature, e-reporting, and e-pharmacy systems to fall into the hands of unauthorized persons. This poses both a danger to the patient's life and financial damage to the state, as it may cause patient data to be changed.

In this study, is planned to make the Medula System more reliable, the control architecture more unique, the patient interaction power faster, and the access to both medicine and medical infrastructure more economical by using Blockchain. It is anticipated that the Medula System will provide a more reliable, more economical, and more ergonomic infrastructure to the healthcare system by taking advantage of the superior features of Blockchain.

Keywords: Blockchain, Medula systems

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Crank-Nicolson Finite Difference Treatment of Time Fractional Klein Gordon Equation

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Abstract

This paper explores treatment of Klein Gordon equation whose time derivative has Caputo meaning fractional derivative via Crank Nicolson finite difference method. The proposed technique relies on the obtaining an algebraic equation using L2 algorithm for time fractional derivative, Crank Nicolson and finite difference approach for spatial derivatives. The obtained results are compared with exact ones and presented for the different values of fractional order α $(1 \leq \alpha \leq 2)$. Graphical findings depict the geometric behavior of the approximation solutions for different values of fraction order.

Keywords: Time fractional Klein Gordon equation, Finite difference method, Caputo derivative

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The Relations of Soft Topological Hyperstructures

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Abstract

Soft sets are a mathematical framework that extend classical set theory to handle uncertainty and vagueness in data and decision-making processes. Soft sets were introduced by Molodtsov in 1999 as a generalization of classical sets. Soft sets are particularly useful in situations where precise membership information is not available, and instead, elements have degrees of membership or uncertainty associated with them. Soft sets have found applications in various fields, including decision-making, data analysis, and information fusion, where uncertainty and imprecision are inherent. One of the application areas of soft sets is topological hyperstructures, which play a very important role in mathematics. In this work, some notions and results concerning soft topological hypergroupoids and soft topological hypergroups are presented. Also, the relations between soft topological hypergroupoids and soft topological hypergroups are analysed, and relevant important conclusions are obtained.

Keywords: Soft Groups Soft topological hypergroupoids; Soft topological hypergroups.

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Rough Approximation Operators on Algebraic Hyperstructures

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Abstract

Rough set theory is an important mathematical tool for modeling uncertainty. This theory has reached a wide potential for study in many fields, especially mathematics, engineering, medicine and computer science. On the other hand, new structures have been introduced by combining algebraic hyperstructures, which are generalizations of classical algebraic structures, with rough set theory. In this study, definitions and some properties of hypergroups, polygroups, rough sets and rough groups are presented. Then, the connections between rough hypergroups and rough polygroups are examined as using the notion of lower and upper approximations, and some important charecterizactions are studied.

Keywords: Hypergroup; Polygroup; Rough set; Rough hypergroup; Rough polygroup.

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Analytic Solutions for Third-Order Fractional Partial Differential Equation Using Modified Double Laplace Transform Method

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Abstract

This paper finds analytical solutions to third-order partial differential equations with fractional derivatives, formulated by the Atangana-Baleanu Caputo (ABC) formulation. Under certain initial and boundary conditions, the study finds analytical expressions using the double Laplace transform method that satisfy the fractional partial differential equation.

Keywords: Third-order partial differential equation; Atangana-Baleanu Caputo (ABC)fractional derivative; Double Laplace decomposition method.

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Some New Results for Exponential-tpye Durrmeyer Sampling Series

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Abstract

In the present paper, we deal with approximation by exponential sampling Durrmeyer operators in logarithmic weighted spaces. We will present pointwise and uniform convergence of the family of operators for functions belonging to logarithmic weighted space of functions and give a rate of convergence via suitable modulus of continuity.

Keywords: Exponential sampling series; Durrmeyer operators; Pointwise/Uniform convergence; Rate of convergence.

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New soliton solutions with generalized exponential rational function method

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Abstract

In this study, the fractional generalized perturbed KdV equation is studied. The generalized exponential rational function method is applied to this equation. Thus, various soliton solutions of this equation are obtained. Various values are given to the obtained solutions and graphical drawings are made.

Keywords: Generalized exponential rational function method; Fractional generalized perturbed KdV equation; Soliton solutions.

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INTRODUCTION TO $\mathcal{M}$-STURM-LIOUVILLE PROBLEM FOR DIFFUSION OPERATOR

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Abstract

In this article, we present the $\mathcal{M}$-Sturm Liouville problem for the diffusion operator depending on initial condition. The aim of the paper is to prove a more general version of the representation of the solution of the Sturm Liouville problem for diffusion operator in classical analysis. We achieve the representation of the solution of the $\mathcal{M}$-Sturm Liouville problem for diffusion operator through the $\mathcal{M}$-Laplace transform[1-4].

Keywords: $\mathcal{M}$-derivative; $\mathcal{M}$-Laplace transform; Diffusion operator.

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PROPERTIES OF ROUGH SUBGRUPOIDS

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Abstract

In this paper, the definition of rough subgroupoid is given using the consepts of groupoid and rough subgroup. By defining the lower and upper approximations of a given set according to the normal subgroupoid, the rough set of this set is obtained. If the lower and upper approximations in the rough set are subgroupoids of the groupoid, then this rough set is a rough subgroupoid with respect to the lower and upper approximations of the groupoid. The properties of the rough subgroups also apply to the rough subgroupoids.

Keywords: Rough Set, Groupoid, Rough Group, Rough Subgroup, Rough Subgroupoid.

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Solving Dynamic Complexity with Analytical Solution Techniques

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Abstract

In this study, we introduce innovative exact solutions for a dynamic model applicable in various fields such as fiber optics, ferromagnetics, water engineering, and oceanography. Our solutions comprise diverse mathematical forms, including exponential, trigonometric, and rational functions. Utilizing advanced symbolic computational software, we visualize the physical behavior of these solutions comprehensively, incorporating 2D and 3D graphs. The various solution techniques presented herein provide valuable insights into dynamic model solutions across different application domains. Moreover, numerous solution techniques documented in the literature significantly contribute to these diverse application areas [1-3].

Keywords: Analytical techniques, dynamic model, exact solution.

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GRUPOID ATLASES

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Abstract

The concept of global effect defined by Anthony Bak is a more complex algebraic structure that reinterprets known classical group effects within certain rules. Many mathematicians have worked on this concept and made various contributions to the literature.

A. Bak developed a combinatorial approach to higher K-theory,in which control is kept of the elementary operations involved,through paths and 'paths of paths'in what he called a global action. The homotopy theory of these was developed by G. Minian. R. Brown and T. Porter developed applications to identities among relations for groups, and also the extension to groupoid atlases.

Here, we focused on the concept of grupoid atlas, which provides the necessary transitions while transferring the global effect to the concept of groupoid.

Keywords : Global action, K-theory, grupoid atlases

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Modified Kudryashov Method for Solving Van der Waals Gas System

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Abstract

In the paper, we obtain some the exact solutions to the nonlinear Van der Waals Gas system which refers to a model for the behavior of gases. This system were analyzed by utilizing the modified Kudryashov method.

Keywords: Modified Kudryashov method; Van der Waals gas system; Exact solution.

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A STUDY ON NUMERICAL SOLUTION OF THE REGULARIZED LONG WAVE EQUATION

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Abstract

This study involves the numerical solution of the 1-Dimensional Regularized Long Wave (RLW) equation, which has an important place in fluid dynamics. After the RLW equation is discretized according to temporal and spatial variables using the three-step Adams-Bashforth and finite difference methods, respectively, numerical solutions are found with the help of the obtained schemes. The proposed schemes are applied to the single solitary wave problem and error norms and conservation constants are calculated. The calculated error norms and conservation constants are presented in tables and compared with the studies of the previous researchers. Additionally, the problem is presented visually by plotting the graphs of the numerical results obtained. From the tables and graphs, it is seen that the proposed schemes are compatible with those of the analytical solution of the single solitary wave problem and preserved the conservation constants.

Keywords: Regularized Long Wave Equation; Adams-Bashforth Method; Finite Difference Method .

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DOMAIN OF MERSENNE MATRIX OPERATOR IN THE SPACE OF CONVERGENT SEQUENCES

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Abstract

In this study, we obtain a new sequence space as the domain of regular Mersenne matrix operator in the space of convergent sequences and we examine some fundamental properties of the aforementioned space.

Keywords: Mersenne matrix operator; Sequence space; Duals; Matrix transformations.

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A NOTE ON ALMOST CONVERGENT MERSENNE SEQUENCE SPACE

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Abstract

This study aims to present a new sequence space obtained as the domain of regular Mersenne matrix in the space of almost convergent sequences and to determine its duals and some properties.

Keywords: Mersenne matrix; Almost convergence; Sequence space; Duals.

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GRAVITY MODELLING AND EARTHQUAKE ANALYSIS FOR EAST ANATOLIAN FAULT ZONE AND SURROUNDING AREA

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Abstract

The 6 February 2023 Kahramanmaraş Earthquakes with moment magnitudes of 7.7 and 7.6 were the disaster of the century for Türkiye. The sequence consisted of two mainshocks demonstrated that East Anatolan Fault Zone (EAFZ) is active not only destructive earthquake potential, but also shallow depth of focus at upper crustal domain. Thus the strength of the upper crustal domain is the important factor in terms of behavior of the upper-lower crust system with earthquake activities. In this study, the crustal deformation and structures of the EAFZ and surrounding area have been investigated using gravity and earthquake analysis. We first calculate radially averaged logarithmic amplitude spectrum of WGM12 isostatic residual gravity anomalies to estimate the average depths of the deeper interfaces and critical cut-off wavenumbers for filtering operations. The average depths of the Conrad and basement have been calculated as 18 km and 6.6 km for the linear segments of the spectrum, respectively. The Conrad undulation is constructed with the gravity inversion based on Parker-Oldenburg's algorithm. Then linear inversion technique, namely the weighted and damped minimum norm inverse solution was then used to estimate density contrasts down to Conrad depth. This inversion technique indicates that deeper interfaces are more undulated in the northern part of the EAFZ region. In addition, sharpen gradient in upper crustal thicknesses in the northern part of the EAFZ, where significant lateral density contrast variations has been revealed. We point out that increasing earthquake activities are caused by intraplate deformation and weaker strength of the crust considering undulated interfaces and sharpen density contrast variation.

Keywords: East Anatolian Fault Zone; Gravity inversion; Upper crust; Seismicity

GENERALIZED FRACTIONAL THE VERTICAL MOTION OF A FALLING BODY PROBLEM

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Abstract

In this study, the vertical motion of falling body problem is considered by the newly given *M*-derivative and generalized fractional derivative. Analytical solutions of the modeling problem are obtained and supported by various graphs including different values comparatively with *M*-derivative and generalized fractional derivative. The Laplace transform is used as the method of choice. [1-4].

Keywords: *M*-derivative; Generalized fractional derivative; Mathematical Model; Laplace transform.

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SOME NEW RESULTS OF THE NONLINEAR CONFORMABLE MODEL ARISING IN PLASMA PHYSICS

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Abstract

The nonlinear conformable model that arises in plasma physics is the 3D conformable Zakharov-Kuznetsov equation (CZKE) with power law nonlinearity (PLNL). The current study applies a modification of the (G'/G)-expansion (MG'/GE) approach to this model and obtains certain closed-form precise wave solutions. By going backwards into the 3D CZKE with PLNL, the obtained results are confirmed, and they are noted as being particularly advantageous over a number of current methods. For the other nonlinear conformable models in physics, mathematics, and engineering, the aforementioned approach could also be used to obtain closed-form wave solutions $(CFWSs)$.

Keywords: Conformable derivative The variation of (G'/G)-expansion method the 3D CZKE with power law nonlinearity.

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New Exact Solutions of the (1+1) dimensional nonlinear Ostrovsky equation

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Abstract

In this study, we obtain new exact solutions to the (1+1) dimensional nonlinear Ostrovsky equation which models for weakly nonlinear surface and internal waves in a rotating ocean by using new version trial equation method. This method allows new exact solutions of the nonlinear partial differential equations. We can say that these new exact solutions which are not in the literature. In addition, two and three dimensional graphs were drawn to illustrate the physical behavior of these new exact solutions.

Keywords: New version trial equation method; (1+1) nonlinear Ostrovsky equation; Exact solutions.

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GENERALIZED SYSTEMS OF LINEAR EQUATIONS WITH LOCAL DERIVATIVE

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Abstract

In this paper, we consider systems of linear differential equations with local derivative. The aim of this paper is to solve systems of linear equations with $\mathcal{M}$-derivative in a more general version. We solve $\mathcal{M}$-derivative systems of linear equations through the $\mathcal{M}$-Laplace transform. In addition, the Cramer method is used by adapting the local derivative and the necessary solutions are given by Mittag-Leffler functions [1-4].

Keywords: Linear equation systems; $\mathcal{M}$-derivative; $\mathcal{M}$-Laplace transform.

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Model Order Reduction for Shigesada-Kawasaki-Teramoto Cross-Diffusion Systems

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Abstract

Shigesada-Kawasaki-Teramoto (SKT) is one of the most popular nonlinear cross-diffusion systems in population ecology. Full-order model (FOM) solutions of the SKT system are computed by applying the symmetric interior penalty discontinuous Galerkin method (SIPG) for space discretization and the semi-implicit Euler method for time discretization. Reduced solutions are calculated by using the proper orthogonal decomposition (POD) method. Also, the discrete empirical interpolation method (DEIM) is used in the computation of nonlinearities of the SKT system. Full-order model solutions and reduced order models (ROM) solutions are compared in numerical results which show the accuracy and efficiency of POD and POD-DEIM methods for the SKT system.

Keywords: SKT systems; full order model solutions; reduced order model solutions; proper orthogonal decomposition method (POD); discrete empirical interpolation method (DEIM).

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AN INVERSE NODAL PROBLEM OF A CONFORMABLE STURM-LIOUVILLE PROBLEM BY RETARDED CONSTANT

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Abstract

In this paper, we presented a new technique to the literature: sa conformable derivative for the inverse problem of a Sturm-Liouville problem with constant delay. We treated the characteristics equation in four different cases and calculated the asymptotic formulas for the eigenvalues and eigenfunctions for each case and demonstrated the existence of the solution. Additionally, we identified the nodal points, from which we generated the problem's potential functions. Next, we used the Lipschitz stability approach and demonstrated the problem's stability.

Keywords: Local derivative, Conformable Sturm-Liouville problem , Spectrum, Constant delay

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FUNDAMENTAL ALGEBRAIC AND TOPOLOGICAL CONCEPTS IN GEOMETRIC ANALYSIS

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Abstract

In this study, the fundamental definitions and theorems given for some algebraic and topological concepts known from classical analysis are given in geometric analysis.

Keywords: Geometric Calculus ; Topological concept; Algebraic concept.

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Blow up at finite time for sixth-order evolution equations with time dependent coefficient

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Abstract

In this presentation, we consider sixth-order evolution equations with time-dependent coefficients. We establish both lower and upper bounds for the blow-up time using a differential inequality argument to determine when blow-up occurs.

Keywords: Blow-up, Parabolic-type equations, Variable Coefficients.

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A COMPARATIVE STUDY OF FINITE ELEMENT METHODS WITH CUBIC AND QUINTIC BASIS FUNCTIONS FOR THE SMCH EQUATION

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Abstract

In this research, the numerical approaches for solving simplified modified Camassa-Holm(SMCH) equation are going to be examined. For this purpose, the studied model problem have been transformed into a linear form using Rubin-Graves linearization method. Then, the finite element method is applied to this linear equation using cubic and quintic B-Spline basis functions. The newly found numerical results are compared according to the degrees of the basis functions at different final time values. As per the obtained results, the error norms L_2 and L_∞ of the numerical results attained using quintic basis functions are smaller than the error norms of the numerical results attained using cubic basis functions. The finite element study based on different basis functions indicate that as the degree of the basis functions increases, the numerical solutions improve in accuracy and convergence. Moreover, higher accuracy is observed with not only larger of elements but also smaller time steps.

Keywords: Finite Element Method, Cubic B-Spline, Quintic B-Spline, Simplified Modified Camassa-Holm Equation.

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A NEW GENERALIZED METHOD FOR THE FRACTIONAL NONLINEAR EQUATION

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Abstract

In this paper, we propose a new generalized method to obtain some new exact trigonometric, hyperbolic, and rational function solutions of the special nonlinear equation. First, we introduce the new version of the generalized method, and then we give the exact solutions of the given nonlinear fractional differential equation. The obtained results are examined under different conditions. The three-dimensional figures for the reported solutions are drawn.

Keywords: Exact solution; Traveling wave solution; Fractional calculus.

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SOME PROPERTIES OF THE EIGENFEQUENCIES OF THE PLATE ON THE DOMAIN

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It is known that the plates are elements included in the composition of various mechanical constructions, and these constructions are widely used in industry, technology, and the construction sector covering the most diverse fields [2,]. Physical properties of different types of plates (free, fixed and clamped) are usually investigated in works dedicated to the study of these issues. But in many cases, these physical characteristics depend not only the material of which the board is made, the environment, etc. but also on its geometric properties. In this sense, the shape and the geometrical structure of the area of the plate are of great importance. Since it is possible to control the geometric parameters of the board in many cases, optimization of one or another physical characteristics required in practice can be achieved through these parameters. Such characteristics can be taken as mass, volume, critical power or eigenfrequency [1, 4, 6].

Here we consider the convex dependence of the eigenfrequency of the clamped plate on its shape.

Let the domain of the plate be D with boundary $S_D \in C^2$. It is known that [6,] the function $w(x_1, x_2, t)$ characterizing the across vibrations of the clamped plate satisfies the following equation

$$\omega_{x_1x_1x_1x_1} + 2\omega_{x_1x_1x_2x_2} + \omega_{x_2x_2x_2x_2} + \omega_{tt} = 0\,. \tag{1}$$

As we consider the clamped plate the boundary condition should be given as below

$$u = 0, \quad \frac{\partial u}{\partial n} = 0, \ \ x \in S_D\,. \tag{3}$$

Basing on the former results obtained in this direction [3, 5] the following theorems are proved.

Theorem 1. Let the support function of the area of the clamped plate satisfies the condition $P'_{D(t)}(x) > 0$ (or $P'_{D(t)}(x) < 0$) for each $t \in [t_0, t_1]$, where t is some parameter. Then the functional $\lambda_j(t)$ is quazi-convex.

Theorem 2. Let the eigenfrequency $\lambda(t)$ of the clamped plate is twice differentiable with respect to the parameter t and the derivative of the support function of the area of the plate keeps its sign in the interval $[t_0, t_1]$. Then there exists a number $k_0 \in R$ such that for any $k \geq k_0$ the functional $\Lambda(t) = e^{k\lambda(t)}$ is convex.

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EXPLOSIVE SOLUTIONS FOR A FOURTH-ORDER REACTION-DIFFUSION EQUATION IN VARIABLE EXPONENT SOBOLEV SPACES

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Abstract

In this work focuses on a fourth-order reaction-diffusion equation featuring variable exponents. Firstly, we explore the phenomenon of finite-time blow-up in solutions with positive initial energy. Later, we establish an upper limit on the blow-up time utilizing a technique involving differential inequalities.

Keywords: Explosive Solutions; Reaction-diffusion equation; Variable exponent.

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Decay of Solutions for a Nonlinear Hyperbolic-type Equations with Variable Exponents

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Abstract

In this study, we investigate the decay of solutions to a nonlinear hyperbolic-type equation with variable exponents, focusing on the case without a source term. By employing Komornik's lemma, we establish the decay of the solutions under appropriate conditions on the variable exponents.

Keywords: Decay, hyperbolic-type equation, variable exponents.

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FORCED VIBRATION ANALYSIS OF FUNCTIONALLY GRADED RODS BY PSEUDOSPECTRAL CHEBYSHEV METHOD

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Abstract

Forced vibration analysis of functionally graded rod with variable cross-sectional area in axial direction is considered. It is assumed that material properties such as elastic modulus and density are graded in the axial direction by the Voigt homogenization model. These conditions result in a partial differential equation with variable coefficients that is difficult to solve with conventional analytical methods. Under the Laplace transform, the partial differential equation is transformed into a time-independent boundary value problem in the axial direction and solved by the pseudospectral Chebyshev Method. With the modified Durbin method, displacements in physical space are obtained by taking the inverse transformation to the time domain. The results obtained are compared with the literature. The effects of randomly selected material mixture on displacement distributions are discussed.

Keywords: Forced vibration; Functionlly greded materials; pseudospectral Chebyshev Method; Laplace transform, modified Durbin Method.

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COMBINATORIAL INVARIANTS OF SATURATED NUMERICAL SEMIGROUPS

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Abstract

In this study, our attention will be directed towards characterizing some families of saturated numerical semigroups. We will discuss about concepts factorizations of an element and the distances between factorizations of elements in terms of numerical semigroups. With the help of these concepts, we will also present results regarding the catenary degree of these numerical semigroup families, which is a combinatory concept and measures the spread of the distance between the factorizations of a given element.

Keywords: Saturated numerical semigroups; Catenary degree; Factorization.

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THERMAL ANALYSIS OF FUNCTIONALLY GRADED 2D PLATE

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Abstract

A closed form solution of the heat transfer problem of a two-dimensional heterogeneous plate in steady state condition has been obtained under the most general boundary conditions. It is assumed that the thermal conductivity of the material varies exponentially in two directions. An analytical solution to the partial differential equation obtained under these conditions is obtained by using the method of separation of variables. The results are discussed on graphs for specifically selected material properties.

Keywords: Heterogeneous plate; Functionally graded materials; Separation of variables

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EXISTENCE AND UNIQUENESS RESULTS FOR SINGULAR FRACTIONAL DIFFERENTIAL EQUATIONS WITH P-LAPLACIAN OPERATOR

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Abstract

In this study, we investigate the existence and uniqueness of solutions for a singular fractional boundary value problem involving the p-Laplacian operator. Our analysis is based on a fixed point theorem. Examples are given for illustrating our main results.

Keywords: Fractional derivative, the p-Laplacian operator, existence and uniqueness, singular.

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THE SPECIFIC ENERGY AND SPECIFIC ANGULAR MOMENTUM ON ROTATIONAL SURFACES IN PSEUDO EUCLIDEAN 4-SPACE WITH INDEX 2

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Abstract

In taking into consideration the mathematical problem of the geodesics on a surface, there is an enormous advantage in conceptual comprehending that results from taking the point of view of a physicist by explaining parametrized geodesics as the paths traced out in time by the motion of a point on the surface, this combination of the constants of the motion is of course also constant along a geodesic. The existence of this constant is a conclusion of the one-parameter rotational group of symmetries of the rotational surfaces, like this constant of the movement introduces a new thing when the surface is invariant under any one-parameter group of symmetries, which is seen in the variation approximate to the geodesic equations easily. Mathematically, this quantity is a constant obtained by Clairaut for geodesic movement on surface defined in a coordinate system adapted to this one-parameter group of symmetries. In this paper, the results show that the specific energy and the specific angular momentum on the surfaces of rotation can be expressed in E_2^4 using some certain results describing the geodesics on the rotational surface are given. As a first instance, using the conditions of being geodesic, in which the curves can be chosen to be time-like curves, which allows us to constitute the specific energy and specific angular momentum.

Keywords: The specific energy; specific angular momentum; geodesic curves

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Expansion Theorem for Sturm-Liouville Problem including Local Derivative

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Abstract

In this study, we give an pansion theorem for the Sturm-Liouville problem with *M*-derivative. m. For the classical Sturm-liouville problem it was given by Levitan and Sargjan in [3] We will give this result for the following problem;

$$-D^x_{\alpha,M}\left(D^x_{\alpha,M}\right)y+q(x)y=\lambda y \tag{1.1}$$
$$D^x_{\alpha,M}y(0)-hy(0)=0 \tag{2.2}$$
$$D^x_{\alpha,M}y(0)y(0)+HD^x_{\alpha,M}y(0)=0 \tag{1.3}$$

where h and H are constants and $D^x_{\alpha,M}$ define the *M*-derivative for $0<\alpha\leq 1$, *q(x)* is real integrable and refers to potential. [1,2,4]

Keywords: Sturm-liouville problem, Potential functon, Spectrum, Conformable M-derivative

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FOCAL CURVES ACCORDING TO THE ALTARNATIVE FRAME

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Abstract

Curves in Euclidean space have been examined in many studies according to different frame works. While examining curves, researchers studied frameworks such as the Frenet frame, Bishop frame and Alternative frame. These frame help us with characterizations of curves.

The aim of this paper is to investigate focal curves according to alternative frame work in 3-dimensional Euclidean space. For this purpose, an alternative frame was first defined. Then, focal curves were given depending on this frame and various characterizations were obtained.

Keywords: Frenet frame, Focal curves, Alternative frame, Euclidean space

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CUBIC HERMITE COLLOCATION METHOD FOR THE EQUAL WIDTH WAVE EQUATION

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Abstract

The fundamental aim of the present article is to numerically solve the non-linear Equal Width-Wave (EW) equation. For this purpose, the nonlinear term appearing in the equation is firstly linearized by Rubin-Graves type approach. After that, to reduce the equation into a solvable discretized linear algebraic equation system which is the essential part of this study, the Crank-Nicolson type approximation and cubic Hermite collocation method are respectively applied to obtain the integration in the temporal and spatial domain directions. To demonstrate how good the offered method generates approximate numerical results, six experimental problems exhibiting different wave profiles known as the motion of single, interacting two and three, the Maxwellian, undular bore and colliding soliton waves given with different initial and boundary conditions of the equation will be taken into consideration. Since only the first model problem has an exact solution, to measure error magnitudes widely used mean squared and maximum norms between exact and approximate solutions are calculated and also compared with those from other existing works in the literature. Furthermore, the three conservation constants known as mass, moment and energy quantities are also calculated and presented throughout the wave simulations with increasing time. In addition, a tabular comparison of the newly computed norms and conservation constants show that the current scheme produces better and compatible solutions than those of the most of the previous works with the same parameters. Apart from those, the stability analysis for this present scheme has been illustrated using the von Neumann method.

Keywords: Equal width-wave equation; cubic Hermite collocation method; solitary waves; stability analysis; Crank-Nicolson type approximation; Rubin-Graves type linearization.

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ON THE APPROXIMATION BY NONLINEAR OPERATORS OF MAX-PRODUCT KIND

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Abstract

Max-product type operators which are a type of nonlinear positive operators, use the maximum and product operations to approximate functions. The max-product type operators have better order of approximation compared to linear operator sequences. In this paper, we introduce the nonlinear bivariate Bernstein max-product type operators by using the GBS operators (generalized Boolean sum) and we investigate their approximation properties by obtaining their rates of convergence.

Keywords: Max-product type operators; Bivariate operators; Order of approximation.

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Examination Of Mhd Effect and Fractional Derivative Model Between Porous Medium Parallel Plates In Time-Dependent Flow

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Abstract

This study investigates the effects of heat and mass transfer on time-dependent flow between porous parallel plates under the influence of a magnetic field. The time-dependent term in the governing equation is approximated by a fractional-order derivative. The partial differential equation system is solved using the finite difference method, with the Grünwald-Letnikov approach for the time derivative and the Crank-Nicolson method for other terms. The Thomas Algorithm is utilized for solving the equation system. Variations in the parameters of the equations are examined, and the resulting differences are presented graphically. It is observed that an increase in Gr and Gm numbers leads to an increase in the velocity profile, while a decrease in M results in an increase in velocity. A decrease in K corresponds to a decrease in temperature, and a decrease in Pr leads to a decrease in temperature. An increase in Sc causes an increase in concentration. Lastly, the change in the fractional derivative order α is investigated. A similar profile is observed for α values of 1, 0.9, and 0.8. As α decreases, the velocity, temperature, and concentration increase.

Keywords: Fractional Derivative; Grünwald Letnikov Approach,; Heat and Mass Transfer.

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ON THE SEMI-ANALYTICAL AND HYBRID METHODS FOR THE DRINFELD-SOKOLOV-WILSON SYSTEM MODELLING DISPERSIVE WATER WAVES

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Abstract

In this study, MVIM, MVILTM and MVISTM are used to solve the Drinfeld-Sokolov-Wilson (DSW) system. Semi-analytical solutions have been obtained for the DSW system. The exact solutions and semi-analytical solutions of the DSW system are compared with each other. Maximum errors of semi-analytical solutions of the DSW system for various iteration values are given by tables. Comparison of relative errors for various iteration values and effect of change of wave constant is visualized by figures. Also, it commented on the effectiveness and usefulness of the methods when applied to the DSW system.

Keywords: Modified variational iteration method (MVIM); Modified variational iteration Laplace transform method (MVILTM); Modified variational iteration Sumudu transform method (MVISTM); The Drinfeld-Sokolov-Wilson (DSW) system.

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THE COMPUTATION OF $\mathcal{H}_\infty$-NORM OF TRANSFER FUNCTIONS OF LINEAR DAEs VIA TWO-STEP METHOD

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Abstract

In this paper, we evaluate $\mathcal{H}_\infty$-norm of a transfer function of a linear DAEs system for special case $D = 0$, using two-step method, which is based on to associate poles of transfer function $G(s)$ to related Hamiltonian matrix. Since the method needs only one iteration then it is extremely fast when compared to other similar methods, that are used to compute $\mathcal{H}_\infty$-norm.

Keywords: DAEs Systems; $\mathcal{H}_\infty$-Norm; Two-Step Method; Hamiltonian Matrix; Singular Values.

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Investigation of extended type a NLS equation using the extended direct algebraic method

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Abstract

In this study, the soliton solutions of the extended type nonlinear Schrödinger equation are investigated using an extended direct algebraic method. The solutions are found in the form of hyperbolic, trigonometric, and rational functions. Various types of well-known optical solitons, including dark, bright and combo optical soliton have been extracted here.

Keywords: Extended direct algebraic method; the extended type NLSE; Optical soliton; Soliton.

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GROWTH OF SOLUTION FOR REACTION DIFFUSION EQUATION WITH KIRCHHOFF TERM AND MULTIPLE NONLINEARITIES

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Abstract

In this presentation, we consider a reaction diffusion equation with Kirchhoff term and multiple nonlinearities. We prove the growth of solution with negative initial energy under suitable conditions.

Keywords: Growth; Reaction diffusion equation; Kirchhoff equation.

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CHARACTERIZATION OF PARAMETRIC SURFACES IN LIE GROUPS USING ALTERNATIVE FRAME

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Abstract

This study focused on describing a surface family by utilizing the alternative moving frame in the 3-dimensional Lie group. We determine the necessary and sufficient conditions for the geodesic curve, asymptotic curve, and line of curvature to serve as an isoparametric curve, respectively. Finally, we provided and visualized some examples based on the obtained results.

Keywords: Lie group; Frenet Frame; Alternative Frame.

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IMPLEMENTATION OF BATTLE ROYALE OPTIMIZATION ALGORITHM FOR 0-1 KNAPSACK PROBLEM USING S-SHAPED AND V-SHAPED TRANSFER FUNCTIONS

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Abstract

In this study, the Battle Royale Optimization Algorithm is applied to 0-1 Knapsack Problems (0-1 KP), which are in the NP-hard problem class. The Battle Royale optimization algorithm proposed for continuous problems cannot be directly applied to 0-1 KP problems with binary structure. Therefore, S-shaped and V-shaped transfer functions are used to adapt the continuous search space to the binary search space. The proposed algorithm is used to solve 0-1 KP problems and the results obtained are compared to determine which transfer function gives more effective results. The proposed algorithm is also compared with different algorithms in the literature.

Keywords: Battle Royale Optimization Algorithm, 0-1 Knapsack Problems, Transfer Functions, Binary Optimization.

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HOUSING PRICE DETERMINANTS: A BIG SPATIAL DATA ANALYSIS

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Abstract

The purpose of this paper is to use a new approach to predict the underlying prices of properties in a city. To evaluate the efficacy of this technique, a thorough investigation of the spatial regression strategy is undertaken through the utilization of geostatistical-based Monte Carlo simulations and the analysis of real data collected from Airbnb.

Keywords: Spatial regression; Big spatial data; Machine Learning.

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PSEUDOSPECTRAL CHEBYSHEV APPROACH FOR NONLINEAR TEMPERATURE DISTRIBUTIONS IN FUNCTIONALLY GRADED DISKS

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Abstract

In this study, the nonlinear heat conduction of a functionally graded disk under various temperature loads is discussed using pseudospectral Chebyshev method. Among the thermal material properties of disk are assumed to be graded in radial direction with Voigt homogeneization scheme. Beside, due to its temperature sensitivity, the heat conduction coefficient is taken to depend on the temperature. While the inner surface of the disk is subjected to constant base temperature load, the outer surface is assumed to be under both Dirichlet and Neumann boundary conditions. Also, the effect of the convection coefficient is examined to model different operating conditions. These conditions lead to nonlinear differential equations that conventional methods may not solve. The nonlinear temperature distributions of the functionally graded disk under the thermo-mechanical loads are determined and illustrated graphically.

Keywords: Nonlinear temperature distribution; pseudospectral Chebyshev method; Voigt homogenization scheme; Functionally graded materials.

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New Optical Soliton Solutions of the NLS Equation with Jacobi Elliptic Function Expansion Method

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Abstract

In this presentation optical soliton solutions are extracted for the proposed equation using the Jacobi elliptic function expansion technique. To better comprehend the dynamic characteristics of the retrieved solutions their graphical visualization are provided.

Keywords: Jacobi elliptic function expansion method; Soliton; Optical Soliton; NLS equation.

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MOTION OF THE FILAMENT IN MINKOWSKI SPACE

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Abstract

This research paper provides an in-depth geometric explanation for nonlinear partial differential equations (NPDEs). It achieves this by utilizing three different spacelike curves that demonstrate geometric flow motion, respectively.

Keywords: Curve Flow; Minkowski Space; Spacelike Curve.

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ON THE UNIFORMLY PARIKH-FRIENDLY WORDS

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Abstract

Mateescu and others [1] introduced Parikh matrix mapping as a sharpening of the Parikh mapping, where somewhat more information is preserved than in the original Parikh mapping. The Parikh matrix of a word is an upper triangular matrix and the classical Parikh vector appear in such a matrix as the second diagonal. All other entries above the main diagonal contain information on the number of occurences of certain subwords of that word. Şerbanuta [3] defined the Parikh matrix mapping in a way that expands it to the Parikh matrix mapping created according to a word u, instead of defining it according to an $\Sigma_k = \{a_1 < a_2 < \cdots < a_k\}$ ordered alphabet. The extending Parikh matrix coincides with Parikh matrix if it is defined with respect to the word $u = a_1 a_2 \ldots a_k$. Salomaa [2] introduced the notion of Parikh-friendly permutation and posed the characterization of Parikh-friendly permutations as open problem. Teh [4] showed that every permutation is Parikh-friendly. Also, he defined the uniformly Parikh-friendly words and proved the existence of the uniformly Parikh-friendly words for every alphabet Σ.

In this talk, we will give a generalization of uniformly Parikh-friendly words.

Keywords: Parikh matrix mapping; Parikh-friendly permutation; uniformly Parikh-friendly word.

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A MESHFREE METHOD FOR NUMERICAL SOLUTIONS OF SOME REACTION-DIFFUSION TYPE EQUATIONS

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Abstract

This study proposes a numerical approach to obtain approximate solutions of some nonlinear partial differential equations (PDEs) of reaction-diffusion type. To this end, for discretization of space variable a meshfree method based on radial basis function differential quadrature method is used. For discretization of time variable of considered PDE, a finite difference method is used. In this way, a full discrete system is obtained whose solution is used for construction of approxiamte solution. Some test problems are solved via proposed method. Acquired approxiamte solutions are compared with exact solutions and with some methods available in literature. From the comparisons, accuracy and feasibility of the proposed method are confirmed

Keywords: Radial basis function differential quadrature;Reaction-diffusion PDE; Numerical method.

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Optimal culling strategy for the fractional-order brucellosis transmission model

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Abstract

We suggest and solve an optimal culling problem within the fractional-order brucellosis model between interspecies. We aim to reduce exposed and infected sheep with the culling strategy while also minimizing the health and economic burden associated with brucellosis. We characterize the fractional optimal control with the Pontryagin Maximum Principle approach, considering the necessary optimality conditions proposed for the Atangana-Baleanu derivative [1,2], and solve the problem numerically by implementing the Adams-type predictor-corrector algorithm combined with the forward-backward sweep method [3].

Keywords: Adams-type predictor-corrector algorithm; Atangana- Baleanu; brucellosis; culling; optimal control;

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POINTWISE HEMI-SLANT SUBMERSIONS FROM COSYMPLECTIC MANIFOLDS

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Abstract

In this paper, we study pointwise hemi-slant submersions as a generalization of pointwise slant submersions and hemi-slant submersions from cosymplectic manifolds onto Riemannian manifolds. We investigate the integrability of distributions and the geometry of totally geodesic foliations which arise from the definition of such submersions. Moreover, we study the φ-pluriharmonicity of such maps.

Keywords: Riemannian submersion; pointwise hemi-slant submersion; cosymplectic manifold; pluriharmonicity.

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MULTIPLICATIVE RECTIFYING CURVE IN MULTIPLICATIVE EUCLIDEAN SPACE

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Abstract
In this talk the rectifying curves are studied in terms of the tools from multiplicative differential geometry. By several characterizations, we classify such curves in the multiplicative Euclidean space by means of the curves on a multiplicative sphere. Several examples are also given by figures.

Keywords: Rectifying curve; spherical curve, multiplicative calculus; multiplicative Euclidean space.

Acknowledgements: This study was supported by Scientific and Technological Research Council of Turkey (TUBITAK) under the Grant Number 123F055. The authors thank to TUBITAK for their supports.

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Solution of Fractional Order Partial Differential Equations with Hosoya Neural Network

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Abstract

In this article, we propose an innovative method that leverages the Hosoya neural network to solve fractional-order reaction-diffusion equations. The architecture of the Hosoya neural network comprises input, hidden, and output layers, each consisting of perceptrons. Specifically, we employ various degrees of the Hosoya polynomial as training functions for the hidden layer. Subsequently, the fractional-order diffusion equation is transformed into an optimization problem. In the subsequent step, we obtain approximate and exact solution graphics using the Python programming language within a specific algorithm. Notably, the results obtained from this study demonstrate greater practicality and efficiency compared to conventional solutions.

Keywords: Partial Differential Equations; Neural Network; Hosoya Polynomial; Fractional Calculus; Reaction Diffusion Equation

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A NEW FACIAL EXPRESSION RECOGNITION METHODS BASED ON HYBRID FEATURE

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Abstract

Within the scope of this study, an application that can predict emotions from people's facial expressions was developed. This developed application consists of two steps: feature extraction and classification. It is observed that there is a significant increase in classifier performance by obtaining robust features, which is an essential factor when extracting features. For this reason, in recent years, hybrid features have been received by combining features instead of classical feature extraction, and more robust features have been used to get more successful results in problems. In this study, support vector machine (SVM), XGBoost (XGB), logistic regression (LR) and random decision trees (RF) classification methods were used to compare the performance of classical features such as SIFT, SURF, KAZE and the HessianSIFT hybrid feature obtained by building the SIFT descriptor on the key points detected with the Hessian detector. The SIFT feature achieved the highest success rate of 95.41% accuracy with the SVM classifier, the SURF feature achieved the highest success rate of 86.75% accuracy with the SVM classifier, and the KAZE feature achieved the highest success rate of 93.07% accuracy with the RF classifier. CK+48 data set was used to obtain the study's performance data. As a result, by classifying the hybrid feature created using the Hessian detector and SIFT descriptive using the SVM method, the classification performance was significantly improved and a success rate of 98.67% was achieved.

Keywords: Robust Features; HessianSIFT; HOG+LBP; SURF; Classification; SVM.

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f −STATISTICAL CONVERGENCE OF DOUBLE SEQUENCES IN TOPOLOGICAL GROUPS

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Abstract

In 2003, Mursaleen and Edeley [5] first introduced the idea of statistical convergence of double sequences. Later, Cakallı and Savaş [3] defined this concept in topological groups. In this study, we gave the concept of f −statistical convergence for double sequences in topological groups by using the concept of unbounded modulus function. We also gave some inclusion theorems.

Keywords: Statistical convergence; Double sequence; Modulus function; Topological groups.

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AN INVESTIGATION OF A FUZZY BOUNDARY VALUE PROBLEM

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Abstract

In this paper, we investigate a fuzzy boundary value problem. We obtain fundamental results for solutions of the problem. Also, we prove when the solutions are valid fuzzy functions.

Keywords: Fuzzy boundary value problem; Fuzzy function; Fuzzy number.

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EXPLAINING OF DECISION MAKING PROCESSES WITH THE HELP OF INTUITIONISTIC FUZZY SETS

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Abstract

Mathematics and logic are deeply interconnected disciplines, with logic providing the framework for mathematical reasoning and mathematics contributing to the development of logical systems. Fuzzy logic provides a mathematical framework for dealing with vague and uncertain information. Intuitionistic fuzzy logic extends the concepts of fuzzy logic by incorporating hesitation and non-membership degrees alongside membership degrees, providing a richer framework for modeling uncertainty and ambiguity. Intuitionistic fuzzy logic is particularly well-suited for decision making problems where decisions need to be made based on multiple conflicting criteria. In such scenarios, intuitionistic fuzzy sets can represent the varying degrees of satisfaction or preference for different criteria, and decision making algorithms can be designed to take into account both the degrees of membership and non-membership in the decision process. In this study, a study was conducted on the applications of intuitionistic fuzzy logic and decision making methods. The methods themselves, which play an important role in the decision making processes, are interpreted by taking into account factors such as weight functions and the importance of decision makers, and their real life results through an original application.

Keywords: Intuitionistic fuzzy sets; Decision making.

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A NEW PARANORMED SEQUENCE SPACE GIVEN BY JORDAN TOTIENT FUNCTION

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Abstract

In this paper, we give a new paranormed sequence space by using the regular matrix given by Jordan Totient function and we prove that this space is linearly isomorphic to $\ell(p)$. Also we compute $\alpha-, \beta-, \gamma-$ duals and the Schauder basis of this space.

Keywords: Paranormed sequence space, $\alpha-, \beta-, \gamma-$ duals, Jordan Totient function.

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Detecting Android Malware Using LightGBM: A Study on the TUANDROMD Dataset

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Abstract

This study emphasizes the importance of security measures for users and organizations facing an increasing number of malicious software threats. The rapid evolution of these threats and the inadequacy of traditional detection methods necessitate the development of new and effective detection techniques. Therefore, this study aims to strengthen both user and organizational digital security by utilizing lightweight and powerful machine learning algorithms such as LightGBM to detect malicious software on the Android platform. Within this context, a model has been developed for detecting Android malware and goodware using the Dataset TUANDROMD. The TUANDROMD dataset comprises 241 features from 4465 Android applications, and techniques such as smoothing and synthetic data generation were employed to address dataset imbalances. The model was trained using LightGBM, a lightweight gradient boosting framework. It achieved an accuracy of 99.44% on the test set, with precision, recall, and F1-score values of 99% for both classes. Additionally, specificity values of 99.42% for class 0 and 99.45% for class 1 were observed. According to the confusion matrix results, only four false positive/negative predictions were made for both classes. These results demonstrate the high performance potential of LightGBM for Android malware detection and the effectiveness of enhancing the dataset through synthetic data generation.

Keywords: Android malware detection, Classification performance, LightGBM, Machine learning, Synthetic data generation, TUANDROMD

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ON THE CONSTRUCTİON OF A TOPOLOGY ON A ROUGH SEMİGROUP

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Abstract

The aim of this talk is to define the topology of a rough semigroup on an approximation space. Moreover, some basic properties and examples are presented.

Keywords: Rough sets, rough semigroup, topological semigroup, topological rough semigroup.

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VOTING CLASSIFIER BASED EXPLAINABLE ARTIFICIAL INTELLIGENCE METHOD FOR DETECTING GLIOMA GRADING USING CLINICAL AND MUTATION FEATURES

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Abstract

In this study, a voting classifier based explainable approach is proposed for glioma grading detection. Logistic Regression, K Nearest Neigbor, Support Vector Machine and AdaBoost are used in this system, which gives output with a voting system in line with the decision outputs of each classifier on the input data in a structure where different classifier structures are used together. Local Interpretable Model-agnostic Explanations method was used to provide an explainable structure of which features the classifiers focus on when making decisions on the input data.

In the experimental studies, the performance of Logistic Regression, K Nearest Neigbour, Support Vector Machine and AdaBoost algorithms were 93.45%, 92.86%, 94.05% and 90.48% respectively. In this study, where classifiers were used together in various combinations, the accuracy rate reached to 92.86% when all classifiers were used with the voting classifier. The obtained results will play an effective role in creating reliable models in the field of health by determining that each classifier can make different decisions on the same input data and according to which criteria they make these decisions. This study has made an important contribution in terms of its explainable aspect and creating a system where different classifiers will make a common decision.

Keywords: Biomedical Engineering, Explainable Artificial Intelligence, Glioma Grading, Machine Learning, Voting Classifier,

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A COMPARATIVE ANALYSIS OF TREE-INSPIRED FRACTAL BRANCHINGS DENDRIFORM STRUCTURES, FROM THE BC TO THE L-SYSTEM BASED STRUCTURES.

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Abstract

Prior to the advent of fractal geometry, the principles of natural geometry were enigmatic and could not be elucidated through conventional methodologies. In the present era, it is possible to employ quantitative techniques to describe the majority of geometrical configurations. This study examined the compatibility of geometric compositions when transferring from Euclidean geometry-based hand-drawing environments to digital drawing and computational CAD tools in architectural products with complex parametric designs. The study considered historical structures such as Saint Chapelle, Gloucester Cathedral, La Sagrada Familia, and Stuttgart Airport Terminal, as well as contemporary examples generated by parametric design tools. In this study, both past and current examples of parametric design were utilized as benchmarks. The plans and column head views of buildings were analyzed using the Fractal Analysis Method with software called FracLac, which acts as a plug-in within ImageJ. Sophisticated column geometry was generated as dynamic geometry using L-System rules and iteration principles. A solid substance was then constructed using Dynamo-PythonScript, which served as an interface command within Autodesk Revit. It thus appears that, contrary to popular belief, the geometry of dendriform structures is not particularly complex, yet exhibits unexpected behavior.

Keywords: Computational architecture, Dendriform, Fractal geometry, Iterative generation method Parametric design.

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Multi-category classification of inappropriate content on social media using Natural Language Processing techniques and Transformer Models

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Abstract

The expansion of social media utilization has led to a surge in user-generated content, presenting critical challenges in online content moderation task. Identifying and categorizing inappropriate content, such as offensive, toxic, sarcastic, and sexist text, has become imperative. In this paper, we present a novel approach to multi-category classification of inappropriate content on social media platforms utilizing advanced Natural Language Processing (NLP) techniques and Transformer-based Models[1] . Particularly, we explore the use of fine-tuned versions of BERT[2] and RoBERTa[3] pre-trained Transformer-based models for our classification task. Our strategy includes preprocessing the input content and training these models on a curated dataset sourced from more than ten datasets dealing with inappropriate content. We illustrate the viability of our approach by accomplishing accuracy scores of 0.98 and 0.97 for improper text detection and classification utilizing the fine-tuned BERT and RoBERTa models, respectively. Our findings emphasize the potential of leveraging state-of-the-art NLP techniques for strong detection of inappropriate content in social media.

Keywords: Natural Language Processing; BERT; RoBERTa; Offensive language; sexism detection ; toxic; sarcasm.

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INVERSE SCATTERING PROBLEM FOR DISCONTINUOUS STURM-LIOUVILLE OPERATOR

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Abstract

In this paper, the inverse scattering problem for Sturm-Liouville operator with discontinuous coefficient and transmission conditions at some point on the positive half plane is examined. The modified Marchenko equation of the inverse scattering problem is obtained and the reconstruction algorithm of the potential function from scattering data of this problem is given.

Keywords: Inverse scattering problem; Sturm-Liouville equation; main equation.

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A Probabilistic Chaotic Image Encryption Scheme

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Abstract

We propose a probabilistic image encryption scheme that improves on existing deterministic schemes by using a chaining mode of chaotic maps in a permutation-masking process. Despite its simplicity, the permutation phase destroys any correlation between adjacent pixel values in a meaningful image. The masking phase modifies the pixel values of the image at hand using pseudorandom numbers with some other initiated random numbers so that any slight change in the plain image spreads throughout the corresponding cipher image. These random numbers ensure the generation of distinct cipher images for the same plain image encryption, even if it is encrypted multiple times with the same key, thereby adding some security features. Simulations show that the proposed scheme is robust to common statistical and security threats. Furthermore, the scheme is shown to be competitive with existing image encryption schemes.

Keywords: Image encryption; chaotic systems; pseudorandom number generators; permutation; diffusion

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*Abstract Submission should be prepared only **1 page**.

Exploring Divergence Measures: Concepts, Applications, and Advances across Disciplines

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Abstract

Divergence measures serve as crucial statistical instruments for quantifying dissimilarities between probability distributions. This study delves into the realm of divergence measurements, elucidating fundamental principles, diverse applications, and recent advancements. Offering a holistic comprehension of these measures, it underscores their pragmatic utilities across multiple domains. Embracing well-known metrics such as Kullback-Leibler, Jensen-Shannon, and Hellinger divergences alongside their extensions, the research explores their applications within machine learning, information theory, signal processing, and image analysis.

Keywords: Divergence measures; Probability distributions; Information theory; Machine learning

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Fixed Points of multiplicative Zamfirescu Mapping in Multiplicative Metric Spaces

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Abstract

In this study, we will examine some fixed point theorems and their applications to Zamfirescu mappings in multiplicative metric spaces. First of all, we will give some basic concepts in the theorems that we will use in the study. Later, we will give preliminary information about some mappings in metric spaces and multiplicative metric spaces. Finally, based on the theorems, we will find the Zamfirescu mappings has a fixed point in the metric spaces and multiplicative metric spaces.

Keywords: Multiplicative metric space, fixed point, metric space, Zamfirescu mappings.

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q −Bell Statistical Convergence

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Abstract

In this paper, we use to the q −Bell matrix $\hat{B}_q = \hat{B}_{nk}(q)$ to introduce the notions of q −Bell summability, q −Bell statistical convergence, strongly $\hat{B}_q[p]$ −Cesaro summability and give some inclusion relations about these concepts.

Keywords: q −Bell numbers; q −analog; Statistical Convergences.

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Mathematical Analysis and Modeling of Biofouling in Urban Water Filtration Systems

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Abstract

This study aims to introduce mathematical analysis and mathematical modeling strategies to increase the performance of microfiltration and ultrafiltration systems. Initially, we will discuss the biological and engineering background. Next, we address the mathematical analysis and formulations. Finally, the results will be analyzed and evaluated using some computer simulations.

Keywords: Microfiltration, Ultrafiltration; Biofouling; Mathematical Modeling

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Effective Method for Analyzing Nonlinear Mathematical Model Behavior

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Abstract

The exponential function method (MEFM) has been utilized to investigate the behaviors of the Joseph-Egri (TRLW) equation, which is one of the nonlinear mathematical models. This method is known to be an effective technique for obtaining solution functions that support such nonlinear mathematical models. In this study, solution functions satisfying the Joseph-Egri (TRLW) equation have been obtained using the MEFM. To further examine the behaviors of the resulting solutions in detail, computer codes suitable for programming have been written, and two- and three-dimensional as well as sensitivity and contour plots have been obtained.

Keywords: Modified Exponential Function Method (MEFM); Joseph-Egri (TRLW) equation; Behavior of traveling wave solutions.

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Ostrowski type inequalities via fractional integrals and related results

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Abstract

In this work, we introduced the Ostrowski inequality based on M-fractional integrals. we initially established an identity concerning this inequality to prove the Ostrowski inequality based on M-fractional integrals. We derive some results for the Ostrowski inequality utilizing this identity, different convex of classes of functions, and well-known inequalities.

Keywords: Ostrowski; Convex function; Fractional inequality.

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PERSONALITY ANALYSIS USING ARTIFICIAL INTELLIGENCE ACCORDING TO THE EYE DESCRIPTIONS IN MARIFETNÂME

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Abstract

Body language, facial structure and general appearance can give many clues about a person's character at first impression. Therefore, people often form their prejudices about a person by basing their first impressions on these clues. The relationship between certain physical characteristics and character and intelligence has been remarkable historically as well as in modern science. In Old Turkish Literature, there are works aimed at character analysis from human physical characteristics. One of these works is Marifetnâme, written by the famous scientist and clergyman İbrahim Hakkı of Erzurum in 1756. In the section of Marifetname called "mirror of bodies", a connection is established between the human body and facial structures and the spiritual aspect. In this study, this connection written by İbrahim Hakkı was transformed into practice with today's technologies and artificial intelligence was used to carry out the character analysis of İbrahim Hakkı. For the decision process, training was performed with three different deep learning-based CNN models (AlexNet, ResNet and YOLOv8) and the results were compared. The proposed application process is based on three steps: In the first step, from each image in the dataset, first the face regions and then the areas where the eyes are located are cropped with a facial landmark detection algorithm. In the second step, an artificial intelligence model was determined to predict the eye structure in each frame. The third step aims to detect in real time the character trait associated with the eye structure determined using this model in Marifetname. As a result of this study, character analysis matched with 96% accuracy according to the developed artificial intelligence-based application process.

Keywords: İbrahim Hakkı; Marifetnâme; Artificial intelligence; Character analysis; Personality.

Exponential Inequalities Involving Riemann-Liouville Fractional Integral

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Abstract

New inequalities related to Riemann-Liouville Fractional integrals for exponential functions are provided. Also, some special cases of these results are examined.

Keywords: Riemann-Liouville Fractional Integral, Ostrowski Inequality, Exponential

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CONFORMABLE STURM-LIOUVILLE PROBLEM WITH TWO PARAMETER

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Abstract

In this study, we used conformable derivatives to define the Sturm-Liouvillle problem with two parameters and examined various spectral properties associated with them. First of these properties, the Sturm-Liouvillle problem with two parameters was reduced to the simpler one-parameter problem. This reduction provides an important perspective for better understanding the fundamental structures of the problems. Additionally, we focused on the orthogonality properties of eigenfunctions. These properties play a critical role in understanding the behavior and relationships of solutions. Investigating the reality of solutions is important to understand the physical relevance and practical usability of the considered eigenvalue problem. This analysis provides a deeper understanding of the system's behavior and potential applications. Finally, we examined integral relations, which are used to explain important connections and relationships between different aspects of the system.

References [1-5] form the basis of our study, and quality and effective results have been carried out from these studies.

Keywords: Conformable Derivative, Eigenvalue Problems, Sturm-Liouville Problems.

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q −Pell Sequence Spaces

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Abstract

In this study, we build q-analogue of the q-Pell matrix $\tilde{P}_q = \left(\tilde{P}_{nk}(q)\right)$ defined by

$$\tilde{P}_q = \left(\tilde{P}_{nk}(q)\right) = \begin{cases} \dfrac{q^k P_{k-1}(q)}{P_n(q) - P_{n-1}(q)}, & n-1 \le k \le n \\ 0, & otherwise \end{cases} \quad n,k = \{2,3 \ldots\}.$$

After, we use this analogue to define the sequence spaces $c(\tilde{P}_q)$, $c_0(\tilde{P}_q)$, $\ell_\infty(P_q)$, $\ell_p(\tilde{P}_q)$ $(1 \le p < \infty)$. Then, we provide some inclusion relations for these spaces and examine a few topological characteristics. Furthermore, we construct a basis for the space $\ell_p(\tilde{P}_q)$, calculate α-, β-, γ- duals of the same space, describe certain matrix classes and look at some geometric properties.

Keywords: Pell numbers; q −Pell numbers; q −analogue; Dual Spaces; Matrix Transformations; Banach-Saks Property.

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ON ρ-STATISTICAL CONVERGENCE DEFINED BY MODULAR SEQUENCE SPACES OF ORDER α

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Abstract

In this paper, we introduce Wijsman ρ-statistical convergence of order α and Wijsman strongly ρ-convergence of order α and define $\left[W_\rho^\alpha, \mathcal{M}, v, p\right]$ by using a sequence of Orlicz functions. Also, some inclusion theorems are presented.

Keywords: Wijsman convergence; statistical convergence; Orlicz function.

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Developing High-Efficiency Organic Solar Cells through Molecular Design Analysis of Novel D-A-Di-A-D Conjugated Compounds

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Abstract

In this investigation, we employed the DFT/TD-DFT/B3LYP/6-31G(d,p) method to analyze the structural, optoelectronic, and optical properties of a series of conjugated compounds characterized by a modular D-A-Di-A-D architecture. These compounds feature a D donor unit (carbazole), an A acceptor unit (benzothiadiazole), and various Di donor units. Utilizing AMPS-1D, we scrutinized the photovoltaic properties of these compounds when combined with the PCBM acceptor, dividing our analysis into three distinct phases. Initially, we assessed the energy conversion efficiency of the compounds, observing performances ranging from 7.11% to 11.70%. Introducing a PEDOT layer between the active layer and the anode in the second phase resulted in a significant enhancement in photovoltaic performance, achieving energy conversion efficiencies of up to 15.31%, the highest recorded in our study. Lastly, incorporating ZnO as an intermediate interface layer in the third phase notably improved photovoltaic performance across all compounds, with energy conversion efficiency values reaching 17.13%, 17.20%, and 18%. These findings underscore the effectiveness of ZnO addition in enhancing photovoltaic conversion, highlighting its potential for organic solar cell applications. Overall, our results suggest that these compounds hold promise as viable candidates for bulk heterojunction organic solar cell applications.

Keywords: Organic compounds; BHJ; Efficiency; PEDOT; ZnO

A NEW FRACTIONAL MODELLING OF RC ELECTRIC CIRCUIT

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Abstract

In this study, we introduce a new fractional RC electric circuit model with the generalized Caputo fractional derivative and obtain analytical solutions via the generalized Laplace and inverse Laplace transforms. We also compare the approximate behavior of the solution of the new fractional RC electric circuit model with the approximate behavior of the solutions of RC electric circuit models defined by the Caputo, Caputo-Fabrizio fractional derivatives and conformable operator, which can be found in the literature.

Keywords: Fractional derivatives; Electric circuits; Mathematical modellings.

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ON WAVE STRUCTURES OF TIME CONFORMABLE ZAKHAROV–KUZNETSOV EQUATION

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Abstract

This study reveals the soliton wave solutions of the time conformable Zakharov–Kuznetsov equation, which models complex wave phenomena in diferent contexts, such as surface water waves, ion-acoustic waves in plasma, and some optical models. A robust solution technique, Sardar sub-equation method is utilised to obtain solutions of the equation with dual power law nonlinearity. The physical implications of the obtained results are illustrated by symbolic computation tools.

Keywords: Zakharov–Kuznetsov equation; Sardar sub-equation method; Dual-power law nonlinearity.

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ON USING A NEW APPROACH TO DETERMINE THE ROOT OF NONLINEAR EQUATIONS

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Abstract

This article presents a recently developed method for solving nonlinear equations. Various iterative methods can be employed to solve nonlinear equations, including the Bisection method, the Newton-Raphson method, the Secant method, the Regula Falsi method, and others. The objective is to identify the roots of nonlinear equations by utilizing polynomial curves obtained through Lagrange interpolation under specified initial conditions, without resorting to any derivative processes. The efficacy of the proposed method has been demonstrated through the examination of well-known examples from the literature.

Keywords: Lagrange approximation; Nonlinear equation; Root finding

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Modeling Epidemics Using Ising Model and Voronoi Tessellation: A Novel Study and Epidemiological Applications

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Abstract

This article aims to investigate the spread of diseases by drawing inspiration from the Ising model in physics. The Ising model, known for simulating magnetic properties, is introduced into the field of disease epidemiology as a novel application area. While Voronoi tessellation provides location data representing individuals' health statuses, the Ising model is employed to model interactions among neighbors. A modified Ising model will be developed to analyze the speed and impact of disease spread, to be examined through Monte Carlo simulations and the Metropolis algorithm. The goal of this article is to assess the potential use of the Ising model in disease epidemiology, contributing to a better understanding of disease spread processes and the development of effective control strategies.

Keywords: Voronoi Tessellation; Ising Model; Monte Carlo Simulation; Metropolis Algorithm; Disease Spread.

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Designing a novel radial basis process for the nonlinear prey-predator system

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Abstract: In this research, a novel deep neural network process (DNNP) is proposed for solving one of the dynamical prey-predator nonlinear systems (PPNS). The mathematical PPNS is based on two categories, one is prey and other is a predator. The proposed DNNP contains three hidden layers with 15, 30 and 45 numbers of neurons, while the log-sigmoid activation function is used in each hidden layer in order to solve the dynamical PPNS. The optimization is performed through the scale conjugate gradient procedure for solving the dynamical PPNS. An Adam method is used to get the dataset, which is used to train the process through scale conjugate gradient by dividing the data into training as 74%, while 13% for both validation and testing. The correctness of the DNNP using the optimization of scale conjugate gradient is observed by using the overlapping of the proposed and reference solutions. The accuracy of the scheme is also observed through the small absolute error values and correlation coefficient values that are obtained as 1 for solving the model. Moreover, the values of the state transitions, error histogram and fitness function performances approve the accuracy of the proposed DNNP using the optimization of scale conjugate gradient for solving the dynamical PPNS.

Keywords: Dynamical prey-predator, Deep neural network; Scale conjugate gradient; Log-sigmoid; Hidden layers.

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LIE ALGEBRA AND SOME GEODESIC PROPERTIES

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Abstract

Geodesy is a word of Greek origin. Geo=earth, world; dezi=means to divide, measure. Geodesy is the science of measuring and projection of the earth's surface. we tried to define Lie groups and Lie algebra based on some definitions about groups and algebra in real numbers. Then, we talked about some Geodesic features and tried to analyze this Geodesy mathematically first. Later, we tried to work on their adaptation to space geometry. For example; we related this to Euler's formula by applying it to the rotational ellipsoid. On the other hand, with the help of Frenet trihedron, we defined tangent and normal unit vectors on the surfaces and obtained curvature and curvature radii accordingly. The reason for all this work was to obtain the Geodesy curve and equation. Therefore; with the help of these studies, we tried to obtain the curvature of a curve and its equation on any surface in space. As a matter of fact, when we adapted this to the earth ellipsoid, we obtained Geodesic equations under the name of Geodesic curvature. Then, using this Geodesic curvature, we obtained the Geodesic torsion and its equation. In conclusion; we have concluded that the shortest curve between any two points on a surface in space is the Geodetic curve.

In this study, we took into consideration the previous studies and tried to find definitions and equations related to different Lie groups and Lie algebras and obtain Geodesic curvature, Geodesic equation and Geodesic torsion.

Keywords: Lie Group, Lie Algebra, Geodesic Curvature, Geodesic Equation, Geodesic Torsion.

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CURVATURES COMPUTATION FOR CURVES IN AFFINE SPACE USING FRACTIONAL CALCULUS

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Abstract

This paper proposes a method to compute the curvatures of equiaffine curves in affine space using local fractional derivatives. It introduces the concepts of α-equiaffine arc length and α-equiaffine curvatures through a generalized local approach involving conformable, V-derivative, and similar methods. Equiaffine Frenet formulas and curvatures are reestablished within fractional calculus.

Keywords: Affine space; Fractional Calculus; Curvatures.

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EXPANDING FRACTIONAL EQUIAFFINE CURVATURES OF PLANE CURVES

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Abstract

This study focuses on equiaffine plane curves, employing a generalized local fractional derivative. It introduces the concepts of α-equiaffine arc length and curvature. Equiaffine Frenet formulas and an equivalent of the fundamental theorem are reintroduced within fractional calculus. Additionally, the study describes plane curves with constant fractional equiaffine curvature.

Keywords: Affine space; Fractional Calculus; Curvatures.

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Several Integral Representaions of the $p-k$ Srivastava's triple hypergeometric functions

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Abstract

This paper introduces newly $\_{p}H\_{A,k}$, $\_{p}H\_{B,k}$, and $\_{p}H\_{C,k}$ Srivastava's triple hypergeometric function using $p-k$ Pochhammer symbol. We also present relationship between $p-k$ Srivastava's triple hypergeometric functions and classical Srivastava's triple hypergeometric functions. Then, we obtain some properties of the $p-k$ Srivastava's triple hypergeometric functions such as integral representations and recurrence formulas.

Keywords: Srivastava hypergeometric function; Integral representations; Derivative formula; Recurrence relations

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Fractional Solutions of the General Class of Non-Fuchsian Differential Equations

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Abstract

In this article, we consider the non-Fuchsian differential equation, which is a general class of second-order differential equations with singular points, such as Fukuhara, Tricomi, Whittaker, Bessel, whose solutions are obtained by different methods in the literature. Then, we obtain new fractional solutions with the help of the fractional operator. This operator is applied to homogeneous and non-homogeneous linear ordinary differential equations. Thus, we obtain new solutions in fractional forms with a newly developed method.

Keywords: Fractional calculus; Non-Fuchsian equations; Differential equations.

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Weighted Statistical Convergence in Probability

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Abstract. In this study, we introduce the concept of weighted statistical convergence in probability and also give some inclusion relations about weighted statistical convergence.

Keywords: Density, Statistical convergence, Sequence of random variables, Weighted statistical convergence.

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THE NEW GOMPERTZ DISTRIBUTION

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Abstract

This research introduces a new four parameter Marshall Olkin Power Gompertz distribution model. The novel model has many sub-models that are very useful in modeling real-life data such as extended Gompertz distribution. The proposed distribution was compared with its sub-models and other existing models

Keywords:.Gompertz Distribution, Marshall Olkin Distribution.

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ANALYSIS OF MATHEMATICAL MODEL WAVE SOLUTIONS WITH THE EXPONENTIAL FUNCTION METHOD

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Abstract

In this study, the analysis of the exponential function method, which is used to obtain traveling wave solutions of partial differential equations and has many applications in the literature, will be included. In addition, the method was used to find the exact solution of the Gibbon equation and several solutions depending on arbitrary parameters were obtained. It has gained validity as an easy, simple and effective method for nonlinear equations that arise in mathematical physics.

***Keywords**:* Exponential function method; exact solution; Gibbon equation; nonlinear wave equations

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PREDICTING STUDENT PERFORMANCE USING STATISTICAL LEARNING TECHNIQUES

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Abstract

Universities accumulate large amounts of student data electronically. Filtering a data according to certain criteria, based on the information stored in the database, becomes difficult when executed manually. Therefore, it is very important to implement tools that analyze data in statistical, descriptive or computational ways. The objectives of this study are listed below:

- To examine and identify the variables used to analyze student performance.
- To examine existing prediction methods for predicting student performance.
-To select a student dataset from the Kaggle website dataset repository ("https://www.kaggle.com/datasets"). Apply machine learning algorithms for classification and prediction on the dataset. Analyze and compare the performance of these algorithms.

Keywords: Machine learning algorithms; Student performance; Kaggle.

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ON THE INVERSE PROBLEM FOR A SECOND-ORDER DIFFERENTIAL OPERATOR WITH A MATRIX POTENTIAL

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Abstract

In this paper, we considered an inverse problem for a second-order differential operator with a matrix potential. In the present study, using Mizutani's method, it was obtained the inequalty concerning the structure of the potentials difference.

Keywords: Inverse problem; Matrix potential; Wellposedness

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COMPARISON OF DETERMINISTIC AND STOCHASTIC DYNAMICS OF SIR MODEL

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Abstract

In this paper we analyse the deterministic and stochastic SIR (Susceptible, Infected, Recovered) models for the comparison of epidemic models. We first introduce the deterministic model and then extend it to its stochastic equivalent. While the deterministic model describes the dynamics of disease spread using mathematical differential equations, the stochastic model offers a more realistic approach involving random events and probabilities. The work, also analyses the impact of both models on the parameters using mathematical calculations based on real data and MATLAB software. The effects of important model parameters such as transmission rate and recovery rate on the models and their results were compared and discussed.

Keywords: SIR model, Brownian motion, Stochastic differential equations, Parameter estimation

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GPLM for Regression of Complex Systems

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Abstract

Complex systems in a network structure arise in several real-life phenomena where the complexity of such systems can increase due to the existence of a large number of variables and unknown parameters. Linear models are generally used to find the unknown parameters which describe the interactions between the components, but in real-life problems they are non-linearly implied. Therefore, more appropriate models need to be investigated to represent accurately both the linear and nonlinear interactions appearing simultaneously in such systems. In this study, the Generalized Partial Linear Model (GPLM) approach (see [1-3] and references therein) is presented for the dynamical modelling of complex regulatory networks to improve the system identification.

Keywords: Mathematical modelling; Regression; Computational biology.

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PLANAR CONGRUENT CURVES ACCORDING TO CAPUTO FRACTIONAL DERIVATIVE

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Abstract

In this paper, a new definition of the Frenet vector of planar curves by means of the Caputo fractional derivative is given. Then planar congruent curves with respect to the new Frenet vectors,are defined and their properties under some special cases are investigated.

Keywords: Caputo fractional derivative, Plane curves, Congruent curves

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DYNAMICS OF A PLANT-HERBIVORE MODEL SUBJECT TO ALLEE EFFECTS WITH LOGISTIC GROWTH OF PLANT BIOMASS

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This paper explores the relationship between herbivores and plants with a strong Allee effect, using the logistic equation to model plant growth. We analyze equilibrium points and their stability, identifying several bifurcations. We discover an Allee threshold below which both populations face extinction, but above which coexistence is stable. Numerical simulations suggest that this range of stability can be extended. The system is found to be highly parameter sensitive. A comparison with a system without strong Allee effects is an enrichment of our understanding.

Keywords: Strong Allee effect; bifurcations; logistic growth; plant-herbivore model; stability

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DECODING STRUCTURAL ISOMER: AN ARTIFICIAL INTELLIGENCE APPROACH TO CLUSTER DETECTION

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Abstract

This study utilizes artificial intelligence to decipher the complex network of isomer connections utilizing sophisticated community detection methods. We utilize artificial intelligence methods to examine molecular networks created from several structural and chemical distance metrics, including Euclidean and Levenshtein distances. Through the utilization of community recognition techniques rooted in deep learning, we are able to discern discrete clusters among the isomers, revealing cohorts that possess common structural and chemical characteristics. The network analysis uncovers notable patterns throughout these isomer communities, providing insights into the molecular traits that support their biological roles and chemical activity. Statistical tests comparing molecular properties across identified clusters demonstrate large disparities in important attributes such as lipophilicity, molecular refractivity, hydrogen bonding capacity, molecule shape, and polar surface area. The results emphasize the practical consequences of the variety of structures in isomer networks and emphasize the ability of AI to uncover intricate connections in chemical systems. Our findings provide a structure for future investigation of molecular variety through the utilization of artificial intelligence-based methods for identifying communities.

Keywords: Deep learning; Mathematical chemistry; Complex networks.

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MEASURING AND ASSESSING ORGANIZATIONAL DATA MATURITY

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Abstract

In today's competitive business environment, data is a crucial factor. Infinite amount of data is produced from many different sources for almost all business types, but these data are meaningless unless analyzed and transformed into significant results. Therefore; as the organizations improve their ability to be data driven, the more competitive they become. The importance of data maturity concept emerges at this point.

Data maturity is defined as a journey towards improvement and increased capacity in data use, and it is a measure of how advanced organizations are in their data-driven way of doing business. It can be measured not by how much data a business collects, but by how much it processes, analyzes and uses this data in its business processes to make the right decisions. In this study, we study a framework to collect data through sectoral questions specific to organizations, make changes on the question sets autonomously with dynamic learning methods depending on the answers received, determine the level of data maturity based on the outputs of the analyses. Also, the system will be supported with various suggestions for end-users to make decisions accordingly.

Keywords: Data maturity; Maturity assesment; Data management.

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The Novel Numerical Solutions of the Cahn-Hilliard Equation via the Novel Hybrid Method

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Abstract

The objective of this study is to explore innovative numerical techniques for solving the Cahn-Hilliard equation. A new hybrid approach is employed to solve the equation. Furthermore, the solutions are visualized using Maple software through two-dimensional and three-dimensional graphs. Computer simulations are performed to verify the effectiveness and dependability of the proposed method.

Keywords: Novel hybrid method, Numerical solution, Cahn-Hilliard equation.

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The New Numerical Solutions of the Navier-Stokes Equation with the New Hybrid Method

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Abstract

The objective of this study is to explore the new numerical solutions to the Navier-Stokes equation. The new hybrid method is utilized to solvee Navier-Stokes equation. Additionally, two and three-dimensional graphs of the obtained solutions were drawn in Maple software. The purpose of the computer simulations was to verify the effectiveness and dependability of the suggested approach.

Keywords: New hybrid method, Numerical solution, Navier-Stokes equation.

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The Novel Numerical Solutions of the Rosenau-Hyman Equation via the Novel Hybrid Method

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Abstract

The aim of this study is to investigate novel numerical methods for solving the Rosenau-Hyman equation. The Rosenau-Hyman equation is solved using a new hybrid approach. In addition, the solutions were graphed in Maple software using both two-dimensional and three-dimensional graphs. The computer simulations were conducted to validate the efficacy and reliability of the proposed approach.

Keywords: Novel hybrid method, Numerical solution, Rosenau-Hyman equation.

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HOW TO DETERMINE THE OPTIMAL STRATEGIES TO ELIMINATE THE HARMFUL EFFECTS OF TECHNOLOGY ADDICTION?

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Abstract

Addictions spread from person to person, just like epidemics. For this reason, various mathematical models have been developed and optimal control strategies have been realized in order to understand the dynamics of addictions and prevent the harmful effects they cause.

With the developing technology, technology addiction has become a factor affecting our lives. This study aims to control the level of an individual's technology addiction and examines the cost of combating addiction with different control strategies. The discussed SLHB model is developed as SLHBR model by considering the recovered compartment into the model.

Before formulating the optimal control problem for the model, the existence of optimal control is ensured. Then, the optimal system is obtained by using Hamilton's formalism. Numerical results are simulated with the Python programming language. In the graphs, the effect of the proposed control strategies and the uncontrolled model are compared. Thus, the importance of implementing optimal strategies to prevent technology addiction is revealed.

Keywords: Technology Addiction; Optimal Control; Mathematical modeling; Epidemiology.

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AN OPTIMAL TRAINING POLICY TO REDUCE CRIMINAL BEHAVIOR

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Abstract

Crime and criminal behavior greatly affect countries socially and economically. Specifically, as the crime rate increases, countries increase their expenditures for prisoners. Reducing crime and criminal behavior ensures peace for the citizens of a country. In this study, we consider a mathematical model to reduce crime dynamics. The model divides society into four groups: susceptible individuals, criminally active individuals, criminals in prison, and reformed individuals. By adapting the control function to the model as a training parameter, we examine the behavior of the prescribed model under this control function. To obtain the effect of the training, we simulate the graphs with the help of the MATLAB software. The graphical results show that the suggested training strategy is optimally effective in reducing criminal behavior as desired.

Keywords: Mathematical model; Optimal Control Theory; Crime Model; Pontraygin's Maksimum Principle.

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ON f-STATISTICAL CONVERGENCE VIA q-CALCULUS

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Abstract

In this paper, we introduce the the concept of $q-$ statistical convergence and $q-$strongly Cesàro summability by using a modulus function. We also give some inclusion relation between this concepts.

Keywords: Statistical convergence; q- Cesàro matrix, Modulus function.

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A RESEARCH ON THE QUALİTATİVE BEHAVİOR OF SOLUTİONS OF NEUTRAL SYSTEMS WİTH PERİODİC COEFFİCİENTS

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Abstract

In this search, we consider a class of nonlinear neutral type systems (NNSs) with periodic coefficients. Some assumptions guaranteeing the exponential stability of the zero solution are pointed out by using the Lyapunov-Krasovskii functional. Under these assumptions, we give some estimates that characterizing the decay rate of solutions at infinity. We give two examples to demonstrate the applicability of the obtained results.

Keywords: Exponential decay, Lyapunov functional, neutral systems, periodic coefficient.

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Explicit Solutions of the Schrödinger Equation Using Fractional Analysis

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Abstract

In this article, the Schrödinger equation with Coulomb potential in $\alpha-$ dimensional fractional space is considered and the radial and angular equations are obtained by the method of separation of variables. Appropriate transformations are made for the solution of the radial equation and the explicit solutions of the second order linear differential equation with singular coefficients are obtained with the help of fractional analysis.

Keywords: Fractional calculus; Schrödinger equation; Differential equations.

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DIRAC SYSTEMS THAT CONTAIN EIGENVALUE DEPENDENT BOUNDARY CONDITIONS

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Abstract

In this article, we deal with the Dirac operator with eigenvalue dependent boundary conditions. Then, we obtain essential and significant results by modifying some known techniques for the presented problem.

Keywords: Dirac system; Eigenvalue dependent bounday conditions; Sampling theory.

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STRUCTURAL, OPTOELECTRONIC AND PHOTOVOLTAIC PROPERTIES OF NEW CONJUGATED SMALL MOLECULES FOR ORGANIC SOLAR CELLS

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Abstract

A series of new conjugated molecules with small band gaps were studied by DFT and TD-DFT methods to propose them as active layers for organic solar cells. The AMPS-1D program was used to simulate and determine the photovoltaic characteristics and cell performance. The organic compounds studied are the basis of the donor unit Triphenylamine, phenylenevinylene and different units such as 3, 4-ethylenedioxythiophene (EDOT), carbazole and thiophene. DFT and TD-DFT calculations show strong linearity of the molecules and the calculated values of different characteristic quantities of these molecular compounds suggest that they are good candidates for use in organic solar cells. The simulation results of solar cells based on our donor material and PCBM as acceptor confirm the conclusion obtained, especially since the power conversion efficiency (PCE) reaches a significant value of 8.58%.

Keywords: Organic materiel, DFT, Solar cell, Power conversion efficiency.

Numerical Solution of the Singularly Perturbed Cauchy Problem for an Ordinary Differential Equation

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Abstract

For a visual description of Lomov's method, we consider the Cauchy problem for a scalar first-order ordinary differential equation:

$$L_\varepsilon u(x,\varepsilon) \equiv \varepsilon u' + a(x)u = f(x), \quad x \in [0,1\},$$

$$u(0,\varepsilon) = u^0, \tag{1}$$

where a(x)>0 $\forall\, x \in [0,1]$, $a(x), f(x) \in C^\infty[0,1], \varepsilon > 0$ is a small parameter.

Using the method of Lomov [1], we reduce the singularly perturbed problem (1) to a problem regular in ε when $\varepsilon \to 0$. To do this, let us introduce a regularizing variable in the following form:

$$\xi = \frac{\varphi(x)}{\varepsilon} = \frac{1}{\varepsilon}\int_0^x a(s)ds \tag{2}$$

and, instead of $u(x,\varepsilon)$ we will consider the extended function $\tilde{u}(x,\xi,\varepsilon)$ such that,

$$\tilde{u}(x,\xi,\varepsilon)|_{\xi=\varphi(x)/\varepsilon} \equiv u(x,\varepsilon). \tag{3}$$

Next, we will partially discretize the extended problem and construct a difference scheme.

Keywords: Lomov's method; Cauchy problem; Singularly perturbed problem.

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INFECTIOUS DISEASE MODELS WITH PROPORTIONAL DERIVATIVES ON TIME SCALES

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Abstract

Fractional calculus is a generalization of ordinary calculus, which includes derivatives and integrals of non-integer order. This field dates back to the times of Leibniz, Gauss, and Newton, who invented such calculations centuries ago. For three centuries, the theory of fractional calculus developed solely as a theoretical area useful to mathematicians. However, in recent times, it has drawn the interest of many scientists and engineers. Furthermore, time scale theory was first introduced by Hilger to unify discrete and continuous phenomena in mathematics. The aim of this study is to establish and solve SIR (Susceptible-Infectious-Recovered) model, which is one of the infectious disease models containing proportional derivatives, on a time scale. While solutions for the classical case of the SIR model exist, solutions will be obtained using proportional derivatives on a time scale in this study. Finally, solutions will be a special case of classical solutions.

Keywords: Time Scales; Proportional Derivative; SIR Model.

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The Concretization Process of the "Pyramid" Concept; Deaf Student Example

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Abstract

In this investigation, we explored the utilization of sign language and gestures in concretizing the pyramid from 3-dimensional geometric objects particularly focusing on their integration into the mathematics learning process. Sign language, being the native language of deaf individuals, encompasses systematic and traditional movements of the hands, face, and body. Sign language (SL) primarily employs manual modality, serving as a substitute for speech among deaf or hard-of-hearing students. Gestures are defined as spontaneous movements of the arms and hands that are closely synchronized with speech. The participants in this case study consist deaf students. Data were gathered through semi-structured interviews and document analysis, which were subsequently subjected to content analysis. The analysis revealed that hand signals, including gestures and sign language, are predominantly employed in elucidating the pyramid and its attributes, while representations such as writing and drawing figures are less frequently utilized. Based on these findings, it is suggested that educators incorporate hand, arm, and body movements into their classroom practices to facilitate the concretization of mathematical concepts, given the significant utilization of hand signs by students.

Keywords: Sign Language; Gesture; Pyramid; Deaf Student

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Modified Exponential Function Method for Two-Dimensional Nonlinear Mathematical Model

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Abstract

In this study, we use the modified exponential function method (MEFM) to investigate the solutions of 2DBSE. MEFM is a powerful mathematical technique for obtaining exact and approximate solutions to nonlinear PDEs, especially soliton solutions. In this way, we obtain traveling wave solutions belonging to the nonlinear mathematical model. We analyze the behavior of these solution functions with the help of the program.

Keywords: Modified Exponential Function Method (MEFM); The two-dimensional breaking soliton equation (2DBSE); Traveling wave solutions.

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The Calculation of the Trace Formulas for Dirac Operator by Lax Method

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In this work the trace formula is calculated by Lax method [1] for Dirac operator in $[0, \pi]$. We consider Dirac operator [2] with self-conjugated boundary condition

$$Ly = \begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix} \begin{bmatrix} y_1 & (x) \\ y_2 & (x) \end{bmatrix} + \begin{bmatrix} p(x) & 0 \\ 0 & q(x) \end{bmatrix} = \mu \begin{bmatrix} y_1 & (x) \\ y_2 & (x) \end{bmatrix}$$

where $p(x),\ q(x) \in C^2[0, \pi]$. Let L_0 is operator L in the case $p(x) = 0,\ q(x) = 0$.

Theorem .1 *Let* $\{\mu_n\},\ n \in Z$ *denote eigenvalues of operator* L, $\{\mu_n(0)\},\ n \in Z$ *denote eigenvalues of operator* L_0*, then*

$$\sum_{n=-\infty}^{\infty} [\mu_n - \mu_n(0)] = \int_0^{\pi} p(x) S_1(x) dx + \int_0^{\pi} q(x) S_2(x) dx,$$

where

$$S_1(x) = \sum_{n=-\infty}^{\infty} [y_{n1}^2(x, 0) - y_{n2}^2(x, 0)],\ S_2(x) = \sum_{n=-\infty}^{\infty} [2y_{n1}(x, 0) y_{n2}(x, 0)]$$

$(y_{n1}(x, 0) y_{n2}(x, 0))^T,\ n \in Z$ *eigenfunction of operator* L_0 *. We denote that the sums*

$$\sum_{n=-\infty}^{\infty} [y_{n1}^2(x, 0) - y_{n2}^2(x, 0)],\ \sum_{n=-\infty}^{\infty} [2y_{n1}(x, 0) y_{n2}(x, 0)]$$

are convergent.

Corollary .1 *In the case of periodic boundary conditions* $y_1(0) = y_1(\pi)$, $y_2(0) = y_2(\pi)$ *trace formula has the following form:*

$$\sum_{n=-\infty}^{\infty} [\mu_{2n}(x, 0) + \mu_{2n+1}(x, 0) - 4n] = 0$$

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1

The Calculation of the Regularization Trace of the Diffusion Equation by Lax's Method

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In this work, by using Lax's method [1], we calculate trace formulas of the equation

$$-y" + [2\lambda p(x) + q(x)]y = \lambda^2 y, \qquad x \in [0, \pi] \qquad (1)$$

with boundary conditions

$$y(0) = y'(\pi) = 0 \qquad (2)$$

$$y'(0) = y'(\pi) = 0 \qquad (3)$$

where

$$q(x) \in W_2^m[0, \pi], \; p(x) \in W_2^{m+1}[0, \pi] \qquad (m \geq 0)$$

Let

$$..., \chi_{-2}, \chi_{-1}, \chi_1, \chi_2, ...$$

$$..., \nu_{-2}, \nu_{-1}, \nu_1, \nu_2, ...$$

is a discrete spectrum corresponding to three boundary problems (1), (2) and (1), (3). For the problem (1), (2) and (1), (3) trace formula has the form respectively

$$\sum_{n=1}^{\infty}(\chi_n + \chi_{-n} - 2c_0) = \frac{p(0) - p(\pi)}{2}$$

$$\nu_0 + \sum_{n=1}^{\infty}(\nu_n + \nu_{-n} - 2c_0) = \frac{p(0) - p(\pi)}{2}$$

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EXAMINING THE RELATIONSHIP BETWEEN INTEGRAL EQUATIONS AND DIFFERENTIAL EQUATIONS

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Abstract

In this study, Integral and Differential equations were introduced and the relations between them and how they could be converted to each other were investigated. It was examined on samples.***Keywords:*** Exponential method; Kundu-Eckhaus; Complex exponential.

Keyword : Differential equations, Integral equations, solved examples

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ASYMPTOTICS OF SOLUTIONS TO A FIRST-ORDER PARTIAL DIFFERENTIAL EQUATION WITH A POWER-LAW BOUNDARY LAYER

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Abstract

In the article, a regularized asymptotic of any order of a mixed problem for a first-order partial differential equation is constructed, when the limit equation has a regular singularity. The constructed asymptotic contains boundary-layer functions of two types: power, exponential, and angular functions. The asymptotic of the solution is constructed by a special class of function corresponding to the structure of the fundamental system of solutions. The asymptotic character of the constructed solution is established.

Keywords: a mixed problem; Lomov method; asymptotic of the solution; singularly perturbed problems.

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*Abstract Submission should be prepared only **1 page**.

ARMAMENT MODEL AND ITS ANALYSIS WITH PROPORTIONAL DERIVATIVE ON TIME SCALES

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Abstract

The time scale is a non-empty subset of the real numbers. Time scale theory is a relatively new research area. This theory was first developed in 1988 by Hilger in his doctoral thesis with the aim of unifying differential equations theory and difference equations. The idea of combining fractional calculus with calculations on time scales was first addressed in Bastos' doctoral thesis with the aim of developing fractional calculus on time scales. Recently, several studies involving nabla, delta, and symmetric fractional calculus on arbitrary time scales have been considered. However, Laplace transform plays an important role in solving differential equations where the integral of the function cannot be obtained. It is a simple and useful transformation for solving differential equations with given initial conditions. The Laplace transform transforms differential equations into algebraic equations, simplifying problems mathematically. In this study, the armament model will be solved using classical methods and proportional Laplace transforms on a time scale, and the results will be compared.

Keywords: Time Scales; Proportional Derivative; Proportional Laplace Transform; Armament Model.

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BLOW UP AT INFINITE TIME OF SOLUTIONS FOR THE VISCOELASTIC PLATE EQUATION WITH DISTRIBUTED DELAY AND SOURCE TERMS

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Abstract

In the eighteenth century, the first equations with delay were considered by brothers Leonard Euler and Bernoulli. By A. Myshkis and R. Bellman, systematical study started at the 1940s. Since 1960, there have been appeared many surveys on the subject. In the middle of 1990s, robust control of systems with uncertain delay was started and led to the `'delay bloom" in the begining of the twenty-first century. Time-delay systems are also named systems with aftereffect or dead-time, equations with deviating argument, hereditary systems, or differential-difference equations. They belong to the class of functional differential equations which are infinite-dimensional, as opposed to ordinary differential equations. In this paper, we consider the viscoelastic plate equation with time delay and source term. At first, we give the local and global existence results. Later, under suitable conditions, we prove the blow up of solutions at infinite time by using the energy method. Time delays often appear in many practical problems such as thermal, economic phenomena, biological, chemical, physical, electrical engineering systems, mechanical applications and medicine.

Keywords: Blow up; Plate equation; Time delay.

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BLOW UP RESULTS AT FINITE TIME FOR THE KIRCHHOFF-TYPE VISCOELASTIC EQUATION WITH TIME DELAY AND SOURCE TERM

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Abstract

In this paper, we consider a Kirchhoff-type viscoelastic equation with time delay and source term. Under suitable conditions, we prove the blow-up results at finite time. Controlling the behavior of solutions for partial differential equations with time delay effects has become an active research area. Generally, delay effects occur in many applications and practical problems such as physical, chemical, biological, thermal and economics. In many cases, delay is a source of instability, even an arbitrarily small delay may destabilize a system which is uniformly asymptotically stable in the absence of delay unless additional conditions or control terms have been used.

Keywords: Blow-up; Time delay; Viscoelastic equation.

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ON PRİME SUBHYPERMODULES

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Abstract

In this paper, we study generalizations obtained on the class of prime subhypermodules of an R-hypermodule, where R is a Krasner hyperring. We give some new properties and examples of S- prime subhypermodules. Also, the definition of almost S- prime subhypermodules and examples are presented.

Keywords: Hyper submodules, S-prime hyper submodules, almost S-asal

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AN APPROACH TO A FUZZY PROBLEM WITH VARIABLE COEFFICIENTS

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Abstract

In this work, we consider a fuzzy problem with variable coefficients. We prove the existence of solutions. We illustrate the problem with examples.

Keywords: Fuzzy problem; Fuzzy sets; Fuzzy differential equation.

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