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"An Istanbul Meeting for World Mathematicians"

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Dear Colleagues and Dear Guests,

On behalf of the organizing committee, welcome to International Conference on Mathematics: An Istanbul Meeting for World Mathematicians, 21-24 June 2022, Istanbul, Turkey.

First of all, we present our deepest thanks to our supporters Fatih Sultan Mehmet Vakif University, Muş Alparslan University, Zeytinburnu Municipality, Çobanpınar water company, Istanbul Metropolitan Municipality, Turkish Airlines and UNDER for their supports and efforts during the conference days.

The conference aims to bring together leading academic scientists, researchers and research scholars to exchange and share their experiences and research results about mathematical sciences.

Besides these academic aims, we also have some social programs for introducing our culture and Istanbul to you. We hope that you will have nice memories in Istanbul for conference days.

We wish to all participants efficient conference and nice memories in Istanbul.

Thank you very much for your interest in International Conference on Mathematics: An Istanbul Meeting for World Mathematicians.

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A brief review bicomplex functions and their applications

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Abstract

This paper is a review paper about bicomplex functions. In the recent developments, efforts have been done to extend the integral transforms, a number of functions like Polygamma function, Hurwitz Zeta function, Gamma and Beta functions, Riemann Zeta function in the bicomplex variable from their complex counterparts. Motivated by the recent developments in bicomplex space, the formula for bicomplex version of Mittag-Le_er function has been discussed.

Keywords: Bicomplex numbers, Polygamma function, Riemann Zeta function, Mittag-Leffer function.

A Comparative Examination Of High School Transition System (LGS) Mathematics Questıons And 8th Grade Mathematıcs Textbooks Unit Evaluation Questions Within The Framework Of "Connection Skills"

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Abstract

The aim of this study is to compare the mathematics questions in the Transition System to High Schools (LGS), which is one of the central exams for transition to secondary education institutions, with the questions in the 8th grade mathematics textbook distributed by the Ministry of National Education and the alternative textbook of a private publishing house, which is frequently used by teachers, revealing their similarities and differences. For this purpose, the questions discussed were analyzed within the framework of 'connection skills' in order to determine what type and how often they contain connections. Document analysis method was used as the research model. The data source of the research is LGS questions, the 8th grade textbook of the Ministry of National Education (MEB) publications, and the unit evaluation questions in the alternative textbook of a private publishing house. According to the data obtained from the study, the types of connection skills were included at a higher rate in the questions belonging to the private publishing house, and it was seen that they were similar to the LGS questions. Less correlations were found in the textbook of MEB publications compared to the others. In all three cases, it was determined that the most connection was 'connection with real life', while the least connection was 'connection with different disciplines'. While the category of 'connection with different disciplines' was not found in LGS, connection as included in all categories in both textbooks. While connection skills were observed in each question in the textbook of the private publishing house, no connection skill was found in only 1 of 47 questions in LGS and in 43 of 104 questions in the textbook of MEB publications. As a result, the findings reveal that LGS and the textbook belonging to the private publisher (B) are at a similar level in terms of connection frequency, but the textbook (A) of the MEB publisher is insufficient.

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Acknowledgement: mathematical connection, connection skills, high school transition system (LGS), math textbooks.

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A coupled finite element method and finite differences method

For solving antiplane frictional contact problems

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Abstract

The objective in this paper is to study a thermal frictional contact model.The variational formulation of the model leads to a coupled nonlinear system. In study of this system, we first consider a fully discrete scheme of it and then focus on deriving error estimates for numerical solutions. Under appropriate assumptions of solution regularity, an optimal order error estimate is obtained.

Keywords: Numerical approximation, optimal order, error estimate, contacts problem, Weak solution, formulation variational.

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A customer churn prediction using KNN Algoritm and Logistic Regression with Pyhton

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Abstract

In this work, customer churn analysis is performed using Logistic Regression and KNN Algorithm on customer data of the telecommunication sector. A machine learning model has been developed that can predict the profile of the customers who will leave the company. As a result, it is concluded that the best estimation model is the one in which the ADASYN sampling method is used.

A differential search algorithm combined with support vector machine to predict the risk of mortality in patients with STEMI-CS

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Abstract

The ST-segment elevation myocardial infarction- cardiogenic shock (STEMI-CS) is one of the strongest factors in patient mortality within hospitals. This paper presents a hybrid machine learning based approach for predicting the risk of mortality in patients with STEMI-CS. The proposed method combines an efficient evolutionary differential search algorithm (DSA) with support vector regression (SVM) in risk prediction phase. The incentive mechanism of using DSA is to optimally tune the parameters of SVM to improve its prediction ability. With a test on a real-world benchmark dataset, the proposed DSA-SVM is confirmed to have significant improvement compared with multiple machine learning models.

Keywords: Myocardial infarction, cardiogenic shock, STEMI-CS, risk prediction, SVM, DSA.

A differential search algorithm combined with support vector machine to predict the risk of mortality in patients with STEMI-CS

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Abstract

The ST-segment elevation myocardial infarction- cardiogenic shock (STEMI-CS) is one of the strongest factors in patient mortality within hospitals. This paper presents a hybrid machine learning based approach for predicting the risk of mortality in patients with STEMI-CS. The proposed method combines an efficient evolutionary differential search algorithm (DSA) with support vector regression (SVM) in risk prediction phase. The incentive mechanism of using DSA is to optimally tune the parameters of SVM to improve its prediction ability. With a test on a real-world benchmark dataset, the proposed DSA-SVM is confirmed to have significant improvement compared with multiple machine learning models.

Keywords: Myocardial infarction, cardiogenic shock, STEMI-CS, risk prediction, SVM, DSA.

A Fixed Point Theorem For Wardoskwi Type F-Contractive Mappings In 2-Banach Spaces

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Abstract

The 2-Banach spaces have been initiated by Ghaler and Iseki who prove some fixed point theorems in these new spaces. A following work from many authors has added further results on fixed point theory in 2-Banach spaces for types of contractive mappings. Our main purpose, is to present and establish here, fixed point theorems for the class of F-contractive mappings related to Wardoskwi type in this framework.

Keywords: F-contractive mapping, 2-Banach space, fixed point

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A Markov Chain Monte Carlo Simulated Annealing Algorithm for Path Travelling Salesman Problem

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Abstract

The path traveling salesman problem is one the most well-known NP-complete problem, where it is restricted to traverse all the nodes exactly ones between two prespecified the source and the destination nodes. So, one the most discussed challenges for this kind of a hard problem is to find a good solution by some. There are some approximate algorithms with tight approximation ratio in the version of the problem that the arc cost values satisfy the triangle inequality. The simulated annealing algorithm is a local search method, which is based on the Markov chain formulation and it discovers a nearby optimal solution. The simulated annealing algorithm produces a solution state space and the Markov chain Monte Carlo search method improves the produced state space. The Metropolis algorithm and Boltzmann distribution function have the critical role to accept or reject the produced solution. The simulated annealing algorithm starts with a relatively high temperature and then the most of the solutions are accepted; however, it is cooled gradually, and at end of the annealing process the temperature is so low that the most of the energy increasing solutions (for a minimizing objective function) are rejected. The Markov chain Monte Carlo method produces some samples around the accepted and the rejected states for the possibly improving directions in the solution state space.

Keywords: Simulated annealing, Markov chain Monte Carlo, Metropolis algorithm, Traveling salesman problem, Sampling methods, Local search methods .

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A Meta-Heuristic Solution for a Chance Constrained Mathematical Model of the Vehicle Routing Problem with Stochastic Demand

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Abstract

In the globalizing economy, supply chain and logistics management has an important place in the transportation of the processed raw material from the production center to the enterprises and from the enterprises to the end customers. Vehicle routing problems (VRP), which is the last stage of supply chain and logistics management, stand out as increasing demands, changing roads, different optimization problems in a limited time. Vehicle routing problem is defined as providing the necessary service to customers located in different geographical locations from the center, defined as the warehouse, with more than one vehicle at the shortest distance and returning the vehicles to the warehouse after providing the service. Mathematically, vehicle routing problems are modeled stochastically due to some uncertainties arising from parameters such as time, route, service and demand. Stochastic demand vehicle routing problems (SDVRP) are modeled as a problem where customer demands are not known precisely in advance and are only estimated based on previous demand information.

In this study, the chance-constrained SDVRP model was considered and the near-optimal solutions of the problem were calculated with the meta-heuristic algorithm, Simulation Annealing.

A Mixed Finite Element Method of Parabolic Equation

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Abstract

We present a mixed finite element Method of parabolic equation, The well-posedness (existence and uniquness) of the problem in suitable Lebesgue Sobolev spaces with variable exponent with the help of nonlinear monotone operators theory is investigated. Some a priori error estimates using Galerkin-Mixed finite element method are shown.

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A Modified Genetic Algorithm to solve the Multiple Traveling Salesmen Problem

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Abstract

This paper presents a modified genetic algorithm (MGA) to solve the multiple traveling salesmen problem (MTSP). This is one of the most important extensions of the traveling salesman problem and has many applications in combinatorial optimization problems. This problem can be used to model many practical problems. Here, in order for the initial solutions to be of high quality and variety, these solutions of the genetic algorithm are generated by the elite ant system algorithm. In addition, at each run of the algorithm, a number of chromosomes are randomly selected to prevent the reduction of the diversity of the solutions, and finally two different mutation algorithms, each with a probability of 0.5 each, are used to improve the final solutions. The results obtained on several standard examples show the performance of the proposed algorithm compared to other meta-heuristic algorithms.

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A multiplication rule for certain automorphisms of relatively free Lie algebras

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Abstract

Let L be the free algebra of finite rank in a variety of Lie algebras satisfying at least one nonzero polynomial identity. In this study, we examine certain subgroups of the automorphism group $Aut(L)$ of the Lie algebra L, and provide an explicit multiplication formula for the pair of elements of the corresponding subgroup.

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A new conjugate gradient method as a modified Conjugate Descent method using the Newton direction for unconstrained optimization

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Abstract

Unconstrained optimization problem can be presented as:

$$\min_{x \in R} f(x) \qquad (1)$$

Where, $f: R^n \to R$ is a smooth nonlinear function. To solve the problem (1) the optimization methods based on line search utilize the next iterative scheme:

$$x_{k+1} = x_k + \alpha_k d_k$$

Where $\alpha_k > 0$ is a step length computed by a line search technique and d_k is a search direction. Different choices of d_k determine different methods. In this paper we are interested by Newton's and conjugate gradient methods. One of the most important features of the Newton's method is the high convergence speed. The CG method is very useful for solving (1) when n is large, the search direction is defined as:

$$d_0 = -g_{0,} \qquad d_{k+1} = -g_{k+1} + \beta_k d_k$$

The different choices for the parameter β_k correspond to different conjugate gradient methods. In this work, we propose combining some nice features of both the conjugate gradient and Newton's methods. To do this, we made some modifications to the conjugate descent (CD) method by making the search direction correspond to that of Newton's. The particularity of our method is that it does not need to save or compute the Hessian matrix needed by the Newton method. It has been proven that the method is globally convergent. The numerical experiments show that our modified conjugate gradient approach is more efficient than the conjugate descent (CD) method.

Keywords: unconstrained optimization, conjugate gradient method, Newton direction.

A new fuzzy fractional order model of transmission of Covid-19 with quarantine class

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Abstract

This paper is devoted to a study of the fuzzy fractionalmathematical model reviewing the transmission dynamics of the infectious disease Covid-19. The proposed dynamical model consists of susceptible, exposed, symptomatic, asymptomatic, quarantine, hospitalized, and recovered compartments. In this study, we deal with the fuzzy fractional model defined in Caputo's sense.We show the positivity of state variables that all the state variables that represent different compartments of the model are positive. Using Gronwall inequality, we show that the solution of the model is bounded. Using the notion of the next-generation matrix, we find the basic reproduction number of the model. We demonstrate the local and global stability of the equilibrium point by using the concept of Castillo-Chavez and Lyapunov theory with the Lasalle invariant principle, respectively. We present the results that reveal the existence and uniqueness of the solution of the considered model through the fixed point theorem of Schauder and Banach. Using the fuzzy hybrid Laplace method, we acquire the approximate solution of the proposed model. The results are graphically presented via MATLAB-17.

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A NEW GENERALIZATION OF r-IDEALS OF COMMUTATIVE RINGS

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ABSTRACT. Let R be a commutative ring with identity. A proper ideal I is said to be an r-ideal of R if for $a, b \in R$, $ab \in I$ and $Ann_R(a) = 0$ imply $a \in I$. In this paper, we give a new generalization of r-ideals by defining a proper ideal I of R to be a semi r-ideal if whenever $a \in R$ such that $a^2 \in I$, then $Ann_R(a) = 0$ or $a \in I$. We give some examples of semi r-ideals and investigate semi r-ideals under various contexts of constructions such as arbitrary intersection, homomorphic images and localizations. Moreover, we present various characterizations of this new class of ideals and characterize rings in which every ideal is a semi r-ideal. Finally, for a ring homomorphism $f : R \to S$ and an ideal J of S, we study some forms of semi r-ideal of amalgamation $R \bowtie^f J$ of R with S along J with respect to f.

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A New Predictor for Simultaneous Prediction in Linear Regression Model

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Abstract

In this study, a new predictor utilizing target function is proposed for simultaneous prediction of the actual and average values of the dependent variable in the linear regression model under the problem of multicollinearity. The new predictor is compared with the predictor based on generalized least squares (GLS) estimator by using the mean squared error of predictions, theoretically. Also, theoretical findings are supported by a simulation study and a numerical example. The results of this study indicate that when multicollinearity exists in data, the new proposed predictor shows better performance than the existing predictor which is only based on the GLS in the linear regression model.

Key Words: Multicollinearity; Simultaneous prediction; Target function

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A New Theorem on Quasi Power Increasing Sequences

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Abstract

Let $A=(a_{nv})$ be a normal matrix, i.e., a lower triangular matrix of non-zero diagonal entries. Let $\sum a_n$ be an infinite series with its partial sums (s_n). Let $(\ddot{}_n)$ be any sequence of positive numbers. The series $\sum a_n$ is said to be summable $\ddot{} -|A,\cent|_k$, $k\geq 1$, $\cent\geq 0$ if (see [1])

$$\sum_{n=1}^{\infty} \ddot{}_n^{\cent k+k-1}\left|A_n(s)-A_{n-1}(s)\right|<\infty$$

where

$$A_n(s)=\sum_{v=0}^{n} a_{nv}s_v, \quad n=0,1,...$$

The aim of this paper is to generalize a known theorem (see [2]) to the $\ddot{} -|A,\cent|_k$ summability method by using quasi -power increasing sequences.

Keywords: Absolute matrix summability, summability factors, quasi -power increasing sequences, infinite series.

References:

[1] H. S. Özarslan, A new study on generalised absolute matrix summability methods, Maejo Int. J. Sci. Technol. 12 (3) (2018), 199-205.

[2] H. Bor and H. S. Özarslan, On the quasi power increasing sequences, J. Math. Anal. Appl. 276 (2002), 924-929.

A note on commutant hypercyclicity of some classical operators

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Abstract

An operator T on a Hilbert space H is commutant hypercyclic if there is a vector x in H such that the set $\{Sx : TS = ST\}$ is dense in H. In this study, we prove that operators on finite dimensional Hilbert space, a rich class of weighted shift operators, normal operators and isometries are all commutant hypercyclic.

A note on the three-dimensional Lorentzian warped product manifolds

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Abstract

The notion of warped product manifolds was first introduced by Bishop and O'Niell to give examples of Riemannian manifolds with negative curvature [1]. The warped product manifolds play a significant role in differential geometry and physics, especially general relativity. In Lorentzian geometry, more solutions to Einstein field equations are obtained by Lorentzian warped products, for example, Schwarzchild and Friedmann-Robertson-Walker metrics [2]. In this paper, we study a specific class of three-dimensional warped product manifolds and compute the tensors $\mathscr{R}$□ , □□ and $\mathscr{R}$[□] on these manifolds. We also provide an example in this context.

A Numerical Approach to Solution of Nonlinear Differential Equation

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Abstract

System operators use power flow simulations for safe operation and planning of their electricity grids. Current power flow simulations run on separated transmission and distribution networks only. The continuing growth of electricity consumption, demand side participation, and renewable resources makes the electricity networks co-dependent. Therefore, integrated transmission-distribution network models are better representatives of electricity networks as the interaction that these networks have on each other is incorporated.

Integrated network models can become very large. In order to run the power flow simulations on these networks quickly, we use numerical analysis to come up with efficient and robust solvers. In this talk, I will give an introduction into power flow simulations on transmission and distribution networks. Next, I'll show several ways of coupling these networks into an integrated network model. Lastly, I'll show the numerical results of running power flow simulations on these integrated networks.

A Refinement Sum-Technique in the Generalised Jacobi Method Adapted for a Linear Operator-System of Equations to Approach a Fredholm Integral Equation's Solution

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Abstract

Based on the use of the geometric series theorem, and having the equation transformed into an equivalently-suitable linear system of Fredholm integral equations of the second kind, we seek to inflict a refinement in the way the generalized Jacobi iterative scheme approximates the solution of a linear, second-kind Fredholm integral equation defined on a large interval, when coupled with Nystr¨om's numerical method. By avoiding to inverse a bounded operator, and computing a truncated geometric sum of the former's associated sequence of bounded operators instead, we notice that our approach furnishes a better performance in terms of computational time and other resources.

Keywords: Fredholm Integral Equation, Jacobi Iterative Method, Bounded Linear Operators.

A review on machine learning-based models for mortality risk prediction in STEMI-CS patients

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Abstract

ST-segment elevation myocardial infarction-cardiogenic shock (STEMI-CS) is one of the important cardiovascular diseases, with a high rate of mortality. A timely diagnosis of STEMI is important to guide treatment and reduce sudden cardiac death. Recently, machine learning (ML) methods were developed to establish predictive models to identify the in-hospital mortality risk of STEMI-CS patients. The experimental results reported in the literature showed that the ML methods obtain relatively high performance on benchmark STEMI-CS datasets. To determine how the ML methods were developed in the past years, this paper surveys recent machine learning methods developed for STEMI-CS risk prediction. The existing methods are examined through a comparison framework. After discussing the development of the field in recent years, some open problems and new emerging trends are identified.

Keywords: Artificial intellience, machine learning, data mining, cardiogenic shock, STEMI-CS, risk prediction.

A Robust Numerical Scheme for Singularly Perturbed Parabolic Differential-Difference Equations Arising in the Modeling of Neuronal Variability

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Abstract

In this study, a robust numerical method for singularly perturbed parabolic partial differential-difference equations with small mixed shifts arising in the modeling of neuronal variability is presented. The method comprises of the implicit Euler method for temporal discretization and the cubic spline in tension method for spatial discretization on uniform mesh sizes. The developed method has shown to be accurate of order O(Δt + h2) by preserving ε−uniform convergence. Moreover, the Richardson extrapolation technique is employed for the time discretization to increase its order of convergence and the resulting method is proved to be ε−uniformly convergent of order O((Δt) 2 + h 2). Some numerical examples are considered to demonstrate the applicability and effectiveness of the proposed scheme. The obtained numerical results Show that the proposed method provides more accurate results than some existing methods in the literature and agreed with the theoretical results.

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A Study on the Earthquake Hazard and Forecasting in the Lake Van and its surroundings, Turkey

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Abstract

In this study, statistical region-time analyses of current earthquake activity in the Lake Van and its adjacent area are performed by considering the Relative Intensity (RI), Pattern Informatics (PI), combined forecast model (RIPI) and Coulomb stress variations. The relations between these variables are used to evaluate the recent earthquake hazard and to make earthquake forecasting in and around the Lake Van. These types of techniques are well-known and have been used in earthquake statistics, especially in statistical seismology. The results show that the areas especially having great stressed distributions at the beginning of 2022 and hotspot locations from combined forecast map between 2022 and 2032 are detected in several same parts of the study area including Erciş and Yeniköşk faults, Van and Saray fault zones between Muradiye, Özalp, Erçek, Van and Gevaş. As a remarkable fact, all anomaly areas of estimated parameters are observed in the same parts of the study region and therefore, these anomaly areas estimated at the beginning of 2022 and also between 2022 and 2032 may be considered as one of the most likely zones for the next strong/large earthquakes. Thus, the interrelationships between these variables may supply more accurate and more reliable interpretations for earthquake forecasting and hazard assessment in this part of Turkey.

Keywords: The Lake Van, Coulomb stress, combined forecast, earthquake hazard.

About the convergence of Pseudospectrum of unbounded operators

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Abstract

This paper investigates the relationship between the generalized pseudo-spectrum of bounded operators and the pseudo-spectrum of unbounded operators. We use this relationship to explore the converges of approximated pseudo-spectrum of unbounded operators to the pseudo-spectrum of unbounded operators under the generalized norm resolvent. Convergence is demonstrated using the Hausdorff distance.

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Aggregation Function Constructed from Copula

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Abstract

In this work, we show that a slight change in the Sklar's formula tremendously affects the class of aggregation functions it represents. While the original formula can only be used to construct d-increasing aggregation functions, this new formula can be used to construct any continuous aggregation function excepted possibly those belong to the boundary of this set. In particular, all continuous aggregation functions can be approximated by aggregation functions in this form. This shows that it is sufficient to only consider aggregation functions in this form for most cases.

Keywords: aggregation function, copula, construction, Sklar's theorem.

Amply Cofinitely Weak e-Supplemented Modules

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Abstract

In this work, every ring is associative with identitiy and every module is an unital left module. Let M be an R-module and $U \leq M$. If for every $V \leq M$ such that $M=U+V$, U has a weak supplement X in M with $X \leq V$, then we say U has ample weak supplements in M. If every cofinite essential submodule of M has ample weak supplements in M, then M is called an amply cofinitely weak e-supplemented module. In this work, some properties of these modules are investigated.

Keywords: Essential Submodules, Small Submodules, Cofinite Submodules, Supplemented Modules.

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Amply e-Supplemented Lattices

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Abstract

In this work, all lattices are complete modular lattices with the greatest element 1 and the smallest element 0. Let L be a lattice. If every essential element of L has ample supplements in L, then L is called an amply e-supplemented lattice. In this work, some properties of these lattices are investigated.
Keywords: Lattices, Essential Elements, Small Elements, Supplemented Lattices.

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An Alternative Analysis of Simple Hyperjerk System in Mathematica

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Abstract

MATLAB is a computer program that is easy to use, gives accurate and reliable results and is the most preferred program in the literature. Therefore it is usually preferred for solution of nonlinear equation sets in literature. In this study, Mathematica, an alternative simulation program to MATLAB, is used to solve nonlinear differential equations. Mathematica is used mostly to make scientific mathematical computations. In this paper, the chaotic dynamics and the chaotic attractor illustration of hyperjerk system with exponential nonlinear equation [1] which are obtained from Mathematica is presented.

Keywords: Mathematica, hyperjerk system, analysis.

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An amalgamation of fixed point theorems with nonlinear problems

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Abstract

The major goal of this presentation is to highlight the applicability of fixed point theorems to many real-world problems appearing in various fields of engineering science and physics, most of which are nonlinear in character. In the first section, I will review notable contributions of recent scholars who worked on nonlinear systems using fixed point theorems. The second portion discusses several fresh fixed point results, followed by some innovative examples and computer simulation. The examples feature a number of complex structural functions that cannot be handled by traditional fixed point approaches. Furthermore, this talk covers some new applications of metric fixed point theory for functional equations in dynamic programming, equations modelling LCR circuits, vibrations of a vertical heavy hanging cable, differential equations, integral equations, stability of a functional equation of the spiral of Theodorus, fractional differential equations, fourth-order elastic beam equations, and basic harmonic motion, among others.

Keywords: Fixed point, metric spaces, generalized contraction, F-contraction, boundary value problem, dynamic programming, hanging cable, oscillation of a spring.

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An Analytical Investigation of the Behavior of Laminated Glass Cylindrical Shell Subjected to Initial Delamination

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Abstract

As a result of its high safety qualities usage of laminated glass in the field of architectural glazing is increasing. Since it is used by automobile and aircraft manufacturers for years the response in these areas are well established. However, studies about architectural response of laminated glass appear to be limited. Delamination of laminated glass refers to the loss of coating adhesion between the glass and interlayer. Since delamination is one of the most common failure form in laminated glass industry, studies about it are increasing day by day. The aim of the present study is to present a computational technique for the modelling of laminated glass shell structure subjected to initial delamination. Deformation and stress equations are obtained by the variational approach and minimum potential energy theorem. For the verification of assumptions used in the developed mathematical model the laminated glass plate is modeled using a finite element software.

Keywords

Delamination Analysis, Finite Element Method, Laminated Glass, Cylindrical Shell, Mathematical Modelling, characters.

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An application of contraction of Samet's method to boundary value problems

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In this research we study an application of some contractions by methods of Samet to investigate the existence and uniqueness of some different classes of nonlinear boundary eigenvalue problems in fractional order.

Keywords: Samet's method; Existence and uniqueness; Nonlinear boundary problems.

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An Application of The Becker's Univalence Criteria

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Abstract

We study univalence properties for certain subclasses of univalent functions. These subclasses are associated with a generalized differential operator. The extended Becker-typed univalence criteria will be studied for these subclasses.

An application through unimodular matrix for finding the solution of the System of Linear Equations

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Abstract

The aim of this paper is the study of finite systems of linear equations using unimodular matrix utilizing Python Programming and Latex Typesetting ([2]). A System of Linear Equations is comprised of one or more linear equations which have the same set of variables. Combining the knowledge of Python and Latex ([1]), we have been able to create a simple application that generates a system of linear equations with unknowns based on user-input. The Graphical User Interface (GUI) has been created using JavaFX. By combining the features of Python, Numpy, JavaFX and Latex a random system of linear equation can be generated together with the solution vector X. In addition, the application can simply be used to find the solution of the System of Linear Equations using the Inverse Matrix Method and store the solution as a txt file for later use or show the solution and generated unimodular matrices into the application by clicking the respective buttons.

Keywords: Python, Latex, Unimodular, System of Linear Equations, Numpy, typesetting, programming, JavaFX.

Acknowledgement

On behalf of professors, Samsul Arifin and Indra Bayu Muktyas of Nusantara University, Applied Math Department Jakarta, Bina Nusantara University, Indonesia 11480.

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An approach to Hilbert's fourteenth problem

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Abstract

Famous mathematician David Hilbert suggested twenty three unsolved problems in the International Congress of Mathematicians in Paris in 1900. The main motivation for the fourteenth problem of Hilbert is he following: Is the algebra of invariants in the polynomial algebra finitely generated under the action of each subgroup of general linear group? The problem is not true in general, however, some significant partial affirmative approaches has been done by many mathematicians. In this study, we lift the problem in a noncommutative and nonassociative setting and give generaitng sets for the algebra of invariants.

An effcient numerical Method for locating zeros of polynomial systems using multi-resultant

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Abstract

In this paper, we study an efficient numerical method for locating zeros of polynomial systems using multi-resultant matrices. These matrices will produce ill-conditional problem of the form of determinant of large spares matrix. To overcome with these difficulty, we replace this problem by stable problems which are stable. Algorithms and numerical results are presented to show the effciency of the proposal method. Theoretical results will be given.

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An extension of TOPSIS method to the Generalized Spherical Fuzzy Environment

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Abstract

The Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) is a multi-criteria decision approach that is based on choosing an alternative that has the shortest distance from the positive ideal solution (PIS) and the longest distance from the negative ideal solution (NIS). Since this method provides the best and worst alternatives in a more realistic form, the obtained solution is thought as more reliable and effective. In this study, we aim to extend the TOPSIS method to the generalized spherical fuzzy environment. First, we establish a novel method to solve the multi-criteria group decision-making problems based on TOPSIS by using generalized spherical fuzzy data. Then, we exemplify this approach to provide the steps more understandable, and finally, we compare the results of the same problem by solving it with the proposed and existing methods.

Keywords: Generalized spherical fuzzy sets, multi-attribute group decision, TOPSIS.

An Optimal Vaccination Strategy for the Smallpox Model

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Abstract

In this work, an optimal control strategy, used as an effective tool to prevent the spread of infectious diseases, is suggested for smallpox. Therefore, vaccination is adapted as the control variable for an available smallpox model [1]. The aim of optimal control is to minimize the number of infected individuals and the cost of vaccination. The effectiveness of the vaccination process to avoid the spreading of the disease is depicted using the fourth-order forward-backward Runge-Kutta method. Ultimately, it is observed from the graphics drawn by MATLAB that the implemented strategy immediately effects to decrease the spread of smallpox. Thus, these results demonstrate the importance and power of vaccination.

Acknowledgement: Optimal control, Epidemiological model, Vaccination. The study is supported by the Scientific Research Projects Department of Balıkesir University by the BAP 2019/089.

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Analysis of Existence Results for Nonlinear Hadamard Type

Fractional Boundary Value Problems

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Abstract

Recently, nonlinear boundary value problems for fractional differential equations have been investigated by many researchers since they have many applications in real world problems related to physics, control theory, engineering, chemistry. (See [1-3]). Many works are done by means of Riemann Liouville or Caputo fractional differential equations. Here, our analysis is based upon the Hadamard fractional differential equations whose derivative involves a logarithmic function of arbitrary exponent. (See [4]).

In this paper, we investigated positive solutions for the nonlinear Hadamard fractional boundary value problems. We applied a fixed point theorem on cones to establish our main result for the Hadamard fractional boundary value problem. Finally, an example is presented to illustrate the existence results.

Keywords: Fixed point theorems on cones, Hadamard fractional differential equations,

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Analysis of Mixed Finite Element Method for Evolution Problem

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Abstract

This paper analyzes mixed finite element method to study the evolution problem, the semi discrete and the fully discrete schemes are extracted and optimal a priori error estimates are extracted for both schemes and also the existence of weak solution is proved. Finally, our theoretical result supported by a numerical experiment.

Acknowledgement: Mixed Finite Element Method, the semi discrete and the fully discrete schemes, the optimal a priori error estimates.

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Application of Lagrange Interpolation Method to Solve First-Order Differential Equation Using Newton Interpolation Approach

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Abstract

In this work, we combine both Newton's interpolation method and Lagrange method (NIPM) to solve first-order differential equations. The results obtained provide minimum approximative error. The result is supported by solving an example.

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Applications of the Closure Property to the Limits of Textures

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Abstract

In this study, we observed that the applications of closure operators on inverse limits in the category whose objects are ditopological plain texture spaces and morphisms are bicontinuous point functions satisfying a compatibility condition. Specifically, we studied with the closure operator according to the corresponding joint topologies to the ditopologies on the inverse limit spaces.

Keywords: Plain texture, Inverse system, Ditopological space, Closure, Joint topology

Applying a wavelets method to approximate nonlinear Fredholm integro-differential equation

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Abstract

We are focus on the nonlinear Fredholm integro-differential equation that has the following form

$$\begin{cases} \phi(t) = y(t) + \int_0^1 K(t, s, \phi(s), \phi'(s))ds \\ \phi(0) = a \end{cases}$$

where $\phi(t), f(t) \in H^1([0,1])$, and both $K, \partial_t K$ are of $C^0([0,1]^2 \times \mathbb{R}^2)$ .We apply projection method using Legender wavelets to obtain an algebraic system which we solve it by Picard sucssesive approximations, we give some examples to verify the accuracy and efficiency of our method.

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Approximation of solutions for nonlinear functional integral equations

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Abstract

Inquiries into nonlinear functional integral equations o_er increasing evidence to the extant literature through replication studies. Correspondingly, this paper deals with the solutions to nonlinear functional integral equations using measure of non-compactness. To this end, we _rst verify the existence of solutions to the considered equation using the generalized Darbo _xed point theorem. Then, we propose an e_cient iterative algorithm to _nd an approximate solution by employing homotopy perturbation method and Adomian decomposition. Further, the e_ciency of the algorithm is asserted with two examples. Finally, an error analysis with the upper bound of errors is presented.

Keywords: Nonlinear functional integral equation; Measure of noncompactness; Fixed point theorem; Homotopy perturbation.

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Artificial intelligence for supervised classification purposes: Case of the surface water quality in the Moulouya River, Morocco

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Abstract

From a management standpoint, water quality is defined by the desired end use. Water intended for leisure, drinking water, and the habitat of aquatic organisms requires higher levels of purity. In contrast, the quality standards of water used for hydraulic energy production are much less important.The major goal of this project is to employ artificial intelligence to develop an evaluation system that deals with supervised classification of the physicochemical quality of the Moulouya River' water surface. Under Matlab 2015, a graphical interface is presented. This allows for the creation of a classification model based on multilayer perceptron artificial neural networks (ANN-MLP). During the study, a variety of configurations were tested. During the test phase, the configuration [9 8 3] gives a coefficient of determination close to the unit with the lowest error value. This study highlights the capacity of the classification model based on artificial neural networks of the multilayer perceptron type (ANN-MLP) proposed for the supervised classification of the different water quality classes, determined by the calculation of the system for assessing the quality of surface water (SEQ-water) at the level of the Moulouya River catchment area, with an overall classification rate equal to 98.5% and a classification rate during the test phase equal to 100%.

Keywords:Artificial intelligence, Supervised classification, Moulouya River, Water quality

Asymptotic Normality of the Robust Equivariant Estimator for Functional Nonparametric Models

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Abstract

As in parametric regression, nonparametric kernel regression is essential for examining the relationship between response variables and covariates. In both methods, outliers may affect the estimators, and hence robustness is essential to deal with practical issues. This paper proposes a family of robust nonparametric estimators with unknown scale parameters for regression function based on the kernel method. In addition, we establish the asymptotic normality of the estimator under the concentration properties on small balls of probability measure of the functional explanatory variables. The superiority of the proposed methods is shown through numerical and real data studies to compare the sensitivity to outliers between the classical and robust regression (fixed and unknown scale parameter). Such a new proposed method will be useful in the future for analyzing data and making decisions.

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Asymptotical Deferred Statistical and Cesàro Equivalence of Order β for Double Sequences of Sets

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Abstract

In this study, it was intend to present the notions of deferred statistical equivalence of order β and deferred Cesàro equivalence of order β $(0 < \beta \leq 1)$ in the Wijsman sense for double set sequences, to investigate some properties of these notions and to examine the relationship between them.

Keywords: Asymptotical equivalence, Deferred statistical convergence, Deferred Cesàro summability, Order β, Wijsman convergence, Double sequences of sets.

Basic Tools of Approximation theory with applications in Engineering, Science and Technology

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Abstract

Approximation theory is the branch of mathematics which studies the process of approximating general functions by simple functions such as polynomials, finite elements or Fourier series. Approximation processes arise in a very natural way in many problems dealing with the constructive approximation of functions as well as solutions to (partial) differential equations and integral equations. The study of such subject falls into an intensive research area, developing in different directions by many mathematicians. Several investigations have been devoted to the approximation properties of new sequences of operators, which might generalize or modify well-known ones, in order to get better results. Issues related to these studies are, for instance, shape preserving properties of the approximating operators, estimates of the rate of convergence, asymptotic formulae, saturation problems, approximation of semi groups of operators, asymptotic behavior, direct, and converse results. Several approximation processes have been successfully applied for example in Computer Aided Geometric Design, in the theory of artificial neural networks, and in evolution problems arising in population genetics, financial mathematics, and other fields. Summability techniques were also applied on some engineering problems like Chen and Jeng [J. T. Chen and Y. S. Jeng, Dual series representation and its applications to a string subjected to support motions, Advances in Engineering Software, vol. 27, pp. 227–238, 1996] who implemented the Ces`aro sum of order (C, 1) and (C, 2), in order to accelerate the convergence rate to deal with the Gibbs phenomenon, for the dynamic response of a finite elastic body subjected to boundary traction. Chen et al. [J. T. Chen, H.-K. Hong, C. S. Yeh, and S. W. Chyuan, Integral representations and regularizations for a divergent series solution of a beam subjected to support motions, Earthquake Engineering and Structural Dynamics, vol. 25, pp. 909–925, 1996] applied regularization with Ces`aro sum technique for the derivative of the double layer potential. Similarly, Chen and Hong [J. T. Chen and H.-K. Hong, Review of dual boundary element methods with emphasis on hypersingular integrals and divergent series, ASME Applied Mechanics Reviews, vol. 52, pp. 17–33, 1999] used Ces`aro sum regularization technique for hypersingularity of dual integral equation. The theory of summability arises from the process of summation of series and the significance of the concept of summability has been strikingly demonstrated in various contexts e. g. in Analytic Continuation, Quantum Mechanics, Probability Theory, Fourier Analysis, Approximation Theory and Fixed Point Theory. The methods of almost summability and statistical summability have become an active area of research in recent years. This short monograph is the first one to deal exclusively with the study of some summability methods and their interesting

applications. We consider here some special regular matrix methods as well as non-matrix methods of summability. Broadly speaking, signals are treated as functions of one variable and images are represented by functions of two variables. Positive approximation processes play an important role in Approximation Theory and appear in a very natural way dealing with approximation of continuous functions, especially one, which requires further qualitative properties such as monotonicity, convexity and shape preservation and so on. Analysis of signals or time functions is of great importance, because it conveys information or attributes of some phenomenon. The engineers and scientists use properties of Fourier approximation for designing digital filters. In this talk, we discuss the basic tools of approximation theory determine the error (degree) in approximation of a signal (function) by different types of positive linear operators in various Function spaces like as in Lp-spaces. During this talk, few applications of approximations of signals will also be highlighted. Approximation processes arise in a very natural way in many problems dealing with the constructive approximation of functions as well as solutions to (partial) differential equations and integral equations. The study of such subject falls into an intensive research area, developing in different directions by many mathematicians. Several investigations have been devoted to the approximation properties of new sequences of operators, which might generalize or modify well-known ones, in order to get better results. Issues related to these studies are, for instance, shape preserving properties of the approximating operators, estimates of the rate of convergence, asymptotic formulae, saturation problems, approximation of semigroups of operators, asymptotic behavior, direct, and converse results. Several approximation processes have been successfully applied for example in Computer Aided Geometric Design, in the theory of artificial neural networks, and in evolution problems arising in population genetics, financial mathematics, and other fields. The goal of this talk is to attract researchers, engineers as well as scientists who are working in the recent advances in operator methods in approximation theory and related applications. The study of sequence spaces occupies a very prominent position in analysis. The convergence problems have always been of great interest. The theory of sequence spaces has widely used in several branches of mathematics such as the structural theory of topological vector spaces, law of large numbers and the theory of functions. It has a significant contribution in enveloping the classical summability theory via matrix transformations from the one sequence space to another sequence space. The study of sequence spaces came into existence by special results in the theory of summability. The concept of summability is the generalization of the concept of convergence. Summability is a theory of assigning the value to a series whose sequence of partial sums diverges. It is an extremely constructive area for the application of functional analysis. In 1890, Italian analyst Ernesto Ces`aro was the first to deal with the sum of divergent series and defined Ces`aro summation. Several alternative methods of assigning a value to an infinite series were invented by mathematicians; these are known as "summability methods". Some of the most familiar methods of summability are those that are associated with the names of great mathematicians like Holder summability, Abel summability, Borel summability, Norlund summability, Riesz summability etc.

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Bernstein-Kantorovich-Stancu Operators with Shape Parameter λ

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Abstract

This talk aims to construct a new type of Bernstein operators depending on the shape parameter $\lambda \in [-1, 1]$. We investigate approximation results and provide some graphical examples to demonstrate the rate of convergence of the constructed operators.

Keywords: λ-Bernstein operators, λ-Kantorovich-Stancu operators, rate of convergence.

Beta Operator with Caputo Marichev-SaigoMaeda Fractional Differential Operator of Extended Mittag-Leffler Function

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Abstract

In this paper, a beta operator is used with Caputo Marichev-Saigo-Maeda (MSM) fractional differentiation of extended Mittag-Leffler function in terms of beta function. Further in this paper, some corollaries and consequences are shown that are the special cases of our main findings. We apply the beta operator on the right-sided MSM fractional differential operator and on the left-sided MSM fractional differential operator. We also apply beta operator on the rightsided MSM fractional differential operator with Mittag-Leffler function and the left-sided MSM fractional differential operator with Mittag-Leffler function.

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Bivariate Biperiodic Fibonacci Hybrinomials

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Abstract

The Hybrid numbers are generalization of complex, hyperbolic and dual numbers. In recent years, studies related with Hybrid numbers have increased significantly. Also, there are many studies interesting generalizations and applications of the Fibonacci polynomials. In this study, we introduce a bivariate biperiodic Fibonacci hybrinomials. Moreover, we present the Binet formula, generating functions, Catalan's identities and Cassini's identities of the Bivariate biperiodic Fibonacci hybrinomials.

Keywords: Bivariate biperiodic polynomials, Hybrid numbers, Binet formula, Generating function

Acknowledgement: This study is a part of the second author's Master Thesis.

Bootstrap in Gaussian Mixture Model and Performance Assessement

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Abstract

The Gaussian mixture model is one of the well-known clustering approaches while representing the data from different normal distributions with distinct parameters. In inference of the model parameters, various methods can be used. Among alternatives, we select the expectation-maximization algorithm as the number of parameters is large to perform maximum likelihood estimators with explicit forms. The underlying estimation problem becomes serious when the numbers of parameter (p) exceeds the number observation (n). Hence, in this study, we propose to apply the bootstrapping strategy so that the difference between n and p can be smaller. In bootstrapping procedure, we implement the Efron's approach which is non-parametric and computationally faster than its alternatives. Then, we evaluate the performance of this proposal model with well-known model selection criteria like the Akaike Information Criterion (AIC) and the ones which are designed specifically for high dimensional datasets, namely, consistent AIC and Information and Complexity Selection (ICOMP). In numerical examples, we investigate the performance of proposed model with real datasets. By means of this study, we aim to improve the accuracy of the Gaussian mixture model in clustering big datasets and to suggest a fair model selection criterion in comparison of the results.

Keywords: Clustering, Bootstrap methods, Gaussian mixture models, Model selection methods

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Howe, J. A., & Bozdogan, H. (2013). Robust mixture model cluster analysis using adaptive kernels. *Journal of Applied Statistics*, *40*(2), 320-336.

Brent Crude Oil Price Fluctuation Analysis Under COVID-19

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Abstract

From January 2019, the purpose of oil has undergone various fluctuations as a result of the appearance of the SARS-COV2 epidemic. This endemic paralyzed the entire economic sphere. This slowdown had a direct impact on the price per barrel. Indeed, the stagnation of the commercial dynamic creates uncertainty and pulls the price per barrel down. However, different socio-economic factors influence the stock market. After three years of pandemic, it becomes possible to analyze its effect on the price of a barrel over this period. It turns out that the system is very complex to analyze by classical mathematical techniques. This study proposes the analysis of the evolution of the price of the barrel by the techniques of artificial intelligence. A fuzzy inference system is proposed. As fuzzy logic deals with the uncertain and imprecise, its application in this area is adequate. The input variable represents the COVID-19 contamination index. The index is far from precise and affects populations in an irregular way, hence its consideration as a fuzzy variable. This variable is then fuzzyfied (its conversion into linguistic variables). The output variable represents the price of the barrel which is also considered uncertain. A basis of the rules that link entry to exit is established from the actual values of the evolution of these throughout the period of the pandemic. Once the system is completed, it will be possible to draw conclusions and predict the evolution of the price of the barrel under the same conditions in other possible pandemics.

Keywords: Crude oil, price, covid-19, artificial intelligence

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Calculation of the Shortest Distance and the Lowest Fuel Cost by Simulating Annealing in the Heterogeneous Fleet Vehicle Routing Problem with Capacity Constraints

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Abstract

The vehicle routing problem (VRP), which is the last stage of the logistics systems and supply chain in the growing economy market, has gained great importance. Vehicle routing problem is a mathematical optimization problem in which minimum cost, shortest distance routes are determined for customer demands located in different locations from a central warehouse. In this study, ARP consisting of capacity-constrained, heterogeneous fleet vehicles has been handled, and the optimization problem in which the optimum route set is calculated and fuel costs are minimized has been examined. The approximate solutions of the problem are calculated with the meta-heuristic Annealing Simulation algorithm in MatLab.

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Certain Sublasses of Multivalent Functions Defined by Deniz-Özkan Differential Operator

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Abstract

In this study, making use of the Deniz-Özkan differential operator two new subclasses of multivalent analytic functions are introduced and some basic properties of them investigated in the open unit disc.

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Characterization of Bivariate Quadratic Transformations of Quasi-copulas

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Abstract

In this study, we focus on bivariate transformations of trivariate quasi-copulas. We characterize necessary and sufficient conditions of transformations that can be written in the form of compositions between two quasi-copulas and a quadratic polynomial function. The conditions only depend on the coefficients of the quadratic polynomial. The set of these coefficients is convex with linear boundary and it lies on the seven-dimensional Euclidean space. All extreme points of this set have been characterized via CAS and can be used to construct quasi-copulas. Construction examples are also given.

Keywords: aggregation function, quasi-copula, quadratic transformation.

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Classical and approximate exponential sampling formula: their interconnections

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Abstract

In the paper [1] we show that the exponential sampling theorem and its approximate version for functions belonging to a Mellin inversion class are equivalent in the sense that, within the setting of Mellin analysis, each can be obtained from the other as a corollary. The approximate version is considered for both, convergence in uniform norm and in the Mellin-Lebesgue norm. Important tools are a Mellin version of the mixed Hilbert transform, introduced in [1] and a suitable subspace of Mellin-Lebesgue spaces. These studies extend those considered in Fourier analysis for the classical Shannon sampling formula. The main results concern the Hilbert space X_c^2 .

[1] C. Bardaro, P.L. Butzer, I. Mantellini, G. Schmeisser, R.L. Stens, "*Classical and approximate exponential sampling formula: their interconnections in uniform and Mellin-Lebesgue norms*" submitted, 2022.

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Coefficient Estimates For A Certain Subclass of Bi-Univalent Functions Defined By using The Generalized Jung-Kim-Srivastava Integral Operator

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Abstract

In this paper, we investigate a new subclass $\mathcal{B}_{\Sigma}^{\delta}(\beta,\lambda;\varphi)$ of bi-univalent functions in the open unit disk $\mathcal{U}$ defined by the generalized Jung-Kim-Srivastava integral operator. We obtain initial coefficients bounds for functions belonging to this class.

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Coefficient Inequalities For A Subclass of Bi-univalent Functions Involving Laguerre Polynomials

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Abstract

In this article, we establish the bounds for the initial Taylor–Maclaurin coefficients $|a_2|$ and $|a_3|$ for a new family of analytic and bi-univalent functions in the open unit disk which involve Laguerre polynomials. Furthermore, we investigate the special cases and consequences for the new family functions.

Acknowledgement: Analytic and bi-univalent functions, subordination, coefficient ineqaulity, Laguerre polynomials.

Collocation and Kantorovich methods for solving linear integro-differential equation

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Abstract

In this study, we built two numerical approximations solutions based on projection method to solve the linear Fredholm integro-differential equation. We explain the basic ideas of the Collocation and Kantorovich methods. We prove the convergence of the approximate solutions two exact solution and we present theorems to show this convergence in the Banach space $C1[a,b]$. Finally, to observe the error behaviour of the two methods, we give numerical examples.

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Commutativity of Fourth-Order Discrete-Time Linear Time-Varying Systems

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Abstract

In this proceeding, two fourth-order discrete-time linear time-varying systems (systems A and B) are considered. These systems are described by fourth-order linear difference equations. Formulations of the cascaded-connected systems AB and BA are presented. Necessary conditions of commutativity of fourth-order discrete-time linear time-varying systems are given.

Composite Anti-Disturbance Control for Fuzzy Chaotic Semi-Markov Jump Systems

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Abstract

This study deals with the problem of asymptotic stabilization and disturbance rejection for fuzzy chaotic semi-Markov jump systems with matched and mismatched disturbances. Specifically, the matched disturbances are dealt by constructing a disturbance observer. Meanwhile, the mismatched part is handled by invoking the H∞ performance. Therefore, by using parallel distributed compensation technique, a composite anti-disturbance control protocol is designed by combining the fuzzy rule-based state feedback controller and output of the disturbance observer. Moreover, by constructing a suitable Lyapunov function, a set of sufficient conditions is derived in the framework of linear matrix inequalities to guarantee the asymptotic stability of the closed-loop system. Further, by solving the obtained inequalities, the controller and observer gain matrices are computed. Finally, simulation results are provided to show the effectiveness of the developed control design.

Keywords: Fuzzy chaotic semi-Markov jump systems; Anti-disturbance control; Disturbance observer; H∞ performance.

Convulation Properties of Certain Sublasses of Multivalent Functions

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Abstract

In this study, we consider certain subclasses of multivalent functions defined by Deniz- Özkan differential operator. We obtain convulation (or modified Hadamard products) of functions belonging to these subclasses

Data Envelopment Analysis in the presence of q-Rung fuzzy inputs and outputs

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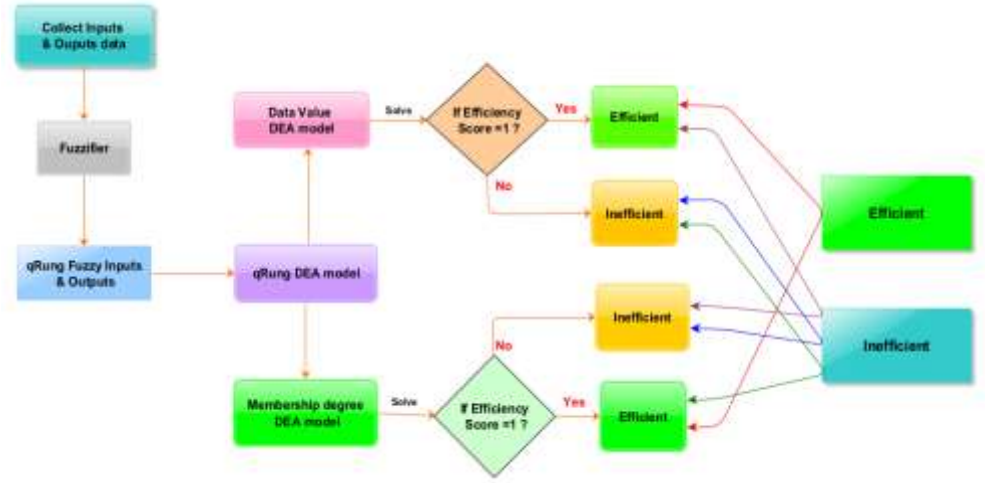
Abstract

This work is the first to investigate the Data Envelopment Model (DEA) in the presence of q-Rung fuzzy inputs and outputs. Fundamental CCR and BCC models are presented in the context of q-Rung triangular fuzzy numbers (qRTFNs), which take into account the truth and falsity degrees of each input and output and provide a novel solution approach for it. This method divides a q-Rung fuzzy DEA (qRF-DEA) model into two crisp DEA models, first evaluating data value efficiency and the second evaluating membership degree efficiency. The efficiency score of the DMU is a combination of the efficiency score of the data value and the efficiency score of the membership degree of the data value. Furthermore, an example shows the applicability and validity of this unique technique, and DMUs are ranked based on their combined overall efficiency score.

Graphical Abstract:



Keywords: Data Envelopment Analysis; q-Rung Fuzzy Set (qRFS); Efficiency Analysis; q-Rung Triangular Fuzzy Number (qRTFN); Ranking.

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Decomposition Formulas of a Third-order Discrete-time Linear Time-varying Systems into its First- and Second-order Commutative Pairs

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Abstract

In this study, a third-order discrete-time linear time-varying system is considered. Decomposition formulas of this system into its first-order and second-order commutative pairs are presented.

Degree Raising and Reduction of Rational Bezier Curves

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Abstract

In this research talk, the rational Bezier curves are considered. The rational Bezier curves of degree n corresponding to the n+1 points p_i and the n+1 weights w_i are defined as follows:

$$R_n(t) := \frac{\sum_{i=0}^{n} w_i p_i \, B_i^n(t)}{\sum_{i=0}^{n} w_i B_i^n(t)}, \qquad t \in [0,1],$$

The values of $R_n(t)$ at the boundaries are:

$$R_n(0) = p_0, \qquad R_n(1) = p_n.$$

Some operations for the rational Bezier curves are investigated; in particular, degree elevation and degree reductions using the L2-norm with geometric boundary conditions will be investigated. The error between the original curve and degree reduced curve will be studied and estimated. Several numerical examples and figures will be presented to demonstrate the applicability of the proposed methods, operations, and properties.

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Demonstration of Several Properties on Special Number Theoretic Functions

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Abstract

The theory of numbers called arithmetic is important in maths science. The importance and implementation of computer science in recent years (as a result of rapid development their fields such as process systems, communication their systems are financial predictions and quantum computers) are increasing related with number theory rapidly. Also, it is easily seen that arithmetic functions have practices (since they related with the coefficients of the power series) in engineering, IT, architecture, economics, physics as well as number theory, combinatorics, game theory, probability theory, analysis in mathematics.

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Main aim in this work is to consider Euler totient arithmetic function and Divisor arithmetic function (the number of positive divisors of natural numbers) with their relations to each others. Firstly, some of the fundamental notations with theoretical results on these arithmetic functions are given. Then, several results are demonstrated by comparing values of these functions for the same natural number. Obtained results are also supported by numerical instances.

Keywords: Arithmetic Functions, Properties of Arithmetic Functions, Primes, Natural Numbers, Euler's Totient Arithmetic Function, Divisor Arithmetic Function, Multiplication.

Design of Finite-Time Robust Control for Uncertain Periodic Piecewise Time-Varying Systems

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Abstract

In this study, the problem of state estimation and finite-time (FT) robust control design for a class of periodic piecewise time-varying systems (PPTVSs) with immeasurable states, external disturbances and parameter uncertainties are investigated. Precisely, in order to reconstruct the states of the PPTVSs, the proportional integral observer system is constructed in accordance with the output of the PPTVSs. Moreover, the technique of FT boundedness and input-output FT (IO-FT) stability is used in order to prevent enormous unfavourable values for PPTVSs in both state and output, respectively. After that, in the setting of linear matrix inequalities, the sufficient conditions for affirming the FT boundedness and IO-FT stabilization of the system are acquired with the assistance of the Lyapunov stability theory and the matrix polynomial lemma. Following this, the gain matrices of both controller and observer are computed on the basis of the established criteria. In the end, numerical example have been provided to validate the developed theoretical results.

Keywords: Periodic piecewise time-varying systems; Parameter uncertainties; Proportional integral observer; Finite-time boundedness; Input-output finite-time stability.

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Disturbance estimator-based predictive tracking control design for semi-Markovian jump systems

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Abstract

In this study, a state tracking control problem for a class of semi-Markovian jump systems (SMJSs) with uncertainties, input time-varying delays and disturbances is addressed. Preciously, to simultaneously compensate the effects of unknown external disturbances and time-varying delay, an improved-equivalent-input-disturbance estimator approach (IEIDEA)-based truncated predictive controller is designed. Specifically, by making use of IEIDEA, the unknown disturbances are estimated with high precision and incorporated into the control input channel, which ease the way for achieving the desired tracking performances. In accordance with Lyapunov stability theory, a set of adequate conditions in the linear matrix inequality framework is established to guarantee the state tracking performance of the system under study. Finally, the numerical examples with simulation results are provided to validate the practicability and efficacy of the developed control strategy.

Keywords: Tracking problem, Disturbance estimation approach, Predictive analysis, Semi-Markovian junp systems.

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Double Hausdorff Deferred Statistical Equivalence of Order μ

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Abstract

In this study, first of all, the concepts of asymptotical Hausdorff deferred statistical equivalence of order μ and asymptotical Hausdorff deferred Cesàro equivalence of order μ $(0 < \mu \leq 1)$ for double sequences of sets are introduced, some properties of these concepts are given and the relations between them are examined. Then, the relation between the concepts of asymptotical Hausdorff deferred statistical equivalence of order μ and asymptotical Wijsman deferred statistical equivalence of order μ for double sequences of sets is showed.

Keywords: Asymptotical equivalence, Hausdorff convergence, Double sequences of sets, Deferred statistical convergence, Deferred Cesàro summability, Order μ, Wijsman convergence.

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Double Wijsman Deferred Cesàro Summability and Statistical Convergence of Order α

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Abstract

The aim of this study is to introduce the notions of deferred Cesàro summability of order α and deferred statistical convergence of order α $(0 < \alpha \leq 1)$ in the Wijsman sense for double set sequences, to give some properties of these notions and to examine the relationship between them.

Keywords: Deferred Cesàro mean, Deferred statistical convergence, Order α, Double sequences of sets, Wijsman convergence.

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Elaboration of stochastic mathematical models for the relative humidity levels prediction using artificial neural networks

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Abstract

The artificial neural networks (ANN) are generally used to deal with mathematical problems, especially in statistical problems where the variables are nonlinear. This work provides the development of a powerful artificial neural network model, for the prediction of relative humidity levels, using other meteorological parameters of the Rabat-Kenitra region. The treatment was applied to a database containing a daily history of five meteorological parameters of 9 stations covering this region for a period from 1979 to mid-2014.

We have shown that for the prediction of relative humidity in this region, the best performing three-layer ANN (input, hidden and output) mathematical model is the multi-layer perceptron (MLP) model. This neural model using the Levenberg-Marquard algorithm, having an architecture [5-11-1] and the transfer functions Tansig in the hidden layer and Purelin in the output layer was able to estimate values for relative humidity very close to those observed. Indeed, this was affirmed by a low mean squared error (MSE) and a high correlation coefficient (R), compared to the statistical indicators relating to the other models developed as part of this study.

Key words — Modeling; ANN; MLP, learning algorithm; Relative humidity.

Epirochoidal Surfaces

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Abstract

We consider the epirochoidal surfaces in 3-dimensional Euclidean space $\mathbb{E}^4$. We give fundamental notations of a Euclidean space. Defining a helicoidal surface, we reveal the epirochoidal surface, and find its Gauss map, Gaussian curvature, and the mean curvature. Then, we indicate some relations between the curvatures of that kind surfaces.

Estimating Parameters of Kumaraswamy Weibull Distribution

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Abstract

The Kumaraswamy Weibull (KwWeibull) is a special case of the generalized Kumaraswamy distribution and it is a better alternative to Weibull distribution. KwWeibull distribution is flexible enough to model different types of skewed data. In this study, estimators of the location and scale parameters of the KwWeibull distribution are obtained by using Tiku's modified maximum likelihood (MML) methodology. The MML methodology is asymptotically equivalent to the maximum likelihood (ML) methodology. Different from ML methodology, it gives explicit estimators of the parameters.

Keywords: Kumaraswamy Weibull distribution, modified maximum likelihood estimators, maximum likelihood estimators.

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Existence and Approximate Controllability of Mild Solutions for \psi-Hilfer Fractional Integro-Differential Equations

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Abstract

In this work, we study the existence and the approximate controllability for \psi-Hilfer fractional integro-differential equations with \psi- fractional nonlocal conditions in a Hilbert space. At first, a group of sufficient conditions is established for the existence of mild solutions without the compactness of operateur semigroup. Then the approximation controllability is studied. The results are obtained with the help of semigroup theory, \psi-Hilfer fractional calculus and the Banach fixed point theorem.

Keywords: approximate controllabiliy, Psi-Hilfer fractional derivative, fixed point theorem.

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Existence of fixed-point theorems for complex partial b-metric spaces using S-contractive mapping.

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Abstract

In this paper, we have proved some results on complex partial b-metric space $(R,\ P_b^c)$, which are more generalization of S-contractive mapping. Also, we have expanded weakly increasing mappings of S-contractive for two self mappings and proved common fixed point theorem with supported example in complete partial b-metric space $(R,\ P_b^c)$.

Key words: S-contraction, weakly increasing mappings, complex partial b-metric space.

Explicit Solution of First-Order Differential Equation Using Aitken's and Newton's Interpolation Methods

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Abstract

In this work, we combine both the Aitken method and the Lagrange interpolation method (NIM) to solve first-order differential equations. The numerical results obtained provide minimum approximative error. The result is supported by solving an example.

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Fault reconstruction for interval type-2 fuzzy-based cyber-physical systems: A learning observer-based approach

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Abstract

This study investigates the stabilization and fault reconstruction issues for interval type-2 fuzzy (IT2)-based cyber-physical systems with actuator faults and external disturbances. The primary intent of this work is to formulate a learning observer system with the IT2 fuzzy technique that reconstructs the actuator faults as well as the states of an addressed system. Notably, the information of reconstructed actuator faults is used in the developed controller with the imperfect premise variables aids in the stabilization of the system under investigation. In the meantime, the H_∞ technique is deployed to reduce the effect of external disturbances in the considered system. Based on these settings, a set of sufficient criteria is derived in the form of linear matrix inequalities to ensure the stability of the system. Moreover, the requisite gain matrices are computed by solving the developed linear matrix inequalities. Finally, a numerical example with simulation is provided to illustrate the effectiveness of developed strategy.

Keywords: Cyber-physical systems; Interval type-2 fuzzy systems; Fault reconstruction; Learning observer.

Fekete-Szegö Inequalities For A Subclass of Bi-univalent Functions Defined by Laguerre Polynomials

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Abstract

In this paper, we obtain the bounds for Fekete-Szegö inequalities for a new subclass of analytic and bi-univalent functions in the open unit disk defined by Laguerre polynomials. Furthermore, we investigate the special cases and consequences for a new subclass.

Acknowledgement: Analytic and bi-univalent functions, subordination, Fekete-Szegö problem, Laguerre polynomials.

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Fekete-Szegö Problem For Some Subclasses of Bi-Univalent Functions Defined By The Generalized Integral Operator

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Abstract

In this study, we solve Fekete-Szegö problem for a new subclass $\mathcal{B}_{\Sigma}^{\delta}(\beta,\lambda;\varphi)$ of bi-univalent functions in the open unit disk $\mathcal{U}$ defined by the generalized Jung-Kim-Srivastava integral operator.

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Fekete-Szegö Problem For Some Subclasses of Bi-Univalent Functions

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Abstract

In this study, we solve Fekete-Szegö problem for a new subclass $\mathcal{B}_{\Sigma}^{m}(\lambda,\beta;\varphi)$ of bi-univalent functions in the open unit disk U defined by an integral operator.

Finding communities: an overview for realistic sparse network

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Abstract

Consider a network in which nodes are divided into K distinct communities. The community labels for the nodes are unknown, therefore estimating them is of great importance (i.e., community detection). A popular network model is the Degree Corrected Stochastic Block Model (DCSBM). The subject of using the DCSBM to detect communities is an interesting one, with the key challenge being degree heterogeneity. A graph partitioning problem resembles community discovery. The majority of network partitioning algorithms are centered on improving a quality function. Traditional network models fail to find the community structure organization, especially for sparse network which have an important characteristics of real-world networks. They're also ineffective at predicting real-world network properties. We present a review of methods for estimating the number of communities methods in a network.

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Finite-time Stabilization for Uncertain Periodic Piecewise Polynomial Systems with Nonlinear Actuator Faults

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Abstract

This aim of this article is to investigate the problem of finite-time stabilization for a class of continuous-time uncertain periodic piecewise polynomial systems (UPPPSs) with external disturbances through robust fault-tolerant controller. Specifically, a parameter uncertainty in the system is considered with random nature and it is assumed to pursue the Bernoulli distributions. Furthermore, the control protocol takes actuator faults into account with nonlinear characteristics. Besides to mitigate the effects of external disturbances, H_∞ performance is implemented. The foremost intent of this study is to design a robust fault-tolerant controller to obtain the finite-time stabilization of the UPPPSs. Moreover, by using the Lyapunov stability theory, linear matrix inequality technique and finite-time stability theory, the sufficient conditions are derived for the undertaken system in the form of linear matrix inequalities. Following this, the desired gain matrix of the controller can be computed by solving the accomplished linear matrix inequality-based criteria. Finally, the developed control scheme's inherent potential and applicability are revealed through numerical simulations.

Keywords: Periodic piecewise polynomial systems; Nonlinear actuator faults; Randomly occuring uncertainties; External disturbances; Finite-time boundedness.

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Fitted Difference Method for Singularly Perturbed Fredholm Integro-Differentıal Equation

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Abstract

In this study, a numerical solution of the second-order singularly perturbed Fredholm integro-differential equation is considered. The properties of the continuous problem are given and the difference scheme is constructed by the method of integral identities with the use of exponential basis functions and interpolating quadrature rules with the weight and remainder terms in integral form. The approximate solution is shown to be second-order uniform convergent according to ε-parameter to the exact solution in the discrete maximum norm. The obtained results are supported by a numerical example.

Keywords: Fredholm integro-differential equation, singular perturbation, uniform convergence.

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Focal Curves of the Principal-Direction Curves

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Abstract

In this study, we obtain some new characterizations for focal curves of principal-direction curves. We also give results that reveal the relations of these curves with some associated curves.

Fractional-Stochastic Keller-Segel model

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Abstract

We introduce stochastic model of chemotaxis by fractional Derivative generalizing the deterministic Keller Segel mo del. These models include flctuations which are important in systems with small particle numbers or close to a critical point. In this work, we study of nonlinear stochastic chemotaxis model with Dirichlet boundary conditions, fractional Derivative and disturbed by multiplicative noise. The required results is prove the existence and uniqueness of mil d solution to time and space-fractional , for this we use analysis techniques and fractional calculus and semigroup theory, also studying the regularity properties of mild solution for this model.

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Frenet ribbons of timelike biharmonic curves according to flat metric in the Lorentzian Heisenberg group $Heis^3$

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Abstract

In this paper, we study Frenet ribbons of timelike biharmonic curves according to flat metric in the Lorentzian Heisenberg group $Heis^3$. We give some characterizations for Frenet ribbons of timelike biharmonic curves. Moreover, we obtain Tchebyshef net on Frenet ribbons in the Lorentzian Heisenberg group $Heis^3$.

Full lattice convergence on Riesz spaces

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Abstract

In this talk, firstly we will give some basic definitions on Riesz spaces. Then we will determine full lattice convergence and fullification. Lastly, types of modifications of full convergence will be given.

Keywords: Full lattice convergence, fullification, Riesz Spaces

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Galilean transformations of moving particle in Euclidean space R^3

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Abstract

In this paper, we use geometrical descriptions of the curvature and torsion functions of the curve for the calculation. Then we consider a second reference system K^*, which moves relative to the K for an arbitrary direction with a uniform velocity under the Galilean transformation. Finally, we compute the relativistic energy on the moving particle considering relative reference system K^*.

Generalization of Riemann-Liouville Fractional Operators in Bicomplex Space and Applications

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Abstract

In this article, we generalize Riemann-Liouville fractional operators to functions of a bicomplex variable. We also replace the order of this operator by a bicomplex number, generalizing further the operator. We give an application of a construction to Maxwell's equations. By representing the fractional version of Maxwell's equation as a bicomplex vector field in vacuum and source-free domain, we show that we can reduce the number of equations by half.

AMS Subject Classification (2010): 30G35, 26A33, 33B15.

Keywords and phrases: Functions of bicomplex variable, Idempotent representation, Bicomplex gamma and beta functions, Riemann-Liouville operators of bicomplex order.

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Generalized Ricci solitons of the lie group $\mathbb{H}^2 \times \mathbb{R}$

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Abstract

Ricci solitons are a large research field in differential geometry. They are important because they are corresponding to self-similar solutions of the Ricci flow and are also a generalization of Einstein manifolds [1]. Some generalization of Ricci soliton such as gradiant Ricci soliton and quasi-Einstein manifolds, play an significant role in the classification of self-similar solutions of geometric flows and to describe the local structure of givem manifolds. In this article, we foocus on generalized Ricci solitons, which is another generalization of Ricci solitons. The concept of generalized Ricci solitons was introduced by Nurowski and Randall [2]. A generalized Ricci soliton is a Riemannian manifold (M, g) admitting a smooth vector field X, such that

$$L_X g + 2\alpha X^b \odot X^b - 2\beta Ric = 2\lambda g, \qquad (1)$$

for some real constants α, β, λ, where L_X shows the Lie derivative in the direction of X, X^b displays a 1-form such that $X(Y) = g(X, Y)$, and Ric is the Ricci tensor.

The Equation (1) corresponds to an overdetermined system of partial differential equations of finite type. The purpose of this article is to study generalized Ricci solitons on three-dimensional Lie group $\mathbb{H}^2 \times \mathbb{R}$.

Acknowledgement: Generalized Ricci soliton, Ricci flow, Lie group.

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Generalized spherical fuzzy topological spaces with their applications to the multi-criteria decision-making problems

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Abstract

The aim of this study is to introduce the generalized spherical fuzzy topological spaces by defining some basic concepts such as generalized spherical fuzzy subspace, generalized spherical fuzzy interior, generalized spherical fuzzy closure and generalized spherical fuzzy boundary. Then, we obtain some properties of these concepts and explain them with examples. We also establish an algorithm to solve multi-criteria decision-making problems based on generalized spherical fuzzy topological spaces. Finally, we compare the proposed method with the generalized spherical fuzzy TOPSIS method under a numerical example to demonstrate the validity and reliability of this new method.

Keywords: Generalized spherical fuzzy sets, generalized spherical fuzzy topological spaces, multi-attribute decision-making, TOPSIS.

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Geometric Properties of Generalized Integral Operator Involving The Rabotnov Function

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Abstract

A useful family of integral operators and special functions plays a crucial role on the study of mathematical and applied sciences. The purpose of the present paper is to give sufficient conditions for an integral operator, which involves the normalized form of the Rabotnov function to be univalent in the open unit disk. Furthermore, we determine the order of the convexity of this operator. In order to prove main results, we use differential inequalities for the Rabotnov functions together with some known properties in connection with the integral operator which we have considered in this paper. Moreover, some graphical illustrations are provided in support of the results proved in this paper.

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Hardy Space of Miller-Ross Function

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Abstract

In this paper, we obtain conditions for the normalized Miller-Ross function to belong to the Hardy space $\mathcal{H}^{\infty}$.

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Hermite collocation technique for the solutions of Erdelyi-Kober fractional di_erential equations

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Abstract

Using the Hermite collocation method (HCM), we create an approximate solution of the higher order E-K fractional di_erential equation with multi terms and initial conditions in this paper. We convert the supplied di_erential equation into an algebraic equation using this procedure, and the unknowns are the coe_cients of the problem's Hermite series solution. We explore some examples and evaluate the Error boundaries for numerical calculations to ensure the method's accuracy.

Keywords and Phrases: Hermite polynomial, Erdelyi-Kober fractional operator, Hermite Collocation method (HCM).

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Higher Order Fitted Numerical Method for Singularly Perturbed Semilinear Boundary Value Problem with Integral Boundary Condition

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Abstract

In this work, our primary interest is to provide efficient and ε-uniformly convergent numerical technique for solving singularly perturbed semi-linear boundary value problem with integral boundary condition. These singular perturbation problems are described by differential equations in which the highest-order derivative is multiplied by an arbitrarily small parameter ε (say) known as singular perturbation parameter. This leads to the existence of boundary layers which are basically narrow regions in the neighborhood of the boundary of the domain, where the gradient of the solution becomes steep as the perturbation parameter tends to zero. Due to the appearance of the layer phenomena, it is a challenging task to provide ε-uniform numerical method. The term 'ε-uniform' refers to identify those numerical methods in which the approximate solution converges to the corresponding exact solution (measured to the supermom norm) independently with respect to the perturbation parameter ε. Thus, the purpose of this paper is to develop, analyze and improve the ε-uniform numerical method for solving singularly perturbed problem under consideration. A uniformly convergent numerical method is constructed via fitted operator numerical method and numerical integration methods to solve the problem. The integral boundary condition is treated using numerical integration techniques. Maximum absolute errors and rates of convergence for different values of perturbation parameter and mesh sizes are tabulated for the numerical examples considered. The method is shown to be ε-uniformly convergent. Finally, two numerical experiments are conducted which support all of our theoretical findings. A concise conclusion is provided at the end of this work.

Keywords: Integral boundary condition, Exponential fitted operator, Semi-linear problem, Singular perturbation, Uniformly convergent.

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Implementation of Modified Hirota Method to a Nonlinear Partial Differential Equation

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Abstract

In this work, modified Hirota method [1,2] is used and we present soliton, complexiton and interaction solutions of a sixth order nonlinear partial differential equation through its bilinear form. Diversity of obtained solutions is gained by means of some restrictions about phase shifts.

Keywords: Modified Hirota method, interaction solutions, bilinear form.

References:

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Improper integral with exponential function

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Abstract

In this paper, we explore the improper integral with exponential function $f = x^x$ is approached to infinite series, and also prove the convergence of these series. An improper integral converges if the limit defining it exists. We use Maple code to calculate the infinite series. The application of improper integral appear in several domain in science. As an application in this paper, three examples are given to illustrate the effectiveness of our main result.

Keywords: Improper integral, Exponential function, Infinite series.

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Initial Bounds For A Certain Subclass of Bi-Univalent Functions Defined By An Integral Operator

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Abstract

In this study, we obtained initial coefficients bounds for a new subclass of bi-univalent functions defined by an integral operator in the open unit disk U .

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Input output finite-time cluster synchronization for complex dynamical networks under dynamic event triggering mechanism

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Abstract

This study deals with the issue of input output finite-time cluster synchronization for a class of complex dynamical networks subject to nonlinearities, external disturbances and actuator faults. To be specific, a dynamic event-triggered transmission scheme is incorporated to reduce the network burden during the data communication from sensors to actuators. In this work, a dynamic event trigger-based reliable controller is designed to ensure the cluster synchronization and desired reduction of communication load for the addressed system. Based on these settings, a set of sufficient conditions is established in terms of linear matrix inequalities using Lyapunov stability theory. Moreover, the desired gain matrices are computed using MATLAB LMI toolbox and further the desired synchronization performance of the addressed system is ensured. Finally, a numerical example is presented to demonstrate the potential of the obtained theoretical results.

Keywords: Complex dynamical networks; Cluster synchronization; Dynamic event-triggering mechanism; Reliable control; Input-output finite time.

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INTERPOLATING AND VISUALIZING WITH PIECEWISE POLYNOMIALS BY USING PYTHON

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Abstract

The purpose of this paper is to study interpolation and make it easier to understand, visualize and use through software, in this case, by utilizing the Python programming language. There are two common methods for interpolating polynomials: Newton's Divided Difference Method and Lagrange's Method. In this study, we are going to are going to focus on Newton's Divided Difference Method. First, we briefly explain what the method does and how to use it given some points. After that, we code its algorithm in Python and test it with some dummy data. The final step is to take all our knowledge and make an application out of it. The user can enter some points, and by using Newton's Divided Difference Method, the user should be able to see the interpolated polynomial of these points, and a plot with a curve fitting them. The user can also enter other points to predict where they would fit in this graph.

Investigation a fractional neutral functional quantum differential equations with application

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Abstract

The principal importance of this paper is to obtain the existence of solution of a fractional neutral functional quantum differential equations with bounded delay based on operator equations by using Krasnoselskii's fixed point theorem. The example which they contain related algorithms with numerical effect, shows application of the our results.

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Jacobi Polynomials for Distributed-Order Fractional Diffusion Equations

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Abstract

The distributed order fractional diffusion equations are the generalization of the standard fractional diffusion equations, which arising in modeling the processes lacking power-law scaling over the whole time-domain, such as; ultraslow diffusion where a plume of particles spreads at a logarithmic rate. In this research, a numerical approach is purposed to obtain the numerical solution of this class of the equations of the general form in the time domain with the Caputo fractional derivative, in the form

$$D_t^{\eta(\alpha)}U(X,t) = \Delta U(X,t) + F(X,t), \quad X \in \Omega, \quad t \in [0,T], \tag{1}$$

subject to the following conditions:

$$U(X,0) = f(X), \qquad U(X,t)_{\partial\Omega} = G(X,t), \tag{2}$$

where Δ is the Laplacian operator, $\partial\Omega$ denotes the boundary of Ω and $D_t^{\eta(\alpha)}$ is the distributed order fractional derivative operator defined by

$$D_t^{\eta(\alpha)}V(X,t) = \int_0^1 \eta(\alpha)\ {}_0^cD_t^{\alpha}V(X,t)d\alpha,$$

and $\eta(\alpha)$ is the smooth, non negative weight function.

For solving equation (1) we apply the orthogonal Jacobi polynomials via spectral methods. We derive a new operational matrix of the distributed order fractional derivative for Jacobi polynomials by some Gauss quadrature and expand the unknown and known functions of equation (1) by Jacobi polynomials. So the main problem reduces to an algebraic equation and for solving the obtained equation, we discretize it using spectral collocation and Galerkin methods. Numerical examples are provided to show the accuracy and efficiency of the purposed method.

Keywords: Distributed order fractional derivative**,** Caputo Jacobi polynomials, spectral method

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Jost Solutions of the Operators Created by Quantum Difference Equations

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Abstract

In this study, we get the q-analogous of the Sturm-Liouville equation on the whole axis first [3], then we consider the q-difference expression

$$q\gamma(t)y(qt) + \beta(t)y(t) + \gamma\left(\frac{t}{q}\right)y\left(\frac{t}{q}\right) = \lambda y(t), \quad t \in q^{\mathbb{Z}}, \qquad (1)$$

which was intensively studied in [1,2], where $\gamma(t) \neq 0$ for all $t \in q^{\mathbb{Z}}$ and λ is a spectral parameter.

The main purpose of this talk is to investigate some spectral properties of Equation (1) such as getting the analytic properties and asymptotic behaviours of the Jost solution and obtain the continuous spectrum of the related operator.

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Acknowledgement: q-difference equation, q-difference operator, Jost solution

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Krasnoselskii Type Theorems in Product Banach Spaces and Applications to Systems Of Nonlinear Transport Equations and Mixed Fractional Differential Equations

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Abstract

We use a new technique for the treatment of systems based on the advantage of vector-valued norms and of the weak topology. We first present vector versions of the Leray-Schauder alternative and then some Krasnoselskii type fixed point theorems for a sum of two mappings. Applications are given to a system of nonlinear transport equations, and systems of mixed fractional differential equations.

Laplace Operator with Caputo-Type Marichev-SaigoMaeda Fractional Differential Operator of Extended Mittag- Leffler Function

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Abstract

In this paper, the Laplace operator is used with Caputo-Type Marichev–Saigo–Maeda (MSM) fractional differentiation of the extended Mittag-Leffler function in terms of the Laplace function. Further in this paper, some corollaries and consequences are shown which are the special cases of our main findings. We apply the Laplace operator on the right-sided MSM fractional differential operator and on the left-sided MSM fractional differential operator. We also apply the Laplace operator on the right-sided MSM fractional differential operator with the Mittag-Leffler function and the left-sided MSM fractional differential operator with the Mittag-Leffler function.

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LINEAR PRESERVER OF n×1 FERRERS VECTORS

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Abstract

Let $A = [a_{ij}]_{m\times n}$ be an $m \times n$ matrix of zeros and ones. The matrix A is said a Ferrers matrix if it has decresing row sums and it is row and column dense with nonzero $(1,1)$-entry. In this paper we characterize all linear maps preservering $n\times 1$ Ferrers vectors set over the binary Boolean semiring and over the Boolean ring $\mathbb{Z}_2$. Also we have achived the number of these linear maps in each cases.

This is a joint work with Leila Fazlpar.

Linearizing then discretizing by Kantrovich projection or by Nystrom process for solve nonlinear integral equations "What is the better process?"

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Abstract

In this talk, we will define a new strategy for solving nonlinear functional equations, specifically nonlinear Fredholm integral equations of the second kind. This new process is started by the linearization phase using the iterative Newton method and then, move on the discretization step by applying for example Kantorovich projection, Sloan projection or Nystrom method. In this work, we will compare between applying the Kantorovich projection and the Nystrom method in the discretization phase of our new strategy, where we will conclude what is the best method that we must apply for solve nonlinear integral equations, where we will be applying our technique for solving system of nonlinear integrodifferential equations.

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Mathematical Modeling of Church Growth

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Abstract

The church has been in existence for so many years and this has changed the lives of many people in the society. The growth of church is essential in the sustainability and spread of the church in any society. In this paper, an SEIR church model is proposed. The model properties is studied with the reproduction number R0 also computed. The steady states of the church model are studied and the church free equilibrium is found to be locally and globally stable. The church endemic state does not exist. The time dependent controls are included in the church model and Pontryagin's Maximum Principle is used to characterise the essential condition for promoting church evangelism which leads to active church members. The numerical simulation results indicate that the combination of all the three controls strategies at the same time helps to maximize the church evangelism and have more unbelievers being converted to active believers.

Mathematical modelling of respiratory viral infections

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In this lecture we will present an overview of recent works on mathematical modelling of respiratory viral infections at the individual and population levels. We will begin with the investigation of infection progression in cell cultures and in tissues of human body. We will determine viral load and infection spreading speed and we will apply these results to evaluate infectivity and severity of symptoms for different variants of the SARS-CoV-2 infection. Next, using the estimates of the infection transmission rate, we will present new immuno-epidemiological models and will use them to evaluate the epidemiological situation for the ongoing COVID-19 pandemic.

This cycle of works is done in collaboration with L. Ait Mahiout, M. Banerjee, N. Bessonov, S. Ghosh, B. Kazmierczak, A. Mozokhina, A. Tokarev.

The work is supported by the RUDN University Strategic Academic Leadership Program.

Metric Dimension of Some Graphs of Convex Polytopes

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Abstract

Let $\Psi = \Psi(V, E)$ be an undirected, simple, and connected graph. Let $d_\Psi(\rho_i , \rho_j)$ denotes the number of edges in the shortest path or geodesic distance between two vertices $\rho_i , \rho_j \in V$.
A subset of vertices $W = \{\rho_1, \rho_2 , \dots , \rho_k \}$ is termed a resolving set (or locating set) for Ψ if for every two distinct vertices $\rho_i , \rho_j \in V(\Psi)$, there is a vertex $\rho_s \in W$ such that $d(\rho_s, \rho_i) \neq d(\rho_s, \rho_i)$. A resolving set containing a minimum number of vertices is termed a metric basis (or reference set) for Ψ and the number of vertices in a metric basis is its metric dimension, denoted by $dim(\Psi)$ or $\beta(\Psi)$. Let R_n and S_n be the graphs of convex polytopes.

In this article, we determine the metric dimension of these graphs and obtain that only three nodes are sufficient to resolve all the nodes of the graphs R_n and S_n.

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Modeling Life Tables with the Piecewise Exponential Survival Function

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Abstract

The piecewise exponential survival function is an appropriate choice for demographic modeling of wild animal populations when little information on mortality is available, as long as one is not interested in the distribution of old age or even wants to estimate the maximum age. A major advantage of this simple function is the fact that simple formulas can be derived for important demographic parameters. Survival functions that consider more complex continuous hazard functions produce essentially the same results. However, they require the estimation of additional parameters, which may not be feasable especially in view of the limited data information available for wild animal populations. As an example, continuous models of population dynamics are used to estimate the intrinsic growth rate and other demographic characteristics of blue whale populations.

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Modeling temperature at the head of distillation column with random forest and artificial neural network models: A comparison study

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Abstract

The primary objective of this research was to predict the temperature in the distillation column's head. To achieve this, different models were implemented, examined and their performances were compared. The installation in this study was a continuous distillation column for methylcyclohexane from a toluene/methylcyclohexane mixture, whose mass composition was defined as 23% methylcyclohexane. Those models were applied to a database of 5670 samples. All the model's important inputs, such as heating power, preheating power, reflux rate, feed rate, pressure drops, and preheating temperature, were defined by the continuous distillation column's inputs during normal operation. The output of the models, on the other hand, was determined by the output of the continuous distillation column during normal operation, namely the temperature at the column's head. A random forest was the first model to be implemented. During the learning phase, this model was tested with 30% of the database, and the findings showed a very good forecasting for the temperature of the head of column. When the number of estimators was set to 70, the coefficient of determination was low (R^2= 0,995). The other model was an artificial neural architecture with one and two hidden layers. Both the one-layer and two-layer artificial neural architecture models performed well, but not as well as the random forest model (R^2=0,947 and R^2=0,975, respectively). Even the residual analysis showed a significant difference in favor of the random forest model, indicating that it is the best option for estimating the temperature of the head column.

Keywords: Modeling of temperature, Random forest, Artificial neural network

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Multi-Objective Optimal Sizing of SC's Considering Compressive and Tensile Deformation Using A Metaheuristic Algorithm

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Abstract

Optimization is significant to many applications such as engineering design, computer science, business planning, artificial intelligence, and industries. And besides, resources and time are precious, and optimal use of them is critical. Furthermore, product designs must maximize energy efficiency, performance, sustainability, and cost and waste minimization. Therefore, optimization is crucial for engineering applications and industries. Steel cushion (SC) is a major device to improve the seismic performance of structures since it is an easy-to-produce and plug-and-play damper with stable hysteretic loops and big displacement capacity, but SC is less effective in the transverse direction. As a result, optimal sizing utilizing intelligent optimization techniques improves the damper's efficiency. Also, we have to optimize multiple objectives simultaneously. Finding solutions to a multiobjective optimization problem, even using a simple method is frequently difficult. Other potential methods, particularly metaheuristic methods such as genetic algorithms (GAs), simulated annealing, particle swarm optimization (PSO), cuckoo search, and firefly algorithm, work well for multiobjective optimization problems. The study's aim is to use a metaheuristic method to optimal size the SC that is subjected to transversal loads. By optimal sizing considering the dissipated cumulative energy as an objective, the efficiency of SC that is subjected to transversal loads in energy dissipation is increased.

Keywords: multi-objective optimization, transversal loading, metaheuristic method

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Mutigrid method for solving antiplane frictional contact problems

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Abstract

The objective in this paper is to study electro-elastic frictional contact model. The variational formulation of the model leads to a coupled nonlinear system. In study of this system, we first consider a fully a multigrid method (MG method) which is **an algorithm for solving differential equations using a hierarchy of discretizations**. Moreover, then focus on deriving error estimates for numerical solutions. The important steps are: Smoothing – reducing high frequency errors, for example using a few iterations of the Gauss–Seidel method. Residual Computation – computing residual error after the smoothing operation(s). Restriction – down sampling the residual error to a coarser grid. Interpolation or prolongation – interpolating a correction computed on a coarser grid into a finer grid. Correction – Adding prolongated coarser grid solution onto the finer grid. Some numerical tests are presented at the end of this work.

Keywords: multigrid method, numerical approximation, discretizations, Residual, Restriction, Interpolation, error estimate, contacts problem, weak solution, formulation variational.

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Neighborhoods and Partial Sums for Certain Subclasses of Meromorphic Functions

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Abstract

In this study, using the fractional derivative operator, we define a new subclass of meromorphic functions. Some properties neighborhoods and partial sums of functions in this subclass are given.

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New earthquake model through a bi-nonlinear Volterra integral equation

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Abstract

In this article, we build a new mathematical model to deal with earthquake phenomenon. What makes our study original, more efficient and realistic compared to other studies developed in this area is the use of a nonconstant friction resistance in opposite to old works. Our earthquake model is described by a bi-nonlinear Volterra equation. We prove that this equation has a unique solution through some realistic conditions. Numerical results show that our analytical and numerical visions are realistic and approach perfectly this physical phenomenon.

Keywords: Earthquake machine, modeling, integral equation of Volterra, Nyström method.

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Nonfragile fault-tolerant controller design for neutral time-delay system with fractional stochastic noise

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Abstract

This work investigates the stabilization problem for a class of neutral-type stochastic systems subject to time-varying delays, actuator faults and fractional stochastic noise. The derivation analysis of this system with fractional stochastic noise is carried out by implementing a fractional infinitesimal operator. Then, by incorporating the fractional infinitesimal operator and choosing a suitable Lyapunov-Krasovskii functional, a set of sufficient conditions is derived in terms of a linear matrix inequality which ensures the stochastic stability of the resulting closed-loop system. Further, the controller gain is calculated by using the MATLAB LMI toolbox. Finally, a numerical example is presented to show the effectiveness of the proposed result.

Keywords: Neutral systems, Fractional Brownian motion, Actuator fault, Nonfragile control.

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Nonfragile H_∞ state estimation for complex dynamical networks with distributed delays

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Abstract

This study focused on the issue of the synchronization and $\mathbf{H}_\infty$ state estimation for complex dynamical networks (CDNs) involving nonlinearities, exogenous input signals and distributed delays. A conventional observer is constructed to estimate the state vectors of the system. The main attention of this study is to design a non-fragile controller such that the addressed network is asymptotically synchronized in the sense of mean-square under $\mathbf{H}_\infty$ attenuation performance. By suitable selection of Lyapunov-Krasovskii functional (LKF) and using the Kronecker product properties together with Jensen's inequality, a new set of synchronization criteria is obtained in the form of Linear matrix inequalities (LMIs). The explicit expression of the desired controller gains can be obtained by solving the obtained LMIs. Finally, a numerical example is presented to illstrate the effectiveness of designed $\mathbf{H}_\infty$ based non-fragile control protocol.

Keywords: Complex dynamical networks (CDNs), Finite distributed delays, Non-fragile controller, $\mathbf{H}_\infty$ performance.

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Normal Surfaces of Principal-Donor Curves

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Abstract

In this study, we obtain some characterizations of normal surfaces of principal-donor curves, which are examples of associated curves. Furthermore, we examine their relationship to some types of curves.

Notes on Some Connections of Electromagnetic Type Structures and Their Applications

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Abstract

Let $(M2n,J,g,w)$ be a metric $J4=I$- manifold equipped with a compatible Riemannian metric g, an electromagnetic type structure J, a fundamental 2-form w can be defined by the formula $w(X,Y)=g(JX,Y)$ and ∇ be an affine connection. In this study we define respectively the conjugate connections of ∇ according to g ,w and J and also, we define an other connection which is called J-parallel affine connection. We investigate the properties of these connections and give some applications of them.

Numerical analysis of entropy generation and induced magnetic field on unsteady stagnation flow with suction/injection

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Abstract

The core part of current model is to analyze the entropy generation and 2-dimensional unsteady stagnation flow with suction/injection constraint present in the boundary. Further, the induced magnetic field has applied with this flow model, which is formed by the motion of fluid that conducts electrically. The time-dependent partial differential equations (PDE) of the recent model are first converted to non-linear ordinary differential equations (ODE) using suitable similarity variables. We obtain solutions numerically using inbuilt shooting technic. We demonstrate the results using the graphs, tables and discussed them in detail. It is found that as the injection parameter is responsible for the thinning of the boundary layer, induced magnetic boundary layer; Brinkman number, Reynolds number, suction, and unsteady constraints decelerate Bejan number; and the unsteady parameter (M) decelerates the f', g' profiles and the temperature distributions accelerate by the (M).

Keywords: Entropy generation; Bejan number; Induced magnetic field; stagnation flow; Unsteady flow; Mass suction/injection; Inbuilt shooting technic.

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Numerical evaluation of multigrid reduction family based methods for parallel-in-time solution of convection-diffusion equations with source term

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Abstract

In this paper, we focus our effort on the numerical solution of time-dependent convection-diffusion equations, possibly with source term, with help of parallel-in-time algorithms. This type of equation appears naturally in many real applications, which include conservation laws. In particular, the systems of transport equations are used to describe in the scope of continuum mechanics reactive transport of substances. Usually, time integration for such equations is performed through a serial time-stepping procedure and its extension to a high-performance parallel environment could be done in many ways. We consider in the current paper the multigrid-reduction-in-time family of algorithms (MGRIT)[1] which generalizes a well-known parareal algorithm [2] to multiply levels of grid hierarchy. The theoretical complexity of this family of methods is discussed and compared with other multigrid-based parallel-in-time algorithms. The empirical performance for small and medium-size distributed high-performance systems against serial runs for a set of benchmarks is evaluated and analyzed. For the set of problems, the 1D convection-diffusion-reaction equation and the 2D incompressible problem with simple adsorption-desorption reaction are taken.

Acknowledgment: The work was supported by the Russian Foundation for Basic Research, Grant 21-51-46007 («Development and application of highly efficient parallel algorithms for supercomputer modeling of complex reacting flows»), and the Scientific and Technological Research Council of Turkey (TÜBİTAK).

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Numerical solutions of fractional Emden-Fowler type equations with beta derivative by Hermite collocation method

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Abstract

In this study, the approximate solutions of fractional Emden-Fowler type equations by Hermite collocation method are investigated. Beta derivative is considered for the fractional derivatives. A numerical example is solved and the absolute errors are presented. The results revealed that the method is very efficient to obtain approximate solutions of fractional Emden-Fowler type equations with beta derivative.

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On construction of certain Fischer embedded subgroups generated by 3-transpositions in F_{i22}

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Abstract

In this talk we investigate the Fischer group $F_{i_{22}}$. This group is generated by a conjugacy class of involutions, any non-commuting pair of which has product of order 3. Such involutions are called transpositions and their conjugacy class is denoted by D. Subgroups generated by elements of D are called D-groups as they have been called by Enright, Fischer embedded or 3-transposition groups.

The purpose of this talk is to describe certain Fischer embedded subgroups and compute their ranks, where the rank of a 3-transposition group G for a class D of transpositions is defined as $\max\{|X| \mid X \subseteq D, \text{ all elements in } X \text{ commute}\}$.

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On Double Wijsman Deferred Invariant Equivalences

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Abstract

The aim of this paper is introduce the concepts of asymptotical deferred invariant equivalence, strongly deferred invariant equivalence and deferred invariant statistical equivalence in the Wijsman sense for double set sequences. Additionally, some properties and based relations among these concepts have been established.

Keywords: Deferred Cesàro mean, deferred statistical convergence, asymptotical equivalence, invariant convergence, Wijsman convergence.

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ON GENETIC LOTKA-VOLTERRA ALGEBRAS

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Abstract

In the present work, a class of ow quantum Lotka-Volterra genetic algebras (FQLVGA) is investigated. Necessary and su_cient conditions for the associativity and alternatively of FQGLV-A are derived. In addition, idempotent elements in FQGLV-A are found. Derivations of a FQLVG-A are described.

Keywords: quasi quantum quadratic operator; positive operator; symmetric; Volterra op-

erator.

On gs-Essential Submodules

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Abstract

In this work, some new properties of gs-essential submodules are studied. Every ring has an unity and every module is an unitary left module, in this work. It is proved that the finite intersection of gs-essential submodules is gs-essential.

Keywords: Essential Submodules, Small Submodules, g-Small Submodules.

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On Hausdorff Deferred Statistical Convergence of Order η of Double Set Sequences

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Abstract

In this study, we firstly introduced the concepts of Hausdorff deferred Cesàro summability of order η and Hausdorff deferred statistical convergence of order η $(0 < \eta \leq 1)$ for double set sequences, gave some properties of these concepts and examined the relations between them. Finally, we showed the relation between the concepts of Hausdorff deferred statistical convergence of order η and Wijsman deferred statistical convergence of order η for double sequences of sets.

Keywords: Double sequences of sets, Hausdorff convergence, Deferred Cesàro mean, Order η, Deferred statistical convergence, Wijsman convergence.

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On Hypersoft Preopen sets in Hypersoft Topological space

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Abstract

In this paper, We define and explore the characterization and properties of hypersoft preopen sets in hypersoft topological spaces. We first present the basic definition of hypersoft preopen sets, hypersoft preclosed sets, hypersoft dense sets, hypersoft submaximal, hypersoft regular open sets, hypersoft preinterior sets and hypersoft preclosure and prove some of its properties with examples. Also we state and prove the necessary and sufficient condition for a collection of hypersoft preopen sets to be a hyper soft topology.

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On Hypersoft Preopen Sets in Hypersoft Topological Spaces

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Abstract

In this paper, we introduce the concept of hypersoft preopen sets, hypersoft dense sets, hypersoft submaximal and hypersoft regular open sets with suitable examples. Also we explore the characterization and properties of hypersoft preopen sets in hypersoft topological spaces. At the end we give the necessary and sufficient condition for a collection of hypersoft preopen sets to be a hypersoft topology.

Keywords: hypersoft set, hypersoft topology, hypersoft preopen set, hypersoft preclosed set, hypersoft preinterior and hypersoft preclosure.

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On Independence Numbers of Cayley Digraphs of Clifford Semigroups

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Abstract

Let $D=(V,A)$ be a digraph with a vertex set V and arc set A. Let I be a nonempty subset of V. The set I is called an *independent set* if (u,v) and (v,u) do not belong to A for any two elements u, v in I. An *independence number* of D is the maximum cardinality of independent sets of D. The set I is called a *weakly independent set* if (u,v) or (v,u) does not belong to A for any two elements u, v in I. A *weak independence number* is the maximum cardinality of weakly independent sets of D. In this study, we determine an independence numbers and weak independence numbers of Cayley digraph of Clifford semigroups.

Acknowledgement: The study is supported by Chiang Mai University.

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On Lacunary Statistical Convergence for Triple Sequences on L − Fuzzy Normed Space

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Abstract

The idea of lacunary statistical convergence for triple sequences, which is a development of statistical convergence, is examined and expanded in this study on L − fuzzy normed spaces, which is a generalization of normed spaces.

Keywords: L-fuzzy normed space, triple sequences, lacunary statistical convergence.

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On Quasi-Einstein Spacetimes Admitting M-Projective Curvature Tensor

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Abstract

The object of the present paper is to study quasi-Einstein spacetimes admitting M-projective curvature tensor. In the first section, we give the definition and some properties of M-projective curvature tensor. In the second section, the definition of quasi-Einstein manifold admitting M-projective curvature tensor is given. Some geometric properties of these spacetimes have been studied under special conditions. In the third section, perfect fluid spacetimes satisfying Einstein's field equations without cosmological constant are examined.

Keywords: Quasi-Einstein manifold, divergence-free M-projective curvature tensor, Codazzi tensor.

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On Some Subclasses of Meromorphic Functions Involving The Fractional Derivative Operator

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Abstract

Let Σ denote the class of functions of the form $f(z)=\frac{1}{z}+\sum_{k=0}^{\infty}a_k z^k$ which are analytic in the punctured disc $\mathbb{D}=\{z:0<|z|<1\}$. We introduce and study some new families of meromorphic functions defined by the fractional derivative operator. A number of useful characteristics of functions in these families are obtained.

On the Approximation by Generalized Szász-Mirakyan-Baskakov Operators

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Abstract

In this presentation, we mention a generalization of Szász-Mirakyan-Baskakov operators. The convergence of these operators is examined with the help of Korovkin's theorem. The order of approximation is established by means of the weighted modulus of continuity.Then a Voronovskaya-type theorem is investigated for asymptotic behaviour. Finally, we give the error estimation of the new operators.

Keywords: Szász-Mirakyan-Baskakov operators, weighted modulus of continuity, Voronovskaya-type theorem.

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ON THE ESSENTIAL SPECTRUM OF A SEQUENCE OF 3 × 3 BLOCK OPERATORSMATRICES

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Abstract

The spectrum of a linear operator is one of the most useful objects in functional analysis. However, since exact computations of the spectrum are almost always impossible, it is relevant to know the spectrum or any of its parts in approximate way. Several authors have studied this problem and other related topics using various types of convergence in $\mathcal{L}(X)$. There are several notions of convergence of a sequence of operators which yield spectral results: the norm convergence, collectively compact convergence ([?]), compact convergence and regular convergence ([5]), stable and strongly stable convergence ([6]), resolvent operator convergence ([7]), convergence of $(T_n)_n$ to T in the sense that the spectral radius $r(T_n - T)$ of $T_n - T$ tends to zero and $\|(T_n - T)T_n\|$ tends to zero ([2]). Moreover, in 1994 M. Ahues, and A. Largillier introduced the ν-convergence in ([1]). The ν-convergence is defined as
$T_n \xrightarrow{\nu} T \Leftrightarrow \{(\|T_n\|)\}$ is bounded, $\|(T_n - T)T\| \to 0$, and $\|(T_n - T)T_n\| \to 0$. In order to study spectral continuity properties, this type of convergence is useful ([4], [8], [3]). This work is devoted to extend the result of Aymen A. in ([3]) on 2×2 Block operators matrices to 3×3 Block Operators Matrices

On the first kind Volterra Nonlinear Integro-differential Equation

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Abstract

Our goal in this work is to study the existence and the unicity of the solution for the Volterra nonlinear integro-differential equation of the first kind. We construct new hypotheses to ensure the existence of this solution, based on upper and lower Lipschitz conditions. In the other hand, we develop new Nyström method to approximate this solution. The convergence is obtained without adding new conditions. Numerical tests show the efficiency of our vision.

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On the generalized multivalued suzuki type contractions via absolute retractivity

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In this study, by using the idea of Suzuki method, we investigate some new results on absolute retractivity of the common fixed points set of multivalued Suzuki type contractions.

Keywords: Absolute retract, fixed point, Suzuki type contraction.

On the translation invariant operators on ℓp(Zd)

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Abstract

In this work, we study boundedness of translation invariant operators in the discrete space ℓp(Zd). In this context a Mikhlin type multiplier theorem is given, yielding boundedness for certain known operators. We also give ℓp − ℓq boundedness of a discrete wave equation.

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On The Univalence Criteria For Analytic Functions Defined by Deniz-Özkan Operator

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Abstract

In this study, we obtained some sufficient conditions for univalence of analytic functions defined by Deniz-Özkan differential operatör.

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One of the Special Type of D(2) Diophantine Pairs

(Extendibility of Them and Their Properties)

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Abstract

Diophantus (who was widely influenced by Mesopotamian mathematics) from Alexandria is defined as the father of algebra. Algebraic equations have been in the Diophantus's book Arithmatica (included 130 equivalents and their solutions) which is first book on the theory of numbers. Diophantus Equations, also known as Diophantine equations, was named on Diophantus after A.D. third century. After him, this famous theory has been worked to extend and generalize more by a lot of mathematicians.

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The aim of this work is to get some new results on the special type of D(2) Diophantine pair ({2, a} where a is written in the terms of the natural numbers). Many significant and useful results are obtained while working on the problem but some of them are shown in this work. Firstly, it is demonstrated that such type of pairs can not be extended to D(2) Diophantine quadruple but they are regular D(2) Diophantine 3-tuples using solvability of the pell equations. Also, it is proven that tripled extension of such pairs can not be written as D(n) Diophantine for values of n other than two. Numerical results are given to countenance to our obtained implications (as we explained above) in this work too.

Keywords: D(n) Diophantine m-Tuples, Pell Equations, Natural Numbers, Regularity of D(n) Diophantine Triples, Iteration, Primes.

Acknowledgement: The study is supported by Scientific Research Project with number KLUBAP-233 of Kırklareli University.

Optimal control for a COVID-19 model under the effect of Beddington-DeAngelis incidence and Holling type II recovery rates

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Abstract

In this study, optimal control of a fractional SIR epidemic model for Covid-19 under the effect of nonlinear incidence and recovery rates is investigated. The incidence rate is a threshold parameter and refers to the interaction between those infected and those susceptible to the disease in a population. Thanks to this ratio, the future state of the disease can be predicted and preventive studies are developed accordingly. It can be defined in different ways, taking into account the population size and the state of the disease. The analyzed model is in terms of Caputo fractional derivative. Also in the model, the incidence rate is defined by the nonlinear Beddington-DeAngelis type and the recovery rate is the Holling type II. The main purpose of this study is to examine the effects of vaccination and plasma transfusion on the prescribed model. These are adapted to the system as control variables. Then, the optimal system is obtained by the Hamiltonian's principle and is solved by the generalized Euler method. Controlled and uncontrolled behaviors of the system are graphed with MATLAB software. According to the numerical results, the reduction in the number of infected individuals under the effect of control strategies is highly desirable.

Keywords: COVID-19, Optimal control, Caputo fractional derivative, Beddington-DeAngelis incidence rate, Holling type II recovery rate.

Acknowledgement: This study is supported by Balikesir University Research Grant BAP 2021/016.

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OPTIMAL CONTROL OF VIBRATIONS ON A METAL PLATE CONTACTED A FLUID

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Abstract

In this presentation, it is aimed to obtain the optimal control function for the control of vibrations in a rectangular metalic plate with magneto-electric elastic structure, which is in contact with the fluid, exposed to an external force, and to dampen the vibrations that occur in the system. After the partial differential equation system in the system is solved, the results obtained are presented by means of graphics.

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Orthogonally Additive Operators

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Abstract

In this talk, I consider orthogonally additive operator in vector lattices. Our main result asserts that, under some assumptions, the uniformly to order continuity of on order continuous orthogonally additive operator between vector lattices together with its horizontally to order continuity implies its order continuity. We say that a mapping T:E →F between vector latties E and F is horizontally to order continuous provided T sends laterally increasing order convergent nets in F, and T is uniformly to order continuous provided T sends uniformly convergent nets to order convergent nets.

Keywords: Orthogonally additive operator, order convergent, order continous operator.

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Parallel tıme ıntegratıon wıth robust multigrid technique

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Abstract

We consider robust multigrid technique (RMT) for the (non)linear systems that arise from the discretization of problems with evolutionary behavior [1]. Typically, solution algorithms for evolution equations are based on a time-marching approach, solving sequentially for one time step after the other. Parallelism in these traditional time-integration techniques is limited to spatial parallelism. Faster compute speeds must come from greater parallelism.

Goal of our activity is to develop unified robust multigrid algorithm for solving evolution and non-evolution equations in unified manner. Coarse grids are generated only in space, 3^m, m=1,2,3... independent computers should be used for parallel implementation of RMT. In linear case, the number of grid levels depends on the coefficient matrix condition number of the resulting system of linear algebraic equations. Parallel RMT uses geometric and algebraic parallelism on coarser and finer levels, respectively. The geometric (smoother-independent) parallelism is based on a decomposition of the given problem into 3m, m=1,2,3... subproblems without an overlap to avoid a communication overhead on the coarse levels. The algebraic (grid-independent) parallelism is based on a decomposition of the given problem into a number of subproblems with an overlap on the finer levels. Fine grid smoother for evolution equations based on waveform relaxation decompose a space-time domain spatially to obtain a collection of coupled space-time subproblems on finer levels.

Description of the algorithm and results of computational experiments performed using the OpenMP technology are given [2]. The difference in solving evolution and non-evolution problems is the number of time layers.

Acknowledgement: The work was supported by Russian Foundation for Basic Research, Grant 21-51-46007 («Development and application of highly efficient parallel algorithms for supercomputer modeling of complex reacting flows»), and Scientific and Technological Research Council of Turkey (TÜBİTAK), Grant No: ARDEB-220N170.

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Prime Ideals in Riesz Space and Properties

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Abstract

In this study, the concept of ideal in Riesz spaces is examined. It has been observed in which cases the prime, maximal and minimal ideals are equivalent or related to each other. The concepts of atom, band, complement, ordered dense, strong unit, relatively uniform convergence and uniformly complete in vector lattices have been defined and theorems related to these have been studied. . The use of Noetherian rings in algebra on ideals in vector lattices is shown and some theorems related to this are given.

Pure Ideals in Power-ordered Semigroups on Semihypergroups

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Abstract

The concept of power semigroups on semihypergroups was introduced by the authors in 2022. A power-ordered semigroup on a given semihypergroup is an algebraic structure which is a generalization of a power semigroup on the given semihypergroup. It is a power semigroup on the given semihypergroup together with a partial order on its base set which is defined by using the partial order on the base set of the given semihypergroup. In this paper, we investigate some properties of ideals and pure ideals in power-ordered semigroups on semihypergroups.

Keywords: Power Semigroups, Power-ordered Semigroups, Pure Ideals.

PρLog: A Language for Exact and Approximate Reasoning

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Abstract

PρLog is a rule-based system [2, 3], that extends Prolog with strategy conditional transformation rules. These rules (basic strategies) define transformation steps on finite (possible empty) sequences. Strategy combinators help to combine strategies into more complex ones in a declaratively clear way. Transformations are nondeterministic and may yield several results, which fits very well into the logic programming paradigm. Strategic rewriting separates term traversal control from transformation rules. This allows the basic transformation steps to be defined concisely. The separation of strategies and rules makes rules reusable in different transformations. Transformation rules are equipped with four different kinds of variables (individual, sequence, function, and context variables) together with regular constraints. These variables allows to traverse sequences in single/arbitrary width (with individual and sequence variables) and terms in single/arbitrary depth (with functional and context variables). Regular constraints are useful to restrict possible values of sequence and context variables by regular sequence expressions and regular tree (context) expressions, respectively. These features facilitate flexibility in matching, providing a possibility to extract an arbitrary subsequence from a sequence, or to extract subterms at arbitrary depth.These capabilities enable PρLog to have highly declarative programming style that is expressive enough to support concise implementations for: specifying and prototyping deductive systems, solvers for various equational theories, tools for XML querying and transformation, etc. Recently, we extended PρLog with fuzzy proximity relation to support uncertain computation [1]. In this talk we give an overview of the PρLog system and underline its new applications.

Acknowledgement: This research has been supported the Shota Rustaveli National Science Foundation of Georgia under the grant YS-18-1480.

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Quantile Regression Neural Network Model in the Description of Biological Networks with Outlier Observations

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Abstract

The quantile regression is one of the regression methods in order to detect outliers specifically, when the conditions of ordinary linear regression are not met such that linearity, homoscedasticity or normality assumptions are not satisfied. Then, this idea has been recently combined by the neural network model, which is a popular machine learning method applied in many fields, and the quantile regression neural network model has been developed to use the advantage of both popular approaches. Hereby, in this study, we implement this novel approach in the representation of complex biological network which includes outliers. In our analyses, we generate outliers under different scenariors, for instance, mean or variance based extreme values and mixture models. Then, we evaluate the performance of suggested approach in various biological networks under random and scale-free topology, different sample sizes and dimensions. Finally, we assess the results by distinct accuarcy measures like specificity and recall.

Keywords: Outlier detection, neural network, quantile regression

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Quantum Genetic Algebras

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Abstract

There exist several classes of non-associative algebras (baric, evolution, Bernstein, stochastic, etc.), whose investigation has provided a number of significant contributions to theoretical population genetics . In the present talk, we discuss about quantum analogous of genetic algebras associated with quantum quadratic stochastic operators.

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Renormalized solution for quasilinear parabolic problem with variable exponents exponents and mesure data

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Abstract: In this paper, the study of the existence of a renormalized solution for quasilinear parabolic problem with variable exponents and measure data. The model is:

$$\begin{cases} u_t - \operatorname{div}(|\nabla u|^{p(x)-2}\nabla u) + \lambda |u|^{p(x)-2} u = \mu & \text{in} \quad Q = \Omega\times]0,T[, \\ u = 0 & \text{on} \quad \Sigma = \partial\Omega\times]0,T[, \\ u(.,0) = u_0(.) & \text{in} \quad \Omega, \end{cases}$$

where $\lambda > 0$ and T is any positive constant, $\mu \in \mathcal{M}_0(Q)$ is any measure with bounded variation over $Q = \Omega\times]0,T[$.
Keywords:renormalized solution, quasilinear parabolic problem, measure data, variable exponents
2010 Mathematics Subject Classification: 35D5.

6th INTERNATIONAL HYBRID CONFERENCE ON MATHEMATICS
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Resilient control design for fractional-order nonlinear systems with distributed delays

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Abstract

This work discusses the stabilization issue for a class of fractional-order nonlinear systems together with time delays. Precisely, the considered system comprises two delays namely distributed delay and time-varying delay. Then, a non-fragile controller is designed which makes the system asymptotically stable with the specified $H\infty$ performance index. A fractional Razumikhin theorem is applied to handle the distributed delay term in the stabilization analysis. With the aid of suitable Lyapunov-Krasovskii functional, sufficient conditions are established in terms of linear matrix inequalities together with the Razumikhin stability theorem for getting the required results. Further, the controller gain matrix is obtained by solving the obtained LMIs and the graphical results are simulated using the FOMCON toolbox. Later, the potency of the developed results is validated by virtue of a numerical example.

Keywords: Fractional-order nonlinear systems, Distributed delay, $H\infty$ performance, Gain perturbation.

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Riesz valued density

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Abstract

Riesz space and statistical convergence are the natural and efficient tools in the theory of functional analysis. The statistical convergence is handled with the natural density of subsets on the natural numbers. Natural density of sets value over the closed interval [0,1]. In this work, we aim to introduce a concept of vector valued density on Riesz spaces, and so, we define a statistical convergence by utilizing the new density. In addition to the fact that results obtained in the settings of Riesz spaces will shed light on the case of convergences on Riesz spaces and Banach lattices.

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Rough Statistical Λ^2-Convergence of Double Sequences of Order α

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Abstract

In this study, we aim to investigate rough statistical Λ^2-convergence of double sequences of order α $(0 < \alpha \leq 1)$ in normed linear spaces. We obtain some fundamental features and also established some examples to show that this new convergence type is more generalized than the rough statistical convergence. In addition, we demonstrate the consequences related to statistically Λ^2-bounded sets of order α and sets of rough statistically Λ^2-convergent sequences of order α.

Acknowledgement: Statistical convergence, rough statistical convergence, rough statistical limit points, normed linear space.

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Rough Statistical Convergence of Order α for Complex Uncertain Double Sequences

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Abstract

The main aim of this paper is to investigate convergence concepts such as, rough statistical convergence of order α, rough statistical convergence of order α almost surely, rough statistical convergence of order α in measure, rough statistical convergence of order α in mean, rough statistical convergence of order α in distribution of double sequence in complex uncertain theory. We also obtain some relationships among them.

Acknowledgement: Statistical convergence, rough statistical convergence, complex uncertain sequence, uncertainty theory

6th INTERNATIONAL ONLINE CONFERENCE ON MATHEMATICS
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Smarandache sα curves according to Sabban frame in the Heisenberg group $Heis^3$

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Abstract

In this paper, we study Smarandache sα curves according to Sabban frame in the Heisenberg group $Heis^3$. Finally, we find explicit parametric equations of Smarandache sα curves according to Sabban Frame.

Soft Quasilinear Operators

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Abstract

In this paper, we have introduced a new concept, called soft quasilinear operator over soft quasilinear spaces which extends the notion of quasilinear operator. Also, we studied some properties of soft quasilinear operators with illustrating examples. Further, we have defined inverse of a soft quasilinear operator and its some different properties from inverse of soft linear operators are obtained.

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Soft Quasilinear Spaces and Soft Normed Quasilinear Spaces

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Abstract

In this study, a recent concepts of soft quasilinear spaces and soft proper quasilinear spaces are presented. Further, soft quasi vectors in soft quasilinear spaces are investigated, and several related properties are examined such as quasilinear dependent and quasilinear independent. Also, the concept of soft quasi norm of soft quasilinear spaces is given. Lastly, soft quasilinear operators on soft normed quasilinear spaces are defined, and some results about the bounded soft quasilinear operators and continuous soft quasilinear operators are obtained.

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Solution of a Lake Pollution Model by Artificial Neural Networks

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Abstract

In this study, a numerical approach for the solution of a lake pollution model is investigated. A system of ordinary differential equations is considered for modelling the phenomena. Artificial neural networks are used for obtaining the approximate solutions. As an activation function, tangent hyperbolic function used. Illustrations are presented in order to show the results of approximation.

Keywords: Lake pollution model, artificial neural networks, deep learning, machine learning.

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Solutions of fractional-order differential equation on harmonic waves and linear wave equation

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Abstract

In this thesis, we will define harmonic waves, linear wave equation on physical problem.[1,2] Initially, we will interrupt physical meaning of harmonic waves on time dependent and we will mention that physical interpretation of linear wave equation with calculating.[1,2] After that, we will use many definitions of fractional derivative in order to need to apply on harmonic and linear waves equation.[3,4] Therefore, definitions of fractional-order derivative will mentioned in our thesis after interrupting harmonic waves and linear wave equation.

Keywords: Riemann-Liouville fractional derivative, Grünwald-Letnikov fractional derivative, harmonic waves, Linear wave, Oscillation, time-dependent equation.

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Solving Hierarchies of Partial Differential Equations

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Abstract

We discuss the one-parameter Lie group transformations that leave di_erential equations invariant. We link these transformations to conservation laws that contain a recursion operator. We showcase how this concept may be used to determine invariant solutions for full partial di_erential equation hierarchies. As an example, we discuss the famous nonlinear Burgers' hierarchy.

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SOME (a,b)-KA INDICES OF LUCAS SUM GRAPH

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Abstract

Let $\mathrm{H_n} = (\mathrm{V}, \mathrm{E})$ be a Lucas-sum graph, where

$$\mathrm{E} = \{\{\mathrm{i}, \mathrm{j}\}: \mathrm{i}, \mathrm{j} \epsilon \mathrm{V}, \mathrm{i} \neq \mathrm{j}, \mathrm{i} + \mathrm{j} \text{ is a Lucas number}\}.$$

(a,b)-KA indices are defined as follows:

$$KA^1_{(a,b)}(G) = \sum_{uv \epsilon E(G)} [d_G(u)^a + d_G(v)^a]^b$$

$$KA^2_{(a,b)}(G) = \sum_{uv \epsilon E(G)} [d_G(u)^a d_G(v)^a]^b$$

$$KA^3_{(a,b)}(G) = \sum_{uv \epsilon E(G)} |d_G(u)^a - d_G(v)^a|^b .$$

In this study, we obtain bounds for some (a,b)-KA indices of Lucas-sum graph as following:

Theorem 1: Let $\mathrm{H_n} = (\mathrm{V}, \mathrm{E})$ be a Lucas-sum graph with n vertices and m edges, then

$$2n\delta^3 \leq KA^1_{(2,1)}(\mathrm{H_n}) \leq 2n\Delta^3.$$

Theorem 2: Let $\mathrm{H_n} = (\mathrm{V}, \mathrm{E})$ be a Lucas-sum graph with n vertices and m edges, then

$$2n\delta^4 \leq KA^1_{(3,1/2)}(\mathrm{H_n}) \leq 2n\Delta^4.$$

Theorem 3: Let $\mathrm{H_n} = (\mathrm{V}, \mathrm{E})$ be a Lucas-sum graph with n vertices and m edges, then

$$2m\delta^4 \leq KA^2_{(2,1)}(\mathrm{H_n}) \leq 2m\Delta^4.$$

Theorem 4: Let $\mathrm{H_n} = (\mathrm{V}, \mathrm{E})$ be a Lucas-sum graph with n vertices and m edges, then

$$2(m\delta^3 - 2(m-1)\delta^2) \leq KA^3_{(1,2)}(\mathrm{H_n}) \leq 2(m\Delta^3 - 2(m-1)\Delta^2).$$

Theorem 5: Let $\mathrm{H_n} = (\mathrm{V}, \mathrm{E})$ be a Lucas-sum graph with n vertices and m edges, then

$$KA^3_{(2,1)}(\mathrm{H_n}) \leq 2m(\Delta^2 - \delta^2).$$

Acknowledgement: Lucas sum-graph, (a,b)-KA indices.

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Some Deferred Invariant Convergence Types for Double Sequences of Sets

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Abstract

In this paper, we presented the concepts of deferred invariant, strongly deferred invariant and deferred invariant statistical convergence in the Wijsman sense for double set sequences. Also, basic theorems associated with these concepts is given.

Keywords: Deferred Cesàro mean, deferred statistical convergence, invariant mean, Wijsman convergence.

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Some Novel Results of {C}-Weak-Fuzzy Contractions with Application

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Abstract

This article implements the idea of introducing the concept of {C}-weak-fuzzy contraction mapping in the framework of fuzzy cone metric spaces and deriving some unique common fixed point results. A nontrivial example is enunciated to uphold our results. Our results unify, enrich and extend some pioneer results in the existing literature in the fuzzy setting. In the end, an application to Fredholm's nonlinear integral equation is offered to show the superiority of our results, which is in turn supported by an example.

Keywords: Fixed point, {C}-weak fuzzy contraction, nonlinear integral equation.

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Some Novelty Inequalities Using Uniformly Exponentially $(\omega_1, \omega_2, h_1, h_2)$-Convex Functions Pertaining to Generalized Integral Operators And Their Applications

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Abstract

In this paper, the authors define a new generic class of functions called it uniformly exponentially $(\omega_1, \omega_2, h_1, h_2)$-convex. A useful integral identity pertaining to generalized integral operators via differentiable function is also found. Applying this as an auxiliary result, we establish some new bounds on Hermite–Hadamard type integral inequality for differentiable functions that are in absolute value at certain powers uniformly exponentially $(\omega_1, \omega_2, h_1, h_2)$-convex. Our results include several new and known results as particular cases. Finally, some applications of presented results for special means and error estimates for the mixed trapezium and midpoint formula have been analyzed.

Keywords: Hermite-Hadamard inequality, uniformly exponentially $(\omega_1, \omega_2, h_1, h_2)$-convexity, generalized integral operators, special means, error estimation.

Some properties of meromorphic solutions of ultrametric difference equations

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Abstract

Let K be a complete ultrametric algebraically closed field of characteristic zero and let M(K) be the field of meromorphic functions in all K. In this work, using the ultrametric Nevanlinna theory, we investigate the growth of transcendental meromorphic solutions of some ultrametric difference equations and find lower bounds for meromorphic solutions of such equations.

Some Properties of ⊕-g-Rad-Supplemented Modules

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Abstract

In this work, some properties of ⊕-g-Rad-supplemented modules are studied. Every ring has an unity and every module is an unitary left module, in this work. It is proved that a direct sum of two ⊕-g-Rad-supplemented modules is ⊕-g-Rad-supplemented.

Keywords: Essential Submodules, g-Small Submodules, g-Supplemented Modules, ⊕-g-Supplemented Modules.

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Some Theorems on Absolute Matrix Summability

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Abstract

Let $A=(a_{nv})$ be a normal matrix, i.e., a lower triangular matrix of non-zero diagonal entries. Let $\sum a_n$ be an infinite series with its partial sums (s_n). Let $(\ddot{}_n)$ be any sequence of positive number. The series $\sum a_n$ is said to be summable $\ddot{} -|A, p_n|_k, k \geq 1,$ if (see [1])

$$\sum_{n=1}^{\infty} \ddot{}_n^{k-1} |A_n(s) - A_{n-1}(s)|^k < \infty.$$

In this paper, two theorems on absolute Riesz summability factors of infinite series are generalized to the $\ddot{} -|A, p_n|_k$ summability method by using almost increasing sequences.

Keywords: Riesz mean, almost increasing sequences, infinite series, absolute matrix summability.

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Special Operators on Banach Lattices

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Abstract

In this talk, we introduce and study some special operators on Banach Lattices. For example, Dunford-Pettis operators, M weakly compact operators, L weakly compact operators, KB operators, Lebesgue operators and so on.

Keywords: Banach Lattice, Dunford-Pettis operator, M weakly compact operator, L weakly compact operatör, KB operator, Lebesgue operator

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Statistical Analysis of Earthquake Occurrences in and around the Çaldıran Fault Zone (Turkey)

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Abstract

In the scope of this study, a statistical assessment of earthquake behaviors in the Çaldıran Fault Zone and its surroundings is achieved by using the seismotectonic *b*-value of Gutenberg-Richter relation, probability and return periods of the earthquakes. Multiple parameters evaluation between these variables is considered for the possible future earthquake forecasting and current hazard assessment. For the analyses, a homogeneous database including 6169 earthquakes with $1.0 \leq M_d \leq 5.6$ between July 12, 1975 and December 29, 2021 was used. Completeness magnitude is estimated as 2.6 for the study region and *b*-value of magnitude-frequency distribution is calculated as 1.07±0.09. This result shows that *b*-value of the study area is well represented by the Gutenberg-Richter scaling law. Regional distribution of *b*-value indicates that the areas having the lower *b*-values (<1.0) are generally observed in all parts of the study region including the Çaldıran fault consisting of Alaçayır, Hidirmenteş and Gülderen segments, Hasantimur, Dorutay and Saray faults. The probabilities earthquake occurrences with M_d=6.0 in Tr = 10, 20, 50, 70 and 100 years are estimated as about 4 %, 7 %, 18 %, 23 % and 32 %, respectively. Also, the return periods of M_d=5.0, 5.5 and 6.0 earthquakes are calculated as about 29, 90 and 300 years, respectively. The results of probabilities and return periods suggest that earthquake occurrences ranging from 3.0-4.5 magnitude levels are more likely than those of the other occurrences in the short term. Çaldıran Fault zone and its adjacent region are very active seismically and tectonically, and many strong/destructive earthquakes occurred in the historical and instrumental periods; the last of these major earthquakes occurred on November 24, 1976 (M_w=7.3). As a remarkable fact, the results of the present study can be used as a promising guide for earthquake forecasting and further hazard potential in this part of Turkey in the intermediate and long terms.

Keywords: Çaldıran Fault zone, *b*-value, earthquake probability, return period, seismic hazard.

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STATISTICAL CONVERGENCE OF LUPAS-JIN OPERATORS

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Abstract

A study of statistical convergence for the sequence of a operators $P_{[\mu]}{}^{n}$ define presented by Patel and Mishra is presented. They modified Lupas, operators in the direction of Jain operators, which is modification of classical Sz´asz-Mirakyan operators. For the sequence of positive linear operators $P_{[\mu]}{}^{n}$, A-statistical convergence and rate of A-statistical convergence is investigated.

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Statistical convergence with Riesz valued density

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Abstract

The statistical convergence is handled with the natural density of subsets on the natural numbers. Recently, the statistical convergence on Riesz spaces with the order convergence have been attracted the attention of many authors. In this work, we aim to introduce a concept of statistical convergence on Riesz spaces with respect to the Riesz valued density. Also, we give some result between this concept and the statistically order convergence. In the settings of Riesz spaces will shed light on the case of convergences on Riesz spaces.

STOCHASTIC MODEL OF THE TRANSMISSION DYNAMICS OF COVID-19 PANDEMIC

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Abstract

In this paper, we formulated $SVITR$ deterministic model and extend in to stochastic model by introducing intensity of stochastic factors and Brownian motion. The basic qualitative analysis of both models are, positivity of the solution, invariant region, disease free equilibrium point, basic reproduction number, local and global stability of disease free equilibrium point, endemic equilibrium point and sensitivity analysis are studied. The stochastic reproduction number and local stability are obtained by using twice differentiable Ito's formula. Global stability of disease free equilibrium point is proved by using a Lyapunove function technically. We determined sensitivity analysis of the effect of each parameter on basic reproduction number of the model by using a normalized sensitivity indices formula. On the other hand, numerical simulation results of deterministic and stochastic model of COVID-19 are demonstrated by using Maple 18 and MATLAB- software. Thus our simulation results indicated that reducing the contact between infected and susceptible individuals as well as improvement in treatment play vital role to control COVID-19 pandemic.

Keywords: COVID-19 disease; stochastic model; numerical simulation.

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Strophoidal Hypersurfaces in Four-Dimensional Euclidean Space

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Abstract

We introduce the strophoidal hypersurfaces in four-dimensional Euclidean space $\mathbb{E}^4$. We give some notions of a Euclidean space. Indicating a helicoidal hypersurface, we obtain the strophoidal hypersurface, and compute its geometric elements, such as Gauss map, Gaussian curvature, mean curvature. Then, we serve some relations between the curvatures of the hypersurfaces.

Acknowledgement: four-space, helicoidal hypersurface, strophoidal hypersurface, Gauss map, Gaussian curvature, mean curvature.

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Study of the Atangana-Baleanu-Caputo type fractional system with a generalized Mittag-Leffler kernel

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Abstract

We devote our interest in this work to investigate the sufficient conditions for the existence, uniqueness, and Ulam-Hyers stability of solutions for a new fractional system in the frame of Atangana-Baleanu-Caputo fractional operator with multi-parameters Mittag-Leffler kernels investigated lately by Abdeljawad (Chaos: An Interdisciplinary J. Nonlinear Sci. Vol. 29, no. 2, (2019): 023102). Moreover, the continuous dependence of solution and δ-approximate solutions are analyzed to such a system. Our approach is based on Banach's and Schaefer's fixed point theorems and some mathematical techniques. In order to illustrate the validity of our results, an example is given.

Study on effect of time -delay on a tumor-macrophages mathematical model

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Abstract

Tumor cells are evolved due to the uncontrolled growth of abnormal cells. During the progression of tumor cells, several immune cells are responsible for their different actions. Recent studies [1, 2] proved that macrophages' roles on tumor evolution and progression are crucial. There are two types of macrophages with different tumor responses: M1 macrophages are called anti-tumor macrophages, and M2 macrophages are called pro-tumor macrophages. In 2020, Shu et al. [9] developed a tumor-macrophages interaction model, which suggests that the activation of M1 and M2 and the transition between M1 and M2 are responsible for reducing tumor growth. Many authors have been attempted delay differential models to describe the tumor-immune dynamics. Several research works [3, 4, 5] found that time delay plays a crucial role in the tumor growth model. in this study, we will investigate a time-delay tumor-macrophages interaction model based on Shu et al. [1]. In the next section, we shall discuss our considered model. It is found that the tumor dominant steady state is locally asymptotically stable under certain conditions, and the stability of the interior steady-state is affected by the discrete-time delay; as a result, the unstable system experiences a Hopf bifurcation and gets stabilized.

Keywords: Tumour, Macrophages, Stability, Hopf bifurcations.

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SVIR epidemic model with Caputo-Fabrizio derivative

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Abstract

Infectious diseases are diseases caused by small organisms such as bacteria, viruses, fungi or parasites that enter the body. There are many different types of infectious diseases and ways of transmission. Moreover, these diseases have important negative impacts on community health. In this study, we aim to deal with contagious SVIR model with Caputo-Fabrizio derivative, then we give special solution and the stability analysis.

Acknowledgement: Caputo-Fabrizio derivative, SVIR model, stability analysis. The study is supported by Balikesir University under the Grant no. BAP 2020/014.

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Tangent developable surfaces of timelike biharmonic general helices in E(1,1)

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Abstract

In this paper, we obtain parametric equation of tangent developable surfaces of timelike biharmonic general helices in the Lorentzian group of rigid motions E(1,1). Finally, we obtain some figures.

Tauberian theorems for weighted means of double sequences in intuitionistic fuzzy normed space

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Abstract

We define weighted mean summability method of double sequences in intuitionistic fuzzy normed spaces(IFNS), and obtain necessary and sufficient Tauberian conditions under which convergence of double sequences in IFNS follows from their weighted mean summability. This study reveals also Tauberian results for some known summation methods in the special cases.

Keywords: Tauberian theorem; double sequence; intuitionistic fuzzy; summability methods; oscillation for double sequences

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Textural Products via Inverse Systems of Ditopological Spaces

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Abstract

A suitable theory of inverse systems [1] is constructed for the some categories which are topological on the category **ifPTex** consisting of plain textures and point functions satisfying a compatibility condition.

Particularly, inverse systems and their limits are established [2] in the topological category **ifPDitop** whose objects are ditopological plain texture spaces [3] and morphisms are bicontinuous **ifPTex** –morphisms.

Finally, in this work it is proved that infinite ditopological products in **ifPDitop** can be represented as an inverse limit for the inverse system consisting of finite ditopological textural products in **ifPDitop.**

Keywords: Inverse limit, Ditopology**,** Plain texture, Category

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The action of the Chevalley group E_6 on the singular subspaces V_2 of a 27-dimensional module

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Abstract

Let A be a 27-dimensional module over the field $\mathbb{F}_2$. On A we define a quadratic form $\hat{Q} : A \to A$. The purpose of this talk is to compute the action of E_6 on the family $V_2 = \{U \leq A \mid \dim U = 2 \text{ and } \hat{Q}(U) = 0\}$.

The Bienergy of Pull-Back Vector Fields

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Abstract

The problem studied in this paper is related to the bienergy of a pull-back vector field from a Riemannian manifold (M,g) to its tangent bundle TN equipped with the Sasaki metric hs. We show that a pull-back vector field on a compact manifold (M,g) which covers harmonic map φ. then the pull-back bundle $V \in \Gamma(\varphi^{-1}(TN))$ is biharmonic if and only if V is parallel.

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The Detour index of graph products

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Abstract

The object of this paper is to investigate the detour index of some graph products. The detour index of a connected graph is defined as the sum of the detour distances (lengths of longest paths) between all pairs of vertices of the graph. The detour index is a well-known topological index, which is used in quantitative structure-activity relationship (QSAR) studies. In this paper, we establish expressions for the detour index of join and corona of some products of graph.

Keywords: Detour index, Join Graphs, Corona graphs, Quasi-corona graphs, Topological index, Chemical graph theory.

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The Effect of Geogebra on Unıversıty Students' Understandıng of Polar Coordınates

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Abstract

Computer-assisted instructions and technology in education have become an acceptable phenomenon in the 21st century. The accessibility and acceptability of technology in mathematics education benefit the teaching and learning process. Several software have been practiced in mathematics teaching and learning. Studies have been done on the integration of GeoGebra software in teaching mathematics concepts like; calculus, trigonometry, statistics, algebra, and geometry. However, polar coordinates as a concept in mathematics is an area in that many studies on the uses of GeoGebra has not been done, especially in Ghana. The purpose of this study was to examine the effect of GeoGebra on University Mathematics students' understanding of polar coordinates. A quasi-experimental design with an equivalent group of 42 participants in both control and experimental groups was used. A simple random sampling approach was used to select the 84 participants from the population and a purposive sampling technique was used to assign the participants to the various groups. A t-test (paired sample and independent sample) analysis was conducted on the pre-test and post-test. It was revealed that students who were taught polar coordinate with the aid of GeoGebra performed better than those taught with the conventional approach did. Analysis of students in the experimental group's responses to the questionnaire showed that they demonstrated positive attitudes and perceptions towards the use of GeoGebra software for the learning of polar coordinates. It was concluded that GeoGebra is more effective in improving University mathematics students' understanding of polar coordinates. It was therefore recommended that institutions running mathematics programmes should integrate appropriate technological tools for teaching various mathematics courses to help improve students' understanding of the concepts.

Two Dimensional Laplace Transform Coupled with the Marichev–Saigo–Maeda Integral Operator and the Generalized Incomplete Hypergeometric Function

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Abstract

This paper represents the processing of the two-dimensional Laplace transform with the two-dimensional Marichev–Saigo–Maeda integral operators and two-dimensional incomplete hypergeometric function. This article provides an entirely new perspective on the Marichev–Saigo–Maeda operators and incomplete functions. In addition, we have included some interesting results, such as left-sided Saigo–Maeda operators and right-sided Saigo–Maeda operators, making this a good direction for symmetry analysis.
Keywords: Laplace transform; integral operators; left-sided Saigo–Maeda operators; right-sided Saigo–Maeda operators

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Uniform Motion of Timelike Spherical Magnetic Curves on the De-Sitter Space S_1^2

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Abstract

In this paper, we investigate uniform motion of timelike spherical magnetic curves associated with the given magnetic field G on the De-Sitter 2-space S_1^2. Finally, we also analyze the necessary and sufficient conditions of the uniformity of the timelike magnetic curves lying on the S_1^2.

Using Special Functions on Grünwald-Letnikov and Riemann Liouville Fractional Derivative and Fractional Integral

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Abstract

Our this thesis; initially, we define special functions on fractional calculus because, gamma function[1,3,4,7], beta function [2,6], Integral function [5], Mittag-Leffler and Integration of the Mittag-Leffler function [3] are related with fractional derivatives and fractional Integrals[7]. Also, matlab, which is used on applied Mathematics field mostly, is applied on our thesis to interrupt special functions curves and to show fractional order derivative equation graphics. Owing to using definition of the special function, fractional derivative and fractional integral[7], we understand theoretic definition more easily.

Keywords: Gamma function, beta function, integral function, Mittag-Leffler function, fractional order derivative, fractional order integral.

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Wavelet Spectral method for Fractional Jaulent–Miodek equation associated with energy-dependent Schrödinger potential

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Abstract

In 1979, Jaulent and Miodek derived the system of equations as an extension to energy-dependent potentials called Jaulent-Miodek (J-M) system. The coupled J-M equations are arising in different fields of science and engineering such as fluid mechanics, condense matter physics, optics, and plasma physics. In this research the fractional Bernoulli wavelets and their operational matrices of fractional derivative and integration are employed for investigating the numerical solution of the fractional order of coupled J-M system as;

$$\begin{cases} D_t^{\gamma} u + u_{xxx} + \frac{3}{2} v\, v_{xxx} + \frac{9}{2} v_x v_{xx} - 6uu_x - 6uvv_x - \frac{3}{2} u_x v^2 v = 0, \\ D_t^{\gamma} v + v_{xxx} - 6u_x v - 6uv_x - \frac{15}{2} v_x v^2 = 0, \end{cases} \tag{1}$$

subject to the initial conditions

$$u(x,0) = \frac{1}{8}\mu^2 \left(1 - 4\,\mathrm{sech}^2(\frac{\mu x}{2})\right), \qquad v(x,0) = \mu\,\mathrm{sech}\left(\frac{\mu x}{2}\right),$$

where $0 < \gamma \leq 1$ is the order of fractional derivative in Caputo sense and μ is an arbitrary constant [1]. For this purpose first, the unknown functions of (1) are expanded in Bernoulli wavelets terms, then by applying the fractional Riemann-Liouville integration operator of order γ, we derive a nonlinear algebraic system of equations. This system is discretized via spectral collocation method; finally we utilize Newton approach for solving the achieved nonlinear system. Numerical examples are provided to show the accuracy and efficiency of the purposed method.

Keywords: Jaulent–Miodek equation**,** Bernoulli wavelets, collocation method, Newton iterative method

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Weak Conditions To Approach The Generalized Quadratic Spectrum

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Abstract

Our work aims to deal with quadratic spectral problems. On one side, we develop some techniques that allow us to build a new method for approaching the spectrum associated with three bounded operators using weak conditions to ensure the convergence of our method, where these conditions are weaker than the norm convergence and collectively compact convergence. On the other side, we construct a numerical test to show the use of our method "the generalized quadratic spectrum approximation method" in the eigenvalues computing of the quadratic pencil of an unbounded operator without spectral pollution which, appears generally in the spectral approximation of unbounded operators.

Weakly g-Supplemented Lattices

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Abstract

In this work, all lattices are complete modular lattices with the greatest element 1 and the smallest element 0. Let L be a lattice and $a,b\in L$. If $a\vee b=1$ and $a\wedge b\ll_g L$, then b is called a weak g-supplement of a in L. If every element of L has a weak g-supplement in L, then L is called a weakly g-supplemented lattice. In this work, some properties of these lattices are investigated.

Keywords: Lattices, Small Elements, g-Small Elements, g-Supplemented Lattices.

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Weakly Prime Submodules

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Abstract

Let R be a commutative ring with non-zero identity. We define a proper submodule N of an R-module M to be weakly prime if $0 \neq rm \in N$ $(r \in R, m \in M)$ implies $m \in N$ or $rM \subseteq N$.

In this study, various properties and results concerning weakly prime submodules are given.

Acknowledgement: Prime, prime submodules, weakly prime submodules.

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WEAKLY UNBOUNDED NORM TOPOLOGY AND *wun*-DUNFORD-PETTIS OPERATORS

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ABSTRACT. Let E be a Banach lattice. A functional $f : E \to \mathbb{R}$ is *un*-continuous, if $x_\alpha \xrightarrow{un} 0$ implies $f(x_\alpha) \to 0$ for each norm bounded net $(x_\alpha) \subseteq E$. We denote the vector space of all *un*-continuous functionals on E by $E^\diamond$ and we call it *un*-dual of Banach lattice E. In this paper, we study the *un*-dual (in symbol, $E^\diamond$) of Banach lattice E and compare it with the topological dual; i.e. E^*. For example, we show that if E^* has order continuous norm, then $E^* = E^\diamond$. We introduce and study weakly unbounded norm topology (*wun*-topology) on Banach lattices and compare it with weak topology and *uaw*-topology. Finally, we introduce and study *wun*-Dunford-Pettis operators from a Banach lattice E into a Banach space X and we investigate some of its properties and its relationships with some well known operators.

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T_0 and T_1 Objects at p in the Category of Quantale-Valued Preordered Spaces

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Abstract

With the advancement of lattice theory, distinct mathematical frameworks have been studied with lattice structures including lattice-valued topology [1], quantale-valued approach space [2-4], quantale-valued metric space [5] and lattice-valued preordered space [1].

Classical separation axioms of topology have been extended to topological category by several authors. In 1991, Baran [6] introduced these axioms in a set-based topological category in terms of initial, final structures and discreteness. He defined separation properties first locally, i.e., at a point p [7], then they are expanded to point-free concepts.

In this paper, we characterize the local T_0 and T_1 separation axioms in the topological category of quantale-valued preordered spaces as well as examine the relationship between them and we investigate their some invariance properties such as hereditary and productive.

Keywords: Topological category, Quantale-valued preorder, Local T_0 objects, Local T_1 objects.

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