ICOMAA-2023

6TH INTERNATIONAL HYBRID CONFERENCE ON MATHEMATICAL ADVANCES AND APPLICATIONS

ABSTRACT BOOK

Editors
Yusuf ZEREN
Murat KİRİŞÇİ
Adem Cengiz ÇEVİKEL

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Abstract Book

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FOREWORDS

Dear Conference Participant,

Welcome to the International Hybrid Conference on Mathematical Development and Applications (ICOMAA-23) we organized the sixth. First of all, I would like to start my words by reminding one of G. H. Hardy's words:

"Mathematics, more than any other art or science, is a young man's game."

This phrase he expressed in his book “A Mathematician's Apology” is quite meaningful. Because Newton discovered his biggest ideas, fluxions and the law of gravitation, when he was just 24 years old. He found the 'elliptic orbit' at 37 years old. Also, Galois(at twenty-one), Abel(twenty-seven), Ramanujan(thirty-three), and Riemann(at forty) had passed away in their youth.

That's why we thought we should continue this series of conferences that brings together exciting and productive young mathematicians. So, we aim to bring together scientists and young researchers from all over the world and their work on the fields of mathematics and applications of mathematics, to exchange ideas, to collaborate and to add new ideas to mathematics in a discussion environment. With this interaction, functional analysis, approach theory, differential equations and partial differential equations and the results of applications in the field of Mathematicsare discussed with our valuable academics, and in mathematical developments both science and young researchers are opened. We are happe to host many prominent experts from different countries who will present the state-of-the-art in real analysis, complex analysis, harmonic and non-harmonic analysis, operator theory and spectral analysis, applied analysis.

I would like to express my gratitude to those who see and appreciate our efforts and innovative steps that we have made to improve our conference every year, to our dear invited speakers and to all our participants. I owe a debt of gratitude to the Scientific committee, organizing committee, local organizing committee and for their efforts throughout this conference series.

The conference brings together about 203 participants and 9 invited speakers from 22 countries (Azerbaijan, India, Algeria, Bangladesh, Georgia, Greece, India, Iran, Iraq, Italy, Kazakhstan, Kosovo, Malaysia, Mexico, Morocco, Pakistan, Poland, Saudi Arabia, Turkey, United Arab Emirates, Uzbekistan, Yemen).

More than 50% of our participants participated from abroad. This shows that the conference meets the criteria of being international.

It is also an aim of the conference to encourage opportunities for collaboration and networking between senior academics and graduate students to advance their new perspective. Additional emphasis on ICOMAA-23 applies to other areas of science, such as natural sciences, economics, computer science, and various engineering sciences, as well as applications in related fields. The articles submitted to this conference will be addressed on the conference web sites and, in the journals, listed below:

- Miskolc Mathematical Notes,
- Türkiye Mathematical Sciences
- Sigma Journal of Engineering and Natural Sciences,
- Istanbul Commerce University Journal of Sciences,
- Journal of Nonlinear Sciences and Applications,
- *Special Issue "Symmetries of Difference Equations, Special Functions and Orthogonal Polynomials" in Symmetry,

This booklet contains the titles and abstracts of almost all invited and contributed talks at the **6th International E-Conference on Mathematical Advances and Applications**. Only some abstracts were not available at the time of printing the booklet. They will be made available on the conference website http://2023.icomaas.com/ when the organizers receive them.

We wish everyone a fruitful conference and pleasant memories throughout the online conference.

Prof. Dr. Yusuf ZEREN
On Behalf of Organizing Committee
Chairman

It was a big excitement moment when Prof. Dr. Yusuf ZEREN discussed with me on the issue of "6th International Hybrid Conference on Mathematical Development and Applications" (ICOMAA-2023) in Yıldız Technical University, Istanbul. It is a great pleasure that this conference is going to take place now. As one of the organizers of the conference, I am delighted with all the delegates, distinguished mathematicians, speakers and young researchers in this international event. It is expected that delegates and participants will benefit from this conference experience and the legacy of information dissemination will continue.

I wish all of you to have a nice and enjoyable participation in the conference.

Prof. Dr. Necip ŞİMŞEK

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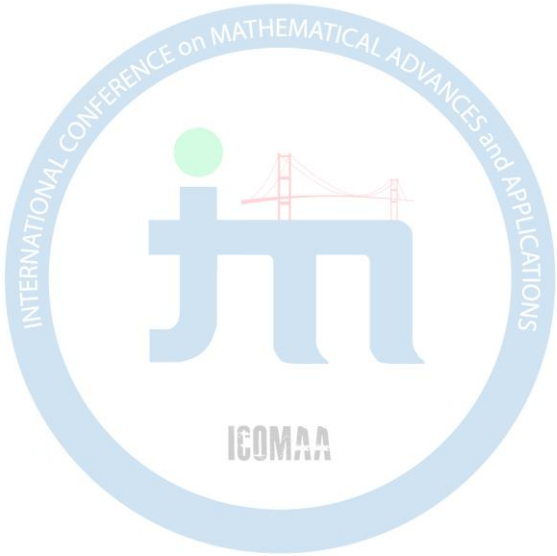

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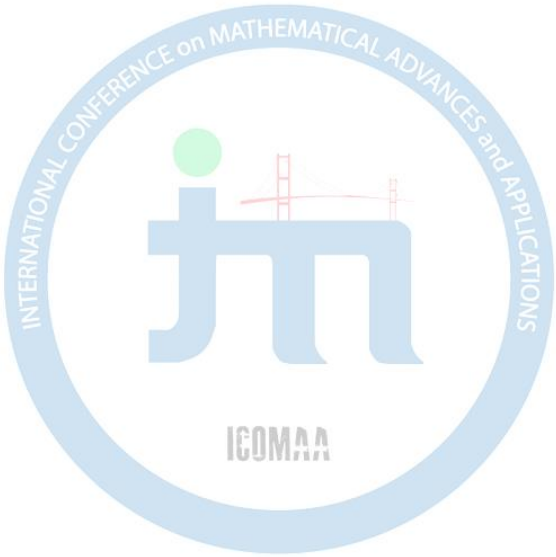
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INVITED TALKS

Holmstedt's formula for the K-functional: the limit case $\theta_0 = \theta_1$

Amiran Gogatishvili
(joint work with Irshaad Ahmed and Alberto Fiorenza)

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Abstract

We consider K-interpolation spaces involving slowly varying functions, and derive necessary and sufficient conditions for a Holmstedt-type formula to be held in the limiting case $\Theta_0 = \theta_1 \in \{0,1\}$. We also study the case $\Theta_0 = \theta_1 \in (0,1)$. Applications are given to Lorentz-Karamata spaces, generalized gamma spaces and Besov spaces.

Keywords: K-functional, slowly varying functions, K-interpolation spaces, Holmstedt's formula, reiteration

References:

1. I. Ahmed, A. Fiorenza and A. Gogatishvili, Holmstedt's formula for K-functional: the limit case $\theta_0 = \theta_1$. Institute of Mathematics CAS, Preprint No. 60-2022, Prague 2022, Preprint arXiv:2210.12377 22 pages, accepted in Math. Nachr.

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Some regularity results for a class of elliptic equations with lower order terms and Orlicz growth

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Abstract

Let us consider the Dirichlet problem

$$\begin{cases} div\, A(x, Du) + b(x)\dfrac{\phi'(|u|)}{|u|}\, u = f \\ u = 0 \qquad\qquad\qquad\qquad\qquad\quad \partial\Omega \end{cases}$$

with $\Omega \subset \mathbb{R}^n, n > 2,\ a$ bounded open set and A(x, ξ) a function satisfying growth conditions, with respect to the second variable, expressed through an N-function ϕ.
We study the regularity properties of the weak solutions u: $\Omega \to \mathbb{R}$ to these problems. More precisely, if $\phi(t) = t^p$, p=2, we establish higher differentiability of solutions to our problem under a Sobolev assumption on the partial map x → A(x, ξ).
In the case of a general N-function ϕ, we prove higher differentiability and higher integrability of the gradient, under mild assumptions on the data, by assuming A(x, ξ) depending on x through an Hőlder continuous function.
The novelty, in both case, is that we take advantage from the regularizing effect of the lower order term, due to the interplay between b(x) and f(x).
Keywords: Higher differentiability, higher integrability, Orlicz spaces, Besov-Orlicz spaces, regularizing effect, boundedness of solutions.

References:

1. C. Capone, T. Radice, Higher differentiability for solutions to a class of elliptic equations with lower
   order terms, Journal of Elliptic and Parabolic Equations, 6 (2), (2020), 751--771.
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C. Capone, A. Passarelli di Napoli, Regularity results to a class of elliptic equations \\with explicit u-dependence and Orlicz growth, (submitted 2022).

Matrix weights in variable Lebesgue spaces: the case of averaging operators

David Cruz-Uribe, OFS
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Abstract

In the 1990s, Nazarov, Treil and Volberg introduced a generalization of the Muckenhoupt A_p weights, replacing the scalar weights w with matrix weights W: that is, measurable, $d \times d$ matrix valued functions whose values are self-adjoint and positive semi-definite almost everywhere. Beginning with their results, there has been a great deal of work done to prove inequalities of the form

$$\|W(T\vec{f})\|_p \leq C\|W\vec{f}\|_p,$$

where T is a Calderón-Zygmund singular integral or some other classical operator of harmonic analysis.

A natural question is to extend these ideas to the scale of variable Lebesgue spaces. These are spaces where the constant exponent p is replaced by an exponent function $p(\cdot)$, with the norm given by the Luxemburg norm:

$$\|f\|_{p(\cdot)} = \inf\left\{\lambda > 0 : \int_{\mathbb{R}^n} \left(\frac{|f(x)|}{\lambda}\right)^{p(x)} dx \leq 1\right\}.$$

The scalar theory of Muckenhoupt weights was extended to these spaces by Cruz-Uribe, Fiorenza, and Neugebauer; Diening and Hästö, and others; however, no work to date has been done on matrix weights in this setting.

We will define a new class of matrix $\mathcal{A}_{p(\cdot)}$ weights which reduces to the scalar class $A_{p(\cdot)}$ defined previously when $d = 1$, and when $p(\cdot) = p$ is constant to the class of matrix weights $\mathcal{A}_p$ defined by Nazarov, Treil and Volberg.

The ultimate goal of this project is to prove that singular integrals are bounded on the space $L^{p(\cdot)}(W)$ when $1 < p_- \leq p_+ < \infty$ and $p(\cdot)$ satisfies the log-Hölder continuity conditions. We begin with an important first step: averaging operators. We prove that this class is necessary and sufficient for averaging operators to be bounded on $L^{p(\cdot)}(W)$. As an application we prove that approximations of the identity converge in this space, and then use this to show that the $H = W$ theorem of Meyers and Serrin can be extended to this setting. This generalizes work by Cruz-Uribe, Moen and Rodney in the constant exponent case.

Results in this talk are joint work with my student Michael Penrod.

Generalised fractional operators with applications in biology

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[2]Institute of Space Sciences,Magurele-Bucharest,Romania

Abstract

Fractional calculus deals with the study of fractional order integral and derivative operators over real or complex domains, and their real world applications. In my talk I will provide the applications of the generalized operators in biology.Several illustrative examples will be presented.

Maximal regularity for non-autonomous problems with a priori assumptions

Peter Hästö
University of Turku

Abstract

Vector-valued generalized Orlicz spaces can be divided into anisotropic, quasi-isotropic and isotropic. In isotropic spaces, the Young function depends only on the length of the vector, i.e. $\Phi(v) = \varphi(|v|)$. In the quasi-isotropic case $\Phi(v) \approx \varphi(v|)$ so the dependence is via the length of the vector up to a constant. In the anisotropic case, there is no such restriction, and the Young function depends directly on the vector. Jihoon Ok and I obtained maximal local regularity results of weak solutions or minimizers of

$$\operatorname{div} A(x, Du) = 0 \quad \text{and} \quad \min_u \int_\Omega F(x, Du)\, dx,$$

when A or F are general quasi-isotropic Young functions. We established local $C^{1,\alpha}$-regularity for some $\alpha \in (0,1)$ and C^α-regularity for any $\alpha \in (0,1)$ of weak solutions and local minimizers with varying a priori assumptions such as $u \in L^s$. Previously known regularity results are included as special cases.

Solvability in the small of higher order elliptic equationsin weighted Sobolev-Banach spaces

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Abstract

We consider m-th order linear, uniformly elliptic equations L u=f with non-smooth coefficients in Banach-Sobolev spaces generated by weighted general Banach Function Spaces (BFS) on a bounded domain.
Supposing boundedness of the Hardy-Littlewood Maximal and Calder\'on-Zygmund singular operators in weighted BFS we obtain solvability in the small in Sobolev-Banach weighted spaces and establish interior Schauder type a priori estimates for the corresponding elliptic operator.

Keywords: Linear higher order elliptic equations, Banach weighted function spaces, Sobolev spaces, a priori estimates.

References:

1. Bennett C., Sharpley R., Interpolation of Operators, Academic Press, 1988,469 p.
2. Bers L., John F., Schechter M., Partial Differential Equations, Lectures in Applied Mathematics, 3A. Providence, R.I.: AMS XIII, 343 p., 1979.
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Some non-matrix summability methods and Korovkin type approximation theorems

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Abstract

Korovkin type approximation theorems are useful tools to check whether a given sequence $(L_n)_{n\geq 1}$ of positive linear operators on $C[0,1]$ of all continuous functions on the real interval $[0,1]$ is an approximation process. That is, these theorems exhibit a variety of test functions which assure that the approximation property holds on the whole space if it holds for them. Such a property was discovered by Korovkin in 1953 for the functions 1, x and x^2 in the space $C[0,1]$ as well as for the functions 1, cos and sin in the space of all continuous 2π-periodic functions on the real line. In this paper, we use the notion of almost convergence and statistical convergence to prove the Korovkin type approximation theorems for the test functions $1, e^{-x}, e^{-2x}$..

Cones generated by a generalized fractional maximal function

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Abstract

In this work we consider the space of generalized fractional-maximal function, constructed on the basis of a rearrangement-invariant space. Four types of cones generated by a nonincreasing rearrangement of a generalized fractional-maximal function and equipped with positive homogeneous functionals are constructed. Questions of mutual covering of such cones are considered. The question of embedding the space of generalized fractional-maximal function in a rearrangement-invariant space is investigated. The cones from nonincreasing rearrangements of generalized Riesz potentials were previously considered in the papers [1],[2].

Keywords: Rearrangement-invariant spaces, non-increasing rearrangements, cones generated by generalized fractional-maximal function, covering of cones.

References:

1. Goldman M.L, On the cones of rearrangements for generalized Bessel and Riesz potentials, Complex Variables and Elliptic Equations. Vol. 55, No.8-10 (2010), 817--832.
2. Bokayev N. A., Goldman M. L.,&Karshygina G. Zh. Cones of functions with monotonicity conditions for generalized Bessel and Riesz potetials, Mathematical Notes. 104, No.3 (2018), 356--373.

Weighted Morrey spaces

Yoshihiro Sawano
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Chuo University

Abstract

Weighted function spaces arise naturally in many contexts of mathematics. Roughly speaking, weighted measure spaces, which generate weighted function spaces, are useful although they break some symmetries. We note that a group can be used to determine the symmetry of a space. In fact, a group action allows the symmetry of the spaces to be measured. For example, O(n), the group of all orthonormal matrices, acts naturally on R^n , and R^n acts on itself as a translation. Hence, we can say that $R^n$is symmetric enough.

CONTRIBUTED TALKS

On the some relations ship between positive and positive p-summing operators

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Abstract

In this paper , with a new study of some relations between positive, regular and positive p- summing operators we show as first contribution a theorem which give a necessary and sufficient conditions that the KB -Banach space Y has the Radon-Nkodým propreity is that all additive operator frome $L_{p'}(\gamma)$, to Y be representable by a function $f \in L_p^+(\gamma, Y)$ such that $\frac{1}{p}+\frac{1}{p'}=1$. In the seconed part , we prove some results to positive and increasing sublinear operators.

Keywords: Banach lattice, Hahn Banach theorem, linear operator, sublinear operator, summing linear operator.

References:

1 O. Blasco, Boundary values of vector valued harmonic functions considered as operators,Studio Math. 86 (1987), 19-33.
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3. L. Mezrag and A. Tiaiba, On the sublinear operators factoring through L_{q}. Int. J. Math. Math. Sci. 50 (2004), 2695-2704.

An Algorithm for Relaxing Multicurves on Small Genus Non-Orientable Surfaces

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Abstract

A multicurve on a given surface *S* is a disjoint union of essential simple closed curves on *S* up to isotopy. In this talk, we consider multicurves in the case where *S* is an *n*-punctured non-orientable surface of genus one with one boundary component, and present an algorithm for solving an interesting combinatorial problem regarding multicurves on S. In particular, we describe an efficient algorithm for relaxing a multicurve in *S* making use of generalized Dynnikov Coordinates and update rules which describe the action of the mapping class group (group of isotopy classes of homeomorphisms) of *S* in terms of generalized Dynnikov Coordinates.

Keywords: Non-orientable surface, Geneneralized Dynnikov coordinates, Multicurves

References:

1. Artin, E., *Theorie der Zöpfe*, Abh. Math. Sem. Univ. Hamburg, **4**,(1925),47–72.
2. Artin, E., *Theory of braids*, Ann. of Math., **48**(2),(1947),101–126.
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SOME PROPERTIES OF GRILL TOPOLOGICAL SPACES VIA G^{α}_{ω} O(X)

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Abstract

The main idea is introducing and investigating a new class of open sets in grill topological spaces, namely s G^{α}_{ω}−ets, which is considered as a strong form of class of G^{α}_{ω}− open sets and it is induced topologies by the collection of G^{α}_{ω}−open sets. Next, we study the separation axioms in the collection of G^{α}_{ω}−open sets.

Keywords: Grill topological space, Induced topology, Separation axioms.

References:

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Bounded finite-time stabilizing positional controls via thecontrollability function as motion time

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Abstract

For the canonical system, a set of bounded finite-time stabilizing positionalcontrols is constructed. This set depends on a parameter which belong toa maximal interval whose terminal points are explicitely calculated. We usethe Korobov's controllability function which is Lyapunov type function. In ourinvestigation, the controllabilty function is exactly the motion time from a giveninitial x0 to the origin.

Keywords: Bounded controls, finite-time stabilization, controllability function.

References:

1. A.E.Choque-Rivero, Korobov' s Controllability function as motion time. Extension of the solution set of the synthesis problem, accepted to appear inMat. Fiz. Anal. Geom. (2023) (31 pages).
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Two-Weighted Inequalities for Some Classical Operators and Their

Commutators in the Modified Morrey Spaces

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Abstract

In this talk, we prove the boundedness of some classical operators as the generalized fractionalmaximal operator and the generalized Riesz potential operator and their commutators in the weightedmodified Morrey spaces and the weighted weak modified Morrey spaces by using two-weightedinequalities. That is, we give sufficient conditions for the boundedness of the generalized Rieszpotential and the generalized fractional maximal operator and also their commutators in the weightedmodified Morrey spaces and weighted weak modified Morrey spaces. Our weighted functions belong to the Muckenhoupt-Wheeden classes and the function *b* is in the Bounded Mean Oscillation BMO spaces.The generalized Riesz potential operator was initially investigated in [1]. The boundedness of our two-operatorsin the Morrey-type spaces is studied by many authors, for instance, see [2, 3, 4, 5].

Keywords:*Weighted Ineaualities, Generalized Riesz potential operator, Generalized fractional maximal operator, Commutators, Modified Morrey spaces*.

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Fekete-Szegö Problem for Certain Subclasses of Analytic Functions Associated with The Combination of Differential Operators

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Abstract

In this work, we introduce and study some new subclasses of analytic functions defined by the combination of Noor and Deniz-Özkan differential operators, and obtain coefficient estimates and Fekete-Szegö inequalities for these new subclasses.

Keywords: Fekete-Szegö problem, Analytic functions, Starlike and convex functions of complex order, Noor and Deniz-Özkan differential operator.

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Majorization Properties for a Subclass of Analytic Function of Complex Order

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Abstract

In this study, we investigate several majorization results for a subordination class of analytic and univalent functions of complex order, defined by $q-$differential operator. Moreover, we point out some new or known consequences of our result, which is in the form of corollaries.

Keywords: Analytic functions, Majorization problem, Starlike functions of complex order, Subordination, $q-$differential operator.

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Inverse Scattering Problem for the Schrödinger Equation with an Additional Growing Potential on the Entire Axis

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Abstract

The Schrödinger equation with an infinitely growing potential at the right end and disappearing at the left end is considered. The method of transformation operators is used to study the direct and inverse problems of scattering theory. The main integral equations of the inverse problem are obtained. The unique solvability of the main equations is proved.
Keywords: Schrödinger equation, harmonic oscillator, scattering data, inverse scattering problem, main integral equations.

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Doubly Diffracted Fields Stimulated by Non-symmetrical Edges at the Junction

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Abstract

This study investigates the doubly diffracted fields generated by the strip that has half soft and half hard boundary conditions on its upper face, and totally soft boundary condition on its lower face. The spectral iteration technique with the Wiener-Hopf method is employed in the study to examine the doubly diffracted fields at the junction on the upper face of the strip. The effect of the non-symmetrical end edges of the strip on the doubly diffracted field at the edge (junction) on the upper face of the strip is presented graphically for the various parameters of the problem.

Keywords: Doubly diffracted field, soft and hard boundary conditions, spectral iteration technique, Wiener– Hopf method.

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Optimal linear approximation and isometric extensions

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Abstract

n-Widths of a compact origin-symmetric sets A, in a Banach space X were introduced in 1936 by Kolmogorov [2] to compare the efficiency of numerical algorithms. It was noticed by Kolmogorov and demonstrated on a concrete example by Tikhomirov [3] that the linear n-width may decrease in an isometric extension of X. Hence it is natural to consider absolute n-widths introduced by Ismagilov [1] in 1974. It was shown by Ismagilov [1] that absolute linear n-widths can be attained in the space of bounded functions on the unit ball in the dual space X*. We show that n-dimensional extensions of X are sufficient to attain absolute linear n-widths and construct these extensions explicitly.

Keywords: Linear approximation, n-width, isometric extension.

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A New Method About Finding Square Root of Perfect Square Numbers

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Abstract

There is a relationship between the squares of two numbers whose sum or difference is multiple of fifty. There is a certain number between zero and twenty-five that will round eachnumber to the nearest multiple of fifty. Therefore, every integer number has a related number between zero and twenty-five. In this method, a smaller perfect square number, which is square of the related number between zero and twenty-five, are used to calculate square root of a bigger perfect square number.

Keywords: Square Root, Square, Perfect Square

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On covered quasi hyperideals in Semihypergroups

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Abstract: In this article, covered quasi hyperideal (CQ-hyperideal) are developed in semihypergroups. Covered quasi hyperideal is the generalization of covered quasi ideal. The greatest covered quasi hyperideal and quasi hyperbase of a semihypergroup are described. Various properties of covered quasi hyperideals are investigated. Also, we have established a relationship between covered hyperideal with covered quasi hyperideal and greatest hyperideal with covered quasi hyperideal.

Keywords: Hyperideal; Covered quasihyperideal; Greatest hyperideal; Quasi hyperbase.
2010 AMS Subject Classification: 18B40; 20M12.

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Exponential Graph Resolvent

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Abstract

Let G be a simple graph of order n and A(G) be an adjacency matrix of G, the spectra of G is the set of eigenvalues of A(G). In other side, the resolvent matrix is a matrix with property that all of its eigenvalues are outside the spectra. In this talk, we present an exponential growth to the graph resolvent.

Keywords: Spectrum, resolvent, power matrix.

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On basicity a system of eigenfunctions of a second orderdiscontinuous differential operator in Lebesgue spaces

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Abstract

Consider the following spectral problem with a discontinuity point

$$y''(x)+\lambda y(x)=0,\quad x\in(0,1/3)\cup(1/3,1), \quad (1)$$

$$y'(0)=y'(1)=0, \quad (2)$$

$$\begin{cases} y(1/3-0)=y(1/3+0), \\ y'(1/3-0)-y'(1/3+0)=\lambda m y(1/3-0), \end{cases} \quad (3)$$

where λ is a spectral parameter, and m is an arbitrary complex number other than zero. Such spectral problems arise in the study of various problems of mathematical physics by the Fourier method [1]. In this paper, using the method of works [2,3], we prove theorems on the basis property of the eigenfunctions of problem (1)-(3) in the spaces $L_p(0,1)\oplus C$ and $L_p(0,1)$, $1<p<\infty$. Note that similar questions for the spectral problem with other boundary conditions were studied in [4,5].

Keywords: spectral problem with a discontinuity point, eigenfunctions, basicity.

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Existence of solutions for impulsive fractional boundary value problem with p-Laplacian via critical point theory

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Abstract

In this work, we consider the boundary value problem for impulsive fractional differential equations with p-Laplacian type. Applying a minimization principal method to prove the existence of solution for this problem.

Keywords: Impulsive fractional differential equation, Boundary value problem, critical point, p-Laplace operator, minimization principal.

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Existence and uniqueness of solutions for p-Laplacian fractional boundary value problem on the half-line

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Abstract

The goal of this work is to study the existence and uniqueness of the solutions to a boundary value problem with p-Laplacian type, associated of caputo fractional differential equation. By using the fixed point theorem of Banach and Krasnosel'skii's theorem that guarenties the solutions of our problem.

Keywords: Fractional differential equation, unbounded intervals, existence solutions, fixed point theory, fractional derivative, p-Laplacian, cone.

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Hardy-Littlewood maximal function on Locally compact Abelian groups

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Abstract

In this paper we investigate a boundedness of the Hardy-Littlewood maximal operator M in the variable Lebesgue spaces in the context locally compact abelian group. We show that the local Muckenhoupt condition implies the local boundedness of M.

Keywords: Locally compact abelian groups, maximal function, variable L^p spaces, Muckenhoupt weights.

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Novel Tempered Fractional Hermite-Hadamard Type Inequalities vian-polynomial Uniformly Convex Functions with Application

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Abstract

In this paper, we obtain some novel tempered fractional Hermite-Hadamard type inequalities for n-polynomial uniformly convex functions. Moreover, using a new identity as an auxiliary result, we deduce several inequalities for n-polynomial convex functions with modulus ψvia tempered fractional integrals, and some special cases are given as well. To validate the accuracy of our main results, we present an application to special means.

Keywords: Hermite-Hadamard type inequalities,n-polynomial uniformly convex functions, Tempered fractional integral operators, Hölder's inequality, Power-mean inequality, Special means.

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APPROACHING GEOMETRIC PROBLEMS WITH THE PARTICLE SWARM OPTIMIZATION METHOD

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Abstract

In our project, which we initiated due to the lack of application in the literature, it is aimed to develop different methods by approaching 7 different analytical geometry problems with the particle swarm optimization method. These problems include a problemwhich aims to divide the area between the x and y lines of a parabolic equation into 4 areas that will be proportional to a 4-element number array, and to find the points where two lines perpendicular to each other intersect the x-axis and the slope of one line. Another problem is to find the points where two lines intersect each other at right angles, which divide a triangle whose one point is on the origin into 4 equal areas, intersect the x-axis at two different points, and find the slope of one line.The method used in our project has been transformed into a design that can be used in many complex systems and problems that involve many variables.

Keywords: Analytical geometry, Particle Swarm Optimization, Area problems, Optimization by coding

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On frame properties of iterates of a multiplication operator

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Abstract

This note is dedicated to the study of frame properties of iterates of a multiplication operator $T_\varphi f(t)=\varphi(t)\cdot f(t),\ f\in L_2(a,b)$.

Theorem 1. *Let* $\varphi(t)$ *be any measurable function and* $f(t)$ *any square summable function on* (a,b). *The system* $\left\{T_\varphi^n f\right\}_{n=0}^{\infty}$ *cannot be a frame in* $L_2(a,b)$.

Theorem 2. *If* $\left\{\varphi^n(t)\right\}_{n=-\infty}^{\infty}$ *is a frame in* $L_2(a,b)$, *then* $|\varphi(t)|=1$ *a.e. on* (a,b), *i.e.* $\varphi(t)=e^{i\alpha(t)}$, *where* $\alpha(t)$ *is a real-valued function.*

Theorem 3. *Suppose that* $\alpha(t)$ *is an invertible function, inverse* $\xi:[p,q]\to[a,b]$ *of which satisfies the following conditions:*

1) $\xi(t)$ *is absolutely continuous, strictly increasing function on* $[p,q]$; $\xi(p)=a$ *and* $\xi(q)=b$;

2) $[p,q]\subset[0,2\pi]$ *and there are constants* $A,B>0$ *such that* $A\le\xi'(t)\le B$ *for almost all* $t\in[p,q]$.

Then the system $\left\{e^{in\alpha(t)}\right\}_{n=-\infty}^{\infty}$ *is a frame in* $L_2(a,b)$.

Acknowledgement. The author is grateful to Professor B.T. Bilalov for discussions.

Keywords: Dynamical sampling, operator orbit, frame, system of powers, Lebesgue spaces.

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Levinson-Type Formula for Sturm-Liouville Operator with a Rational Function of Spectral Parameter in Boundary Condition

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Abstract

We consider the Sturm-Liouville operator on the half line$[0,\infty)$ with a rational function of spectral parameter in the boundary condition and investigate the continuity of scattering function $S(\lambda)$.The increment of the argument of scattering function is obtained.

Keywords: Sturm-Liouville operator, scattering function, Levinson-type formula.

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On a Scattering Problem for Discontinuous Second Order Differential Operators with Herglotz Function of Spectral Parameter in Boundary Condition

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Abstract

In this work, we consider a boundary value problem of scattering theory for second order differential operators on the half line $(0 \leq x < \infty)$with discontinuous coefficient and Herglotz functionof the spectral parameter in the boundary condition. By using the new representation of solution of differential equation, scattering data is provided and its properties are investigated. The Marchenko-typefundamental equation is derived in order to discuss inverse scattering problem.

Keywords: Second order differential operator, boundary value problem, scatering data, spectral parameter, discontinuous coefficient.

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Basicity of the double exponential system in weighted Lebesgue space

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Abstract

This work considers a double exponential system with complex-valued coefficients, which is a generalization of the well–known exponential system $\left\{e^{i(n-\alpha\, sign n)t}\right\}_{n\in Z}$, where $\alpha -$ is, in general, some complex parameter. The study of basis properties of this system has a deep history which dates back to the works of Paley, Wiener and N. Levinson. The well–known Kadets 1/4 theorem also refers to this range of questions. In this work, it is proved that the double exponential system forms a basis for the weighted Lebesgue space $L_{p,w}(-\pi,\pi),\ 1<p<+\infty$, if and only if it is isomorphic to the classical exponential system $\left\{e^{int}\right\}_{n\in Z}$ in it and the weighted function $w(\cdot)$ satisfies the Muckenhoupt condition.

Keywords: weighted Lebesgue spaces, exponential system, basis property, Muckenhoupt condition.

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Conformal Mapping Preserving the Z-Symmetric Tensor on a Riemannian Manifold

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Abstract

In this paper, we denote the conformal mapping of the Z-symmetric tensor on a Riemannian manifold. After that, the properties of the conformal mapping that preserves this tensor are examined.

Keywords: Conformal mapping, Z-symmetric tensor, conharmonic transformation.

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Existence and decay of solutions for a fourth-order hyperbolic equation with a variable coefficients

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Abstract

In this presentation, we consider a fourth-order hyperbolic equation with a variable coefficients. Problems about the mathematical behavior of solutions for PDEs with time delay effects have become interesting for many authors mainly because time delays often appear in many practical problems such as chemical, physical,thermal, biological,economic phenomena, electrical engineering systems, mechanical applications and medicine. We prove the existence and decay of solutions.

Keywords: Existence, decay, variable coefficients.

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The Inverse Strum-Liouville Problem With One Of The Boundary Conditions Including Eigenvalue

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Abstract

Spectral analysis of differential operators has an important place in applied sciences and especially in some physics problems. Spectral analysis is studied under two headings: straight problems and inverse problems.

In our study, we considered the Inverse Sturm-Liouville Problem.

Based on the spectral properties of the Sturm-Liouville Problem with an eigenvalue in one of the boundary conditions we have considered, we have obtained the necessary and sufficient conditions for the potential function "q" in our equation and its solvability by using the eigenvalue sequences and norm constants of all the parameters in our boundary conditions.

Keywords: Inverse Problem, Sturm-Liouville Equation.

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FINITE ELEMENT BASED SCHEME FOR THE BURGERS EQUATION WITH FORCING EFFECTS

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Abstract

This study concentrates on investigation of numerical solutions of the Burgers Equation with source effects. To achieve that aim, the article offers three-point discretization in time and Galerkin Finite Element Method (TDFEM3). In the present method the backward finite difference in time and the finite element method in space are applied to solve the Burgers equation, and then the resulting system of the nonlinear ordinary differential equations obtained at each time step is solved by using computer codes generated in MATLAB. To show the efficiency of the presented method, the numerical solutions evaluated for various values of viscosity at different times is stated in terms of the error norms. These methods are seen to be a very good choice to obtain a high degree of accuracy for the numerical solution of the Burgers equation.

Keywords: Burgers equation, forcing term, time discretization,the backward finite difference, Galerkin finite element method

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On non-increasing rearrangement of generalized fractional maximal function

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Abstract

We give a sharp pointwise estimates of the non-increasing rearrangement of the generalized fractional maximal function via an expression involving the non-increasing rearrangement of*f*. It is shown that the obtained estimate is more sharp than the inequality which is followed from the estimate for the generalized Riesz potential.

Similar questions for the space of classical fractional maximal function are considered in [1] and [2]. And questions ofnon-increasing rearrangements of generalized Riesz potentials were previously considered in [3].

Keywords:generalized fractional maximal function, non-increasing rearrangements, generalized Riesz potential

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On the strong solvability of a nonlocal boundary value problem for the Laplace equation in a rectangular domain

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Abstract

The following nonlocal problem for the Laplace equation in a rectangular domain is considered:

$$u_{xx}+u_{yy}=0,\quad 0<x<2\pi,\ 0<y<h, \tag{1}$$

$$u(x,0)=\varphi(x),\ u(x,h)=\psi(x),\ 0<x<2\pi, \tag{2}$$

$$u_x(0,y)=0,\ u(0,y)=u(1,y),\ 0<y<h\,. \tag{3}$$

Such problems have specific features in comparison with problems with local conditions. For the Laplace equation in an unbounded domain, a similar problem was considered in [1,2], where the classical solution of the problem is studied.Earlier in [3], problems with nonlocal boundary conditions for a shifted equation were considered. For elliptic equations, nonlocal problems were considered in [4], and in [5], a boundary value problem with a nonlocal condition for multidimensional parabolic equations was solved.

In this paper, we study problem (1)-(3) in a weighted Sobolev space with a weight from the Mackenhoupt class. The notion of a strong solution of this problem is defined. Using the Fourier method, under certain conditions on the functions $\varphi(x)$ and $\psi(x)$, we prove the correct solvability of this problem.

Keywords: Laplace equation, nonlocal problem, weighted Sobolev space, strong solution.

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Study of Nonlinear Partial Fractional Boundary Value Problem

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Abstract

In this piece writing, to resolve fractional stochastic equation with initial data, the fractional Duhamel principle is applied and use it to establish the well-boudedness and stability of a mild solution of our problem.

Keywords: Partial differential equations, exixtence, Duhamel principle, stability.

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Recursive Estimation of the Conditional Distribution Function on Riemannian Manifolds

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Abstract

The main of this paper is to treat the estimation of conditional distribution function on Riemannian manifolds. We defined the recursive version of the Nadaraya–Watson estimator. Under some assumptions in Riemannian Manifolds data analysis, we study the properties of a recursive family kernels regression, the asymptotic normality of estimator is established.
Keywords: Riemannian Manifold, asymptotic normality,conditional cummultative distribution function.

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On the recursive sequence

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Abstract

Difference equations appear naturally as discrete analogs and as numerical solutions of differential and delay differential equations, having applications in biology, ecology, physics. Difference equations are used in a variety of contexts, such as in economics to model the evolution through time of variables such as gross domestic product, the inflation rate, the exchange rate, etc.

In this paper, we explore the dynamics of adhering to rational difference formula

$$x_{n+1} = \frac{x_{n-26}}{1 + x_{n-2}x_{n-5}x_{n-8}x_{n-11}x_{n-14}x_{n-17}x_{n-20}x_{n-23}},$$

where initial values are nonnegative real numbers.

Keywords: Difference equation, equilibrium points, recursive sequence.

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Dynamics and Hopf Bifurcation of A Sustainable Tourism Model with Time Delay.

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Abstract

In this work, a model describing the relations between the tourists visiting a protected area, environmental pollution and the capital stock is proposed and studied. The model consists of a system of three nonlinear delay ordinary differential equations. The time delay in the model accounts for the spread of public praise and plays a crucial role in the dynamics.

We show that the system possesses a positive equilibrium point. By studying the stability of this equilibrium, we find that as the time delay parameter exceeds a critical threshold, a Hopf bifurcation occurs which leads to the emergence of a time-periodic solution. We also analyze the stability of the Hopf bifurcation by applying the normal form theory and the center manifold theorem.

Finally we provide several numerical simulations and describe the results in terms of its consequences in terms of sustainable tourism.

Keywords: Sustainability, Stability Analysis, Hopf Bifurcation, Equilibrium Point, Time Delay.

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Korovkin-typetheoremsandtheirstatisticalversionsintheweighted grand-Lebesguespaces without Muckenhoupt condition

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Absract

In this paper, we investigate Korovkin-typetheoremsandtheirstatisticalversionsin the weighted grand Lebesgue spaces$L_{p),\rho}$. basedonshiftoperator,We define the subspace$G_{p),\omega}(-\pi,\pi)$ofthe space.$L_{p),\omega}(-\pi,\pi)$,where continuousfunction are dense, and study some properties of the functions belonging to this space *The analogs of Korovkin theorems are provedin.*$1<p<+\infty$,whenweightfunction$\omega\epsilon L_1(-\pi,\pi)$, $\exists\epsilon_0\epsilon(0,\ p-1)$ and $\omega^{-1}(t)\in L_{\frac{1}{P-\epsilon_0-1}}(-\pi,\pi)$

Keywords:weighted grand-Lebesgue space, Korovkin theorems, statistical convergence

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HARMONIC TRINOMIAL WITH COMPLEX

PARAMETER

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Abstract

Much work has been done examining the similarities and differences between analytic and harmonic functions. Many familiar results for analytic functions hold for complex-valued harmonic functions with only slight modifications. The harmonic analog of the Argument Principle for Analytic Functions. In this paper, we study the number of zeros of harmonic trinomials with complex coefficients of the form$h(z) = z^n + a\bar{z}^k - 1$, n > k , and gcd(n; k) = 1; we determine how the number of zeros depends on the complex parameter **a**.

Keywords:
Polynomial, Harmonic trinomial, Wilmshurst's conjecture .

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Numerical Solution of Second-orderPartial Voletrra Integro Differential Equations Via Taylor Collocation Method

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Abstract

The goal of this work is to propose a method to solve a particular type of partial Volterra integro-differential equations (PVIDEs) numericaly. These equations describe the behavior of systems that involve both waves and particles, making them particularly useful in studying phenomena like fluid dynamics, acoustics, and electromagnetic radiation.

The PVIDEs under consideration in this work are second kind, two-dimensional linear partial Volterra integro-differential equations of second-order

$$\frac{\partial^2 u(x,y)}{\partial x \partial y} + \alpha \frac{\partial u(x,y)}{\partial x} + \beta \frac{\partial u(x,y)}{\partial y} = \gamma\, u(x,y) + g(x,y) + \int_0^x H(x,y,t)u(t,y)dt,$$

subject to initial value conditons.
The proposed technique relies on utilizing two-dimensional Taylor polynomials and explicit schemes to obtain an approximate solution. The accuracy and efficiency of the method are illustrated through various examples using error estimation and convergence testing.

Keywords: Partial Volterra integro-differential equation, Hyperbolic partial differential equation, Collocation method, Two-dimensional equations, Taylor polynomials.

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Existence of Real Models of K3-Surfaces in Arithmetical Terms

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Abstract

Although it is quite common that a real variety may have no real points, very few examples of equsingular deformation classes of projective models of K3-surfaces with this property are known. Clearly, any class of equisingular strata containing a real model is real. However, the converse is not true, but the only known counterexample is the stratum of the space of sextics found in [1].In this research, we study phenomena of this kind, considering from a more general perspective, for all projective models of K3-surfacesand restate the existence of real models in arithmetical terms.

Keywords:K3-surfaces, real models, arithmetical reduction, projective models.

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Maximal-simultaneous approximation by Faber series in Bergman space

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Abstract

Let G be a bounded simple connected domain in the complex plane C, bounded with a quasiconformal boundary L. We recall that L is a quasiconformal curve if there exists a quasiconformal homeomorphism of the complex plane C onto itself that maps a circle onto L. For the functions f analytic in G we consider the Bergman space defined as: $A^2(G):=\{f: \iint|f(z)|^2 d\sigma_z\}$.

We study maximal-simultaneous approximationof the Faber series produced by the integral representation given by V. I. Belyi in the domains withaquasiconformal boundary. The error of this approximation in the norm of the space $A^2(G)$ with dependence of the best approximation number and also of the parameters of the considered canonical domains are estimated.

Keywords: Faber series, maximal convergence, simultaneous approximation, Bergman space.

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The application of expansive mappings to the existence problems

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Abstract

We consider a certain class of expanisve mappings defined on a closed and bounded subset of a Banach space. For such mappings there will be presented some results of Krasnosel'skii typeconcerning the existence of fixed points for compact operators. The results will be applied to the existence problems of nonlinear type.

Keywords: Expansive mapping, Banach space, Compact operator, Fixed point, Nonlinear integral equation.

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Boundedness and Compactness of Commutators for Riesz Potential on LocalMorrey-type spaces.

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Abstract

The paper considers Morrey-type local spaces from $LM_{p\theta}^{w}$. The main work is the proof of the commutatorcompactness theorem for the Riesz potential [b;I_α] in local Morrey-type spaces from $LM_{p\theta}^{w_1}$to $LM_{q\theta}^{w_2}$.

We also give new sufficient conditions for the commutator to be bounded for the Riesz potential[b;I_α]in local Morrey-type spaces from $LM_{p\theta}^{w_1}$to $LM_{q\theta}^{w_2}$.In the proof of the commutator compactness theoremfor the Riesz potential, we essentially use the boundedness condition for the commutator for the Rieszpotential [b;I_α]in local Morrey-type spaces $LM_{p\theta}^{w}$, and use the sufficient conditions from the theorem ofprecompactness of sets in local spaces of Morrey type $LM_{p\theta}^{w}$[1], [2]. In the course of proving the commutatorcompactness theorem for the Riesz potential, we prove lemmas for the commutator ball for the Rieszpotential [b;I_α]. Similar results were obtained for global Morrey-type spaces $GM_{p\theta}^{w}$ [3]and for generalizedMorrey spaces M_p^w[4].

Keywords: Compactness, Commutators, Riesz Potential, Local Morrey-type spaces.

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Pre & Post Pandemic Formative Assessments Methodologies to Improve Mathematics Learning for University Students

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Abstract

Formative assessments help teachers identify concepts that students are struggling to understand, skills they are having difficulty acquiring, or learning standards they have not yet achieved so that adjustments can be made to lessons, instructional techniques, and academic support. This paper focuses on a study at the American University of Sharjah, Mathematics Department of integrating the use of technology with formative assessments in order to identify students who are struggling and focus on specific points prior to exams rather that doing a general review. More specifically, the study was conducted over two different semesters. The first semester (before the pandemic), classroom response systems with PollEverywhere was used while in the second semester (after the pandemic), ILearn Formative Feeback was used. The uniqueness of this research study is the integration of formative assessments and feedback with technology in the delivery of Mathematics Subjects in Higher Education. Both quantitative and qualitative results were collected and there was evident and significant improvements in students' performance when the proposed formative feedback prior to exams was used. It was also apparent that after the pandemic, the use of Ilearn formative feedback was very beneficial for the students and helped improve their performances signficantly in Mathematics.

Keywords: Ilearn, LMS, Polleverywhere, Formative Feedback, Mathematics Teaching, Technology in Education, Lecture Capture, Learning Objectives, Formative Assessments.

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Periodicity and Stability in the Kaldor Model of Economics with Impulse Effects

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Abstract

The Kaldor model in economics possessing impulse effects is under investigation. It is shown that the model has a unique periodic solution under certain conditions. The asymptotic stability is rigorously proved.

Keywords: Kaldor model, Asymptotic stability, Periodic solution

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Adaptation of Some Graceful Graph Labeling Methods to Combinatorial Block Designs

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Abstract

In 1985, S. Lo introduced the notion of edge-graceful graphs. A graph$G = (V, E)$ is said to be edge-graceful if there exists a bijection f from E to $\{1,2, \dots, |E|\}$ such that the induced mapping f^+ from V to$\{0,1, \dots, |V| - 1\}$ given by$f^+(x) = (\sum f(xy))\ (mod\ |V|)$ taken over all edges xy is a bijection. We adapt the edge-graceful graph labeling definition into block designs and define a block design (V, B) with $|V| = v$ and $|B| = b$ as block-graceful if there exits a bijection $f: B \to \{1,2, \dots, b\}$such that the induced mapping $f^+: V \to \mathbb{Z}_v$given by $f^+(x) = \sum_{\substack{x \in A \\ A \in B}} f(A)\ (mod\ v)$ is a bijection in this work. We find a necessary condition and prove some basic results on the existence of block-graceful(v, k, λ)-BIBDs. Moreover, we study the existence problem of block-graceful Steiner triple systems, affine and projective geometries.

Keywords: Block-graceful design, Steiner triple system, affine geometry,projective geometry.

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Embedding the stationary spacetimes into Brans-Dicke cosmology via conformal transformations

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Abstract

A conformal transformation of a static or stationary spacetime by a time dependent conformal scale factor $S(\tau)^2$ is one of the methods of producing a cosmological spacetime. Using this knowledge and Brans-Dicke (BD) field equations, we investigate two time dependent metrics, including Friedmann-Lemaitre-Robertson-Walker (FLRW) spacetime and conformally transformed Kerr-Newman black hole, and we obtain solutions that allow different expansion rates for each geometry. These expansion rates depend on the matter content of the conformally transformed geometry. We state that the BD scalar field yields accelerated expansion of the conformal spacetime if the original metric has vacuum geometry, and no acceleration if the original spacetime has some curvature or matter content in it.

Keywords: Cosmology, FLRW spacetime, Kerr-Newman black hole, Scalar tensor theories.

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On a New Type Gaussian Sequences

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Abstract

In this work, we investigate several properties of a new complex sequence, such as Binet formula, generating function, summation formulas, identities and matrix formulation. We also examine Lucas generalization of these generalized Gaussian special numbers.

Keywords: Tribonacci numbers, Tribonacci-Lucas numbers, Gaussian Tribonacci Numbers, Gaussian Tribonacci-Lucas numbers.

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On the Factorial of Split Quaternions

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Abstract

In the literature, the Gamma function is defined for complex number z with a positive real part and its domain can be extended tocomplex plane with the exception of the values zero and negative integers, [2-3]. Moreover, the Gamma function is also defined for real quaternion q with a positive real part, [1]. In addition, the real quaternionic binomial coefficient and the inverse of real quaternionic binomial coefficient are defined and their properties are investigated.

In this study, we have used the set of split quaternions with the metric $(+,+,-,-)$. The aim of this study is to contribute to the literature by defining the split quaternionic gamma function, split quaternionic binomial coefficient and inverse of split quaternionic binomial coefficient for split quaternions and examining their properties.

Keywords: Real Quaternion, Split Quaternion, Factorial, Gamma Function, Binomial Coefficient, Inverse of Split Quaternionic Binomial Coefficient.

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Spectral Analysis of a Singular Dissipative Third-Order Differential Operator

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Abstract

In this talk, we investigate the spectral properties of a singular dissipative third-order differential operator with deficiency indices (3,3) at singular point with the aid of the resolvent operator. In particular, after showing that the resolvent operator is a trace-class operator, using Lidskii's theorem we introduce some completeness theorems. Moreover we share the trace of the resolvent operator as well as some additional results on the resolvent operator.

Keywords: Dissipative operators, Spectral analysis, Resolvent operators.

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Dependence of Eigenvalues of Dirac Systems on the Data

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Abstract

In this talk, we show that the eigenvalues of a regular boundary value problem generated by a Dirac system depend continuously on the data. Moreover, we share some derivatives of the eigenvalues with respect to some elements of the data.

Keywords: Dirac systems, Frechet derivatives, Eiegenvalues of boundary-value problems.

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Some New Results of Weighted Generalized Norlund-Euler Statistical Convergence

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Abstract

In this paper, we defined generalized weighted Norlund-Euler statistical convergence. We also proved some properties of this type of statistical convergence by applying generalized weighted Norlund-Euler summability method. Moreover, we prove Korovkin's theorem using generalized weighted Norlund-Euler summability theorem for functions on general. We also study rate of generalized weighted Norlund-Euler statistical convergence and some sequences spaces defined by Orlicz functions.

Keywords: Statistical convergence; Generalized weighted Norlund-Euler summability method; Korovkin's type; approximation theorem; Rate of generalized weighted Norlund-Euler statistical convergence; Orlicz functions.

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Zero-Hopf bifurcation of fourth-order quadratic polynomial differential systems, via averaging theory of third order

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Abstract

The goal of this work is to study the maximum number of limit cycles that can be bifurcate from a zero-Hopf equilibrium point of a quadratic polynomial differential system in $\mathbb{R}^4$, byusing the averaging theory of third order.

Keywords: Zero-Hopf bifurcation, averaging theory, quadratic polynomial differential system.

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Dissipative extensions of one operator with potential in the form of a Dirac function

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Abstract

The paper describes all dissipative extensions of the minimal operator generated by the differential expression $-\Delta+\sum_{s=1}^{n}\delta(x-\xi_s)$, where $\delta(x)-$ the Dirac function, $\xi_s \in E_3$, $\xi_s \neq \xi_{s'}, s \neq s'$.

Keywords:the Dirak function, minimal operator, dissipative exstensions of the operator.

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DRBEM Solution of MHD Flow in a Rectangular Duct under Axially-changingExternal Magnetic Field

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Abstract

The laminar, fully-developed magnetohydrodynamic (MHD) pipe flow of a viscous and incompressible fluid has been considered between consecutive magnets placed on the pipe-axis. The flow is under the effect of an axial-dependent applied magnetic field. The MHD flow equations are transformed to three nonlinear Poisson type equations in terms of velocity, induced magnetic field and electric potential, and they are solved by using the dual reciprocity boundary element method (DRBEM) with the fundamental solution of Laplace's equation. The study shows that, axially-changing magnetic field makes the flow to turn its direction at a certain position of the axis. The problem parameters, Hartmann number M and magnetic Reynolds number $R_m$effects on the flow behavior contrast with each other in the sense that, the lengths of the intervals on the pipe-axis on which the flow is reversed are increasing as M increases, however, they are getting shorter as $R_m$increases.

Keywords:DRBEM, MHD duct flow, axially-changing magnetic field.

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On k- Oresme Hybrid Polynomials

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Abstract

In this study, we examined both *k*- Oresme hybrid polynomials and the types of these polynomials with negative indices. Given all the remarkable properties of the polynomial sequence, we also derived some fundamental identities provided by the elements of these polynomials.

Keywords: Oresme polynomials, Hybrid numbers, Reccurence relations.

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Numerical Investigation of Stiff Epidemiological Models

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Abstract

Mathematical models play an important role in understanding natural laws and predicting how they shape the real world. In epidemiology, these models are used to simulate the spread of infectious diseases and forecast the number of individuals who will become infected over time.An essential characteristic of ordinarly differential equation based epidemiological models is the presence of stiffness, which can arise due to different parameter settings. Stiff models are difficult to solve using standard numerical methods, as they require small time steps and significant computational resources. This study investigates the suitability of MATLAB numerical solvers, such as ode15s, ode23s and ode45, for simulating stiff epidemiological models and evaluates their performance in terms of computational efficiency.

Keywords: Mathematical epidemiology, SIR model, SEIR model, Time integration, Stiff ODEs.

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ss-Injective Modules

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Abstract

In this study, we define the concept of *ss*-injective modules, which lies between the class of injective modules and almost injective modules. We say that a module M is *ss*-injective provided M is an *ss*-supplement submodule of every module which contains M. We compare this concept with other injective module generalizations. We show that *ss*-injective property is inherited by direct summands. We also investigate *ss*-injective modules over various ring types.

Keywords:*ss*-injective modules, *ss*-supplement submodules, left V-ring, left small ring.

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Power Series Statistical Convergence of Cheney-Sharma Operators

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Abstract

In this presentation, we investigate some Korovkin type approximation properties of the Cheney-Sharma operators via power series statistical convergence. We also compute the rates of convergence by modulus of continouity and the elements of Lipschitz class.

Keywords: Power series statistical convergence; Cheney-Sharma operators; rate of convergence

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High Order Numerical Approach for Solving the Modified Equal Width Equation

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Abstract

The Modified Equal Width (MEW) equation

$$u_t + 3u^2u_x - \mu u_{xxt} = 0$$

was explored by Morrison et al [1] to model the nonlinear dispersive waves. Since the analytical solutions of the MEW equation are obtained only for restricted solution set of initial and boundary conditions, it has gained great importance to obtain the numerical solutions of the MEW equation over the last years. In the present work, a high order computational approach is introduced to find the approximate solutions of the MEW equation. This approach is formed by using quintic trigonometric B-spline collocation procedure in the spatial discretization and fourth-order two step scheme in the temporal discretization. As a test problem, the motion of the single solitary wave is examined. To see accuracy of the proposed approach and to show the improvement in the results, the L_∞ error norm is computed and compared with the existing techniques in the literature. The obtained results verify that the proposed approach has markedly advantage over some existing studies in terms of accuracy. Also, the temporal order of convergence and three invariant constants are computed numerically and found to agree with their theoretical.

Keywords: Collocation method, Trigonometric B-splines, Modified equal width equation, Solitary waves.

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Effect of Caputo-Fabrizo Dertivative on Scabies Model

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Abstract

A tiny burrowing mite known as Sarcoptes scabiei causes the itching skin condition known as scabies. In a family, daycare center, classroom, or nursing home, close person-to-person contact can quickly spread scabies, which really is contagious, fairly quickly. In this study, Caputo-Fabrizio (CF) derivative is originally used to remodel a scabies disease model and what's more we closely analyse numerical aspects of this fractional model and generate some graphical outcomes in order to forecast difficult and complicated occurrences. With a greater understanding of what is vital to public health research and decision-making processes, such analyses will be beneficial to subsequent research efforts.

Keywords: Caputo-Fabrizio derivative, scabies model

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Alternative Solution Method on Matrix Games with Fuzzy Goals

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Abstract

Two-person zero-sum games have been widely studied in game theory. In these games, each player is mainly interested in maximizing her/his payoff by choosing the best strategy. In the crisp scneario, this is done by maximizing an objective function under the linear constraints. However, the player cannot always be in the crisp scenario and can have to play under the fuzzy environment. One of the situation that fuzziness can occur in two-person zero-sum games is that player's ambiguous preferences. This kind of games is expessed as the matrix games with fuzzy goals. Nishizaki and Sakawa (2001) considered fuzzy goals as player's degree of satisfaction for a payoff. They suggested a solution method for solving these games by constructing linear programming problems for both players. The method consists of a membership function that is aimed to be optimized for each fuzzy goal. In this work, it is studied whether the membership function in the optimization problem can also be directly applied to the elements of payoff matrix. In this way, it was questioned whether a more direct solution method could be obtained. Multi-objective games with fuzzy goals are examined as well as single objective games.

Keywords: Two-person zero-sum games, fuzzy goal, membership function, linear programming.

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A Note on Singular Integral Operators Associated with Laplace-Bessel Differential Operator in Variable Lorentz Space

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Abstract

One of the important tools of harmonic analysis theory is singular integral operator. In this study, we consider singular integral operators associated with Laplace-Bessel differential operator (B −singular integral operators). The boundedness of classical singular integral operator and its version associated with Laplace-Bessel differential operator in variable exponent function spaces have been studied by many authors. In general, to obtain the boundedness of this operator in these spaces, authors impose some regularity conditions on variable exponent function. In this work, we investigate B −singular integral operators invariableLorentz space$L_{p(\cdot),q(\cdot),\gamma}(\mathbb{R}^n_{k,+})$. Here, we use to obtain the $L_{p(\cdot),q(\cdot),\gamma}(\mathbb{R}^n_{k,+})$ −boundedness of these operators the rearrangement estimates and O'Neil type inequalities instead of regularity conditions.

Keywords:γ-rearrangement, singular integral, variable exponent Lorentz space.

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A Local Taylor Series Method for Non-linear Singular Boundary Value Problems

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Abstract

In this paper, we propose the utility of the implicit-explicit local differential transformation method (IELDTM) based on the local Taylor series approximation for solving two-point singular boundary value problems. These problems arise in many fields of science such as gas dynamics, nuclear physics,atomic structures, and electro hydrodynamics, etc.First, we give some basic information to explain the mathematical structure of the method, then consider the results produced by the method. We show that IELDTM eliminates thedisadvantages of existingdifferential transform-based methods. It has been shown that the IELDTM yields more accurate solutions with fewer CPU times than the rival numerical methods.

Keywords:implicit-explicit local differential transform method, taylor series, differential transform method, non-linear singular boundary value problems.

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Mechanistic Modelling of Contact Tracing and Isolation Policies

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Abstract

The COVID-19 pandemic has become a global crisis since its emergence, affecting all aspects of life, including social, economic, physical, and mental health. Various intervention policies have been implemented since the early days of the disease, such as the use of masks, social distancing, contact tracing and isolation, lockdowns, and other restrictions. In this study, we derive the S(Susceptible)- E(Exposed)- (P)Presymptomatic- A(Asymptomatic)- D (Symptomatic)- R(Reported) model including contact tracing and isolation policies. The SEPADR model is represented by the system of integro-differential equations.

Keywords: COVID-19, Compartmental model, SEIR model, Integro-differential equations

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Thermoelastic laminated Timoshenko beam with distributed Delay: global existence and stability

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Abstract

In this work, we consider a linear thermoelastic laminated Timoshenko beam with distributed delay, where Cattaneo as law gives the heat conduction. We establish the well posedness of the system. For stabilityresults, we prove exponential and polynomial stabilities of the system for thecases of equal and nonequal speeds of wave propagation. Our work is a natural extension of Feng's work in [4].

Keywords: Well-Posedness, Exponential Decay, Plynomial Decay, Thermoelastic Laminated, Distributeddelay term.

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On Some Beta Type Operators

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Abstract

Benrtein type operators have been widely studied by many researchers. In this presentation, we focus on some beta type operators and their approximation properties such as a direct approximation theorem by means of modulus of continuity and approximation rate for functions having derivatives of bounded variation. We support the theoretical parts by computer graphics.

Keywords: Bernstein-type operators, bounded variation, beta type operators, rate of approximation, approximation properties.

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On Some Beta Type Operators

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Abstract

Benrtein type operators have been widely studied by many researchers. In this presentation, we focus on some beta type operators and their approximation properties such as a direct approximation theorem by means of modulus of continuity and approximation rate for functions having derivatives of bounded variation. We support the theoretical parts by computer graphics.

Keywords: Bernstein-type operators, bounded variation, beta type operators, rate of approximation, approximation properties.

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Lie Group Property of Generalized Linear Deformation Transformation

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Abstract

In this study, using the definition of linear anisotropic transformationin 3-dimensional Euclidean space E^3, we have defined a linear generalized deformation transformation. Unlike homothetic rotation matrices, we have shown that this transformation consists of the product of different expansion (or shrinkage) and different infinitesimal orthogonal matrices for each $x \in \mathbb{R}^3$ and $\lambda_1, \lambda_2, \lambda_3 \in \mathbb{R}^+$ scalars. We have shown that matrix B is a regular matrix and that this set of matrices has a group structure. We examined the Lie group structure of this group.

Keywords: Anisotropic transformation, Lineaar anisotropic transformation, Generalized linear deformation transformation, Lie group

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A Note About Pseudospectrum Of The Tensor Product Operator

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Abstract

The connection between the $\varepsilon-$pseudospectrum of the tensor product operator $A_1 \otimes A_2$ and the $\varepsilon-$pseudospectrums of A_1 and A_2 has been investigated and some results are given about the this connection under certain conditions.

Keywords: Tensor product, Pseudospectrum.

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On basicity of the system of eigenfunctions for a discontinuous spectral problem in variable exponent Lebesgue space

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Abstract

In this study, the basicity properties of the eigenfunctions system of a second order differential operator containing spectral parameters under boundary conditions in variable exponent Lebesgue space are investigated. For this purpose, we apply the theory of close bases. In this method we use the classical systems such as exponential and trigonometric systems to obtain the basicity properties of the system.

Keywords:variable exponent space, theory of close base, basicity, second-order discontinuous spectral problem.

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Constructing Lyapunov Functions for Delay ReactionDiffusion Systems and Application

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Abstract

Motivated by some biological and ecological problems given by reaction diffusion system with delays and boundary conditions of Neumann type; knowing their associated Lyapunov functions for delay ordinary differential equations, we review a method for determining their Lyapunov functions to establish the local/global stability. The method is essentially based on adding integral terms to the corresponding Lyapunov function for ordinary differential equations. The new approach is not general but it is applicable in a wide variety of delays reaction diffusion models with one discrete delay or more, distributed delay and combination of both of them. To illustrate our result, we give an application to a reaction diffusion epidemiological model with time delay (latency period) and indirect transmission effect.

Keywords: Reaction-diffusion system with delay, Lyapunov function, epidemiological model, latency period, basic reproduction number R_0.

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Solution Of Composite Beam With Periodical Curvature By Finite Difference Method Under Uniform Loadings

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Abstract

In this study, deflection equations of the simply and/or fixed supported, composite plate-strip(beam) having periodical curved material in structure has been obtained in the framework of Akbarov and Guz' continuum theory by using Kirchhoff-Love plate theory. Computer codes prepared in the programming language Matlab, used to get the numerical results. Deflection equation of the above plate-strip at a point $x_i$has been defined for different curved values.Finite-difference method has been used in the solution of thedeflection equations of the plate-strip, subjected to different distributed load. In numerical analysis, finite-difference methods (FDM) area class of numerical techniques for solving differential equations by approximating derivatives with finite differences. The effects on the deflection value have been studied, by changing the value of the elasticity modulus ratio of the plate-strip laminates and the amplitude, wavelength and phase angle of the periodic curvature.

Keywords: composite, plate-strip, Finite difference method, Kirchhoff-Love plate theory

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Machine Learning Models in the Diagnosis of Alzheimer Disease

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Abstract

Dementia has become a major global problem in the 21st century, with Alzheimer's disease (AD) the most common type of dementia. Due to the increasing elderly population, there are difficulties in meeting the demand for diagnosis due to the lack of specialists, especially in many middle and low-income countries. New methods are needed in the diagnosis of individuals with cognitive impairment due to various reasons. In this study, we present some robust machine learning models for diagnosing normal cognitive function, non-AD cognitive disorders and individuals with AD. We use different classification algorithms such as LGBM, Random Forest, MLP, CatBoost, and evaluate the performance of our framework using performance metrics. We show that our machine learning models provide reliable predictions for AD diagnosis.

Keywords: Alzheimer disease, Machine learning, Demantia, Computational neuroscience,Artificial intelligence.

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A New Function Type in Grill Minimal Spaces and Its Properties

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Abstract

In this work, a new function is defined on the power set of a non-empty set by using concepts such as minimal structure, grill and minimal semi-closure. According to the relation of being a subset,this new function is compared with the function shown with $(.)^{*\mathcal{M}}$ in the literature. Moreover, the properties of this function are examined.
Keywords: Minimal structure, Minimal space, Minimal semi-closure, Grill, Grill minimal space.

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Approximative Properties of Perturbed Exponential System in Orlicz Spaces

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Abstract

The non-homogeneous Riemann boundary value problem with piecewise H¨olderian coefficient is considered in Hardy-Orlicz classes. Based on N-function we introduce new characteristic of Orlicz space and establish its relationship between Boyd indices of considered Orlicz space.

Keywords: Orlicz space, Hardy-Orlicz classes, approximative properties.

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Almost Shortest Paths: To Alternate Routes for Security Reasons in Graphs

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Abstract

This study discusses how form of a path in a graph representing a computer network affects the message delivery during distribution. In order to reduce the delivery time and other costs, shortest paths are widely used for message transfer by the computer network users. However, this sometimes can cause traffic in the network. Additionally, the users also consider other routing issues such as delivery time, security etc. In this case, the users search for altenative routes that do not waste the sourses as well as the shortest ones in the network. In this study, we present a secure and fast way to choose the appropriate routes among alternatives. The computer network is represented by a mathematical graph and we label the paths with binary strings by considering structural properties of the graph.We support the path-coding method with mathematical proofs and theorems.

Keywords: Graph, computer network, path,message delivery, routing.

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Upper bounds for blow up of solutions for a fourth-order parabolic equation with viscoelastic term

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Abstract

In this paper, we study a fourth-order parabolic type equation with viscoelastic term. This type problem occurs in many mathematical models in engineering and physical sciences, such as nuclear scince, chemical reactions, heat transfer, population dynamics. We prove the upper bounds for blow up of solutions.

Keywords: Blow up, parabolic equation, viscoelastic term.

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Blow up solutions for a fourth-order parabolic equation with variable exponents

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Abstract

In this presentation, we consider a fourth-order parabolic type equation with a variable exponents. This type problem occurs in many mathematical models of applied science, such as electrorheological fluids, population dynamics, heat transfer, chemical reactions. We prove the blow up of solutions.

Keywords: Blow up, parabolic equation, variable exponents.

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Investigation of Hadamard Fractional Differential Inclusions

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Abstract

This paper investigates the existence of solutions forhybrid fractional differential inclusions involving Hadamard fractional derivative together withhybrid Hadamard nonlocal integral boundary conditions. By using a fixed point theorem due to Dhage, we establish our main results.
Keywords: Hybrid differential inclusions, Fixed point, Multivalued map, Caratheodory.

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Neutrosophic Statistical Analysis of Temperatures of Cities in theSoutheastern Anatolia Region of Turkey

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Abstract

Turkey is one of the countries that will be most affected by a possible climate change within its complex climate structure, especially due to global warming. It is naturally surrounded by seas on three sides and has a faulty topography.Different regions of Turkey will be affected by climate change differently and to varying extents due to its orographic characteristics.In recent years, many heat strokes have been recorded, causing many problems in the environment. Animals die because of water due to environmental change. Statistical methods are widely applied for estimation and estimation of temperature.

In thiswork, neutrosophic statisticalanalysis of temperature data of different cities in the southeasternanatolia region of Turkey is given. The neutrosophic mean and neutrosophiccoefficient of variation are computed using the temperature data. Inaddition, the neutrosophic results are compared with results under classicalstatistics.

Keywords: Neutrosophic sets, Neutrosophic statistics, temperature, indeterminacy.

Acknowledgements: This projected work was partially (not financial) supported byHarran University with the project HUBAP ID: 22261.

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Semi Global Domination Number in Product Fuzzy Graphs

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Abstract

In this paper we introduced the concepts of semi global domination number in product fuzzy graph and is denoted by γsg(G) and semi complimentary product fuzzy graph. We determine the semi global domination number γsg(G) for several classes of product fuzzy graph and obtain Nordhaus-Gaddum type results for this parameter. Further, some bounds of γsg(G) are investigated. Moreover, the relations between γsg(G) and other known parameter in Product fuzzy graphs are investigated.

Keywords: Product fuzzy graphs, semi complimentary product fuzzy graph, semi global domination number in product fuzzy graph.

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Trace formula for differential equation with coefficient containing first degree polynomial depending on spectral parameter

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Abstract

In the Hilbert space $L_2(H,(0,1))$ (where H is separable Hilbert space) we consider the boundary value problem for differential equation with unbounded operator coefficient containing first degree polynomial depending on spectral parameter:

$l[y] \equiv -y''(t) + Ay(t) + q(t)y(t) = \lambda y(t)$, $y'(0) = 0$, $y(1)(1+\lambda) = y'(1)(1+h+\lambda)$, $h \in R$.

A is a self-adjoint positive-definite operator in H and $A^{-1} \in \sigma_\infty$. $\gamma_1 \le \gamma_2 \le ...$ and $\varphi_1, \varphi_2, ...,$ are eigenvalues and eigenvectors of A . $q(t)$ is a self-adjoint operator-valued function, suppose that $q(t)$ is weakly measurable and the following conditions are satisfied: $\|q(t)\| \le C$, $t \in [0,1]$;

$q'(0) = q'(1) = 0$; for each t $\sum_{k=1}^{\infty} |(q(t)\varphi_k, \varphi_k)| < const$; $\int_0^1 (q(t)\varphi_k, \varphi_k)dt = 0$, $k = \overline{1,\infty}$.

Lemma . If eigenvalues of A $\gamma_k \sim gk^\alpha, k \to \infty$, $g > 0, \alpha > 0$, then for the eigenvalues of L_0 we can write $\lambda_n(L_0) \sim dn^{\frac{2\alpha}{\alpha+2}}$, $d = const$

Theorem. If the operator function $q(t)$ satisfy above conditions. Then under the conditions of lemma, we get the following regularized trace formula $\lim_{m\to\infty} \sum_{n=1}^{n_m} (\lambda_n - \mu_n) = \frac{tr\, q(0) + tr\, q(1)}{4}$.

Keywords: Hilbert space, eigenvalue parameter, the first regularized trace.

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Some Improvement of Berezin Radius inequalities via Specht's Ratio

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Abstract

The Berezin symbol $\widetilde{\boldsymbol{X}}$ and the Berezin number of an operator $\boldsymbol{X}$ on the reproducing kernel Hilbert space $\boldsymbol{\mathcal{H}(\Lambda)}$ over some set $\boldsymbol{\Lambda}$ with the reproducing kernel are defined, respectively, by

$$\widetilde{\boldsymbol{X}}(\boldsymbol{\varrho}) = \langle \boldsymbol{X}\frac{\boldsymbol{k_\varrho}}{\|\boldsymbol{k_\varrho}\|}, \frac{\boldsymbol{k_\varrho}}{\|\boldsymbol{k_\varrho}\|}\rangle, \boldsymbol{\varrho} \in \boldsymbol{\Lambda} \text{and} \boldsymbol{ber}(\boldsymbol{X}) = \boldsymbol{sup}_{\boldsymbol{\varrho}\in\boldsymbol{\Lambda}}\left|\widetilde{\boldsymbol{X}}(\boldsymbol{\varrho})\right|$$

By using this bounded function$\widetilde{\boldsymbol{X}}$, we discover a few inequalities pertaining to Berezin number inequalities of functional Hilbert space operators. There are also some conclusions drawn using Hermite-Hadamard inequality. We strengthen and broadena few inequalities in relation to Specht's ratio. With these enhancements, we also demonstrate a number of new inequalities for the Berezin norm and Berezin radius of operators.

Keywords: Berezin number, Hermite Hadamard inequality, Specht's ratio, positive operator.

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Exponential, Logarithmic and Trigonometric Functions on Split Quaternions and Their Characterizations

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Abstract

In the literature, there are two definitions of the set of split quaternions that is defined by the metrics$(-,-,+,+)$ or $(+,+,-,-)$. Polar forms and exponential functionshave already been defined over the set of split quaternionswith the metric$(-,-,+,+)$.

In this study, we considered the set of split quaternions with the metric $(+,+,-,-)$. It is clear that the set of the vector part of them is isomorphic to $\mathbb{R}_2^3$ with the metric $(+,-,-)$. We discussed the properties and characterizationsof the exponential function on split quaternions considering definition of the exponential function via this approach. Additionally, we defined logarithmic and trigonometric functions on split quaternions and discussed their properties and characterizations.

Keywords: Split quaternions, exponential function, logarithmic function, trigonometric function.

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Some Combinatorial Results for the Hyperoctahedral Group

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Abstract

In this work, we will present that the flag major index fmajdefined in [1] on the hyperoctahedral group is equi-distributed over the group with the inversion statistic introduced in [3] with respect to the root system of this real reflection group. In addition, we will combinatorially show that Dmaj permutation statistic defined in [2] on the group of even-signed permutations and the inversion statistic we constructed depending on the root system of the group are equi-distributed over this group.

Keywords: Hyperoctahedral group, permutation statistic, root system.

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A Relation between Bosbach State Operator and Very True Operator

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Abstract

In this study, the concepts of Bosbach state operator and Very True operator in many-valued algebraic structures corresponding to many-valued logic are discussed and the relations between these concepts are revealed. To support mentioned concepts, we give place to some interesting examples.

Keywords: Bosbach state operator, Very True operator, many-valued algebra, many-valued logic.

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Some Existence Theorems for Solutions of Set-Valued Optimization Problems with Respect to Various Set Order Relations

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Abstract

In this work, relations among existence of solutions of a set-valued optimization problem with respect to vector and set optimization criteria are given. For set optimization criterion set order relations $\preccurlyeq_c, \preccurlyeq_{mc}, \preccurlyeq_{mn}, \preccurlyeq_m$ given by Jahn and Ha [1], $\preccurlyeq_s$ given by Nishnianidze [2] and Young [3] are considered. Also, under some cone compactness assumptions existence theorems for solutions of a set optimization problem with respect to these order relations are presented.

Keywords:set-valued optimization, set optimization criterion, vector criterion, set order

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Revenue MaximizationFor PolynomialDemandFunction UsingInterval-ValuedTrapezoidalFuzzyNumbers

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Abstract

In this talk, we first consider the linear demand function

$$p = a - bx$$

where $a, b > 0$ and p is the unit price with respect to the demand quantity x. Then we use the parabolic demand function

$$p = a - bx - cx^2,$$

where $a, b, c > 0$. After the coefficients a, b *and* c are fuzzified by interval-valued fuzzy numbers, we calculate maximum revenue.

KeyWords*:* Demandfunction;Revenuefunction; Trapezoidal fuzzy number; Interval-valuedtrapezoidal fuzzy number; Graded mean defuzzificationmethod.

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Minkowski difference and sum of half planes

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Abstract

A straight line given in a plane divides it into two convex areas. We call one of these spheres a half-plane. One can think about the Minkowski difference and sum of such half-planes. Works [1], [3] provide information about the Minkowski sum and Minkowski difference of straight lines. Using these, we will consider the problem of finding the Minkowski sum and difference of half-planes.

In this article, the conditions for the Minkowski difference and sum of two half-planes to be non-empty are derived and proved in the form of a theorem. Also, the method of calculating the given two half-planes in the presence of the Minkowski difference is described. In writing this article, we widely used works [2], [4], [5]. Continuing the results presented in this paper, these results can be used to calculate the Minkowski difference of other unbounded sets.
Keywords: Minkowski difference, Minkowski sum, half plane, a straight line, unbounded set.

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On the completeness and minimality in the space $L_p(0,\pi)$ of a weighted system of sines with a power-law weight with an excluded arbitrary element

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Abstract

The paper considers the issue of completeness and minimality of aweighted exponentialsystemin the grand Lebesgue space.It follows from the results of [1] that weighted exponential system does not form a basis inthe grand Lebesgue space. Also in [1], sufficient conditions for the completeness and minimality of the weighted exponential system were found. In this paper, we give criteria for the completeness and minimality of the weighted exponential system in grand Lebesgue space. Note that in the case of a weight function of a general form, the criteria for completeness and minimality of weight systems of exponents and systems of cosines with an excluded arbitrary element were studied in [2, 3].

Keywords:completeness, minimality, Lebesgue space, weighted system, sines

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A Novel Alternative Algorithm to Find All Multiple Solutions of General Integer Linear Programs

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Abstract

Integer linear programming (ILP) is often used to model and solve real-life problems. In practice, alternative solutions are very useful as they significantly increase flexibility for the decision maker. In this study, an alternative method based on parameterization obtained from the Diophantine equation is developed to find all alternative solutions of ILP problems and an easy to implement, efficient and reliable algorithm is presented. The proposed method was used without being affected by the number of variables and constraints in the problem.Numerical examples are presented to demonstrate the usefulness of the proposed method. In addition, these examples are coded in the MAPLE programming language according to the proposed algorithm.

Keywords: Linear integer programming, Linear Diophantine equations, Optimal hyperplane, Pure integer programming problems.

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A Novel Alternative Algorithm for Solving Integer Linear Programming Problems

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Abstract

This study proposes an integer linear programming (ILP) an iterative method for solving integer programs with linear objectives and linear constraints. The proposed method is based on the parameterization obtained from the Diophantine equation, and using this parameterization the original problem is reformulated as another ILP problem that can be more efficiently solved using simple mathematical programming. The method is used without being affected by the number of constraints of the problem and also offers all alternative solutions to the decision maker. It is demonstrated by some examples that this method provides an efficient algorithm.

Keywords: Linear integer programming, Linear Diophantine equations, Optimal hyperplane, Pure integer programming problems.

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Effects of Musics Composed Using Mathematical Methods and DNA On the EEG Frequency Bands of Healthy Individuals

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Abstract

Researches about the mathematical techniques that famous musicians used are still being debated by musicians and mathematicians.In this paper, composing new musics using new mathematical techniques or DNA was aimed to remove the lack of literature on this topic. Totally five musics were composed for this project by using DNA, Golden Ratio, and Fibonacci numbers. After the composing process, the EEG tests of the healthy volunteers were taken while they were listening to composed musics. After that, the results were evaluated (by comparing them), and found new techniques for music therapy.

Keywords: Mathematics, Golden Ratio, Fibonacci numbers, Music, DNA, EEG

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New Triangular q-Fibonacci Matrix and Its Applications

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Abstract

In this study, we construct a new triangular q-analogue of the q-Fibonacci matrix$\tilde{F}_q = \left(F_{nk}(q)\right)$defined by

$$F_{nk}(q) = \begin{cases} \dfrac{q^k F_k(q)}{F_{n+2}(q) - 1}, & 1 \le k \le n \\ 0, & otherwise \end{cases}.$$

Later, we define the sequence spaces$c\left(\tilde{F}_q\right)$, $c_0\left(\tilde{F}_q\right)$, $\ell_\infty\left(\tilde{F}_q\right)$, $\ell_p\left(\tilde{F}_q\right)$ $(1 \le p < \infty)$with this analogue and study some topological properties, and give some inclusion relations for these spaces. In addition, we build a bases for the space$\ell_p\left(\tilde{F}_q\right)$, compute α-, β-, γ- duals of the same space, characterize some matrix classes and examine some geometric properties.

Keywords:q-Fibonacci numbers, q-analogue, dual spaces, matrix transform, Banach-Saks property.

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A new approach to the generalization of Hardy-Littlewood integral inequalities on time scale

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Abstract

Hardy-Littlewood type integral inequalities have an important place in harmonic analysis and time scale. In this study, we will present a new approach to generalize multivariate fractional Hardy-Littlewood type inequalities on time scale calculus.

Keywords: Morrey-type classes, harmonic functionsStatistical Convergence, λ- statistical convergence,Cintuitionistic fuzzy 2-normed space.

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Several characterizations of the Bessel functions and their applications

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Abstract

The complex form of certain special polynomials are investigated by many authors, see for example [1-3]. Recently, Srivastava and co-authors [3] show that the real and imaginary parts of a general set ofcomplex Appell polynomials can be represented in terms of the Chebyshev polynomialsof the first and second kind. After that, Kim [2] introduced the degenerate form of the complex Appell polynomials. The main motive of this paper is to show that the generating function can be employed efficiently to obtain certain results for the special functions. The complex form of the Bessel functions is introduced by means of the generating function. Certain enthralling properties for the complex Bessel functions are investigated in view of generating function method. By considering the real and imaginary parts of the complex Bessel functions separately, we get the cosine-Bessel functions andthe sine-Bessel functions. Several novel identities and Jacobi-Anger expansions for the cosine-Bessel functions and sine-Bessel functions are established. Moreover, the generating function of the degenerate Bessel functions is investigated and certain novel identities for these functions are obtained. A hybrid form of these degenerate Bessel functions, namely degenerate Fubini-Bessel functions is constructed using the replacement technique. Finally, the explicit forms of the real and imaginary parts of the complex Bessel functions are established by using hypergeometric approach.

Keywords: Bessel functions; 2-variable Fubini polynomials; complex Bessel functions; degenerate Bessel functions, hypergeometric functions

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Pseudo-implication and fuzzy ideals in Bl-algebras

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Abstract

In this work, the concept of pseudo-implication was presented by Yongwei Yang and Xiaolong Xin.They defined this new operation as a binary operation in BL-algebras that is non-abelian and gave another description of ideals in BL-algebras. Our aim is to employ this operation to define the concept of a fuzzy ideal, which serves as a natural extension of the idea of a fuzzy ideal in MV-algebras. By utilizing pseudo-implication, we obtain another simplified description of fuzzy ideals in BL-algebras and provide several characterizations.

Keywords:BL-algebra, fuzzy ideal, fuzzy filter.

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Existence of Solutions to Fuzzy Stochastic Differential Equations

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Abstract

Stochastic differential equations are a good tool for modeling dynamic phenomena subjected to uncertainty resulting from the action of random forces. To formulate and apply them, concepts of stochastic integrals are needed. In practice, there is a need to take into account uncertainties that are not of the stochastic type. For example, some human judgments about the parameters of the considered dynamical system may be vague, ambiguous or fuzzy.To model the dynamics of systems operating in random and unclear/fuzzy environments, we propose to use fuzzy stochastic differential equations and their particular version, i.e. set-valued stochastic differential equations. In this communication, we will define how fuzzy stochastic differential equations should be understood and focus on the question of the existence of solutions to such equations.

Keywords: Fuzzy stochastic differential equation, Fuzzy stochastic process, Fuzzy integrals.

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A unified Feng–Liu type result in relationalmetric spaces with an application

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Abstract

The purpose of this paper is to obtain an existence Feng–Liu type fixed point result for multi-valued mappings in relational metric spaces which generalizes, extends and unifies several relevant fixedpoint results of the existing literature. Suitable illustrative examples areadopted to substantiate the genuineness of our newly proved result. Besides this, we present a result in a Banach space and utilize the sameto show the convergence of successive approximation for the modifiednonlinear Bernstein operators in C[0, 1].

Keywords: Fixed point, multi-valued mapping, binary relations, relational metric space, Bernstein operators.

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Analytical approximate solutions of some nonlinear evolution equations of fractional order via a novel fractional variational iteration method

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Abstract

In this paper, first we formulate and analyze a novel fractional analytical approximation method named as fractional alternative variational iteration method (FAVIM). After formulation of the FAVIM, we consider the initial value problems (IVPs) corresponding to nonlinear time-fractional Fornberg-Whitham equation (NLTFFWE), modified nonlinear time-fractional Fornberg-Whitham equation (mNLTFFWE), time fractional modified Camassa-Holm equation (TFmCHE), time fractional modified Degasperis-Procesi equation (TFmDPE). Then, we apply our formulated FAVIM for solving the considered IVPs. Here, we use the symbolic software package "Maple" for finding the solution of the considered IVPs and for plotting the 3D and contour figures of the obtained analytical approximate solutions. Finally, we check the accuracy of the obtained solutions by making a numerical comparison with the exact solutions and other existing analogous approximate solutions and which verify that the effectiveness, suitability and time consumed ability of the proposed FAVIM is better.

Keywords: Fractional alternative variational iteration method, Nonlinear evolution equations of fractional order, Caputo's fractional derivative, Maple software package.

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Stancu-Type Generalized q-Bernstein–Kantorovich OperatorsInvolving Bezier Bases

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Abstract

We construct the Stancu-type generalization of q-Bernstein operators involving the idea of
Bézier bases depending on the shape parameter $-1 \leq \lambda \leq 1$ and obtain auxiliary lemmas. We discuss the local approximation results in term of a Lipschitz-type function based on two parameters and a Lipschitz-type maximal function, as well as other related results for our newly constructed operators. Moreover, we determine the rate of convergence of our operators by means of Peetre's K-functional and corresponding modulus of continuity.

Keywords:
(λ, q)-**Bernstein operators; bezier bases; uniform convergence; Lipschitz-type functions; rate of convergence**
.

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The Marchenko Method for the DerivativeNLS Equation

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Abstract

We present the Marchenko method to solve the derivative NLS(nonlinear Schrödinger) equation. This is done by deriving a linear integral equation, which is our Marchenko integral equation, using as input the time-evolved reflection coefficient and the time-evolved bound-state data expressed in terms of a matrix triplet. In the reflectionless case, we present a solution formula, and we illustrate our method with some explicit examples.

Keywords: Derivative NLS equation, inverse scattering, Marchenko method

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A New Note on Summability of Infinite Series and Fourier Series

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Abstract

In this paper, we have generalized two main theorems dealing with absolute Riesz summability factors of infinite series and Fourier series to the $\left|A, p_n, \beta; \delta\right|_k$ summability method. Also, some results related to the new theorem are obtained.

Keywords: Absolute matrix summability, Infinite series, Summability factors, Fourier series.

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A NOTE ON CONSTRAINED MULTIVARIATE LINEAR MODEL AND ITS REDUCED MODELS

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Abstract

The fundamental prediction problems relating to a constrained multivariate linear model (CMLM) and its reduced models are covered in this work. We obtain an unconstrained multivariate linear model (UMLM) from the CMLM by using a reparameterization approach. Thus, we present the derivation of analytical formulas for calculating the best linear unbiased predictors (BLUPs) of all unknown parameter matrices by using some quadratic matrix optimization methods after converting the CMLM to the UMLM. We may also refer to [1-5], for the corresponding studies in which similar approaches were conducted.

Keywords: BLUP, constrained multivariate linear model, reparameterization, reduced models.

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Soliton Solutions of the (3+1)-dimensional Generalized Kadomtsev-Petviashvili Equation

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Abstract

This study investigates soliton solutions of the generalized Kadomtsev-Petviashvili equation in (3+1)-dimension that was recently introduced. The KP equation is used to model shallow water waves and the topic is a vital aspect of fluid dynamics, enabling researchers to gain valuable insights into the behavior of fluids in diverse scenarios. First, the considered method was converted into an ordinary differential equation (ODE) using an appropriate wave transformation and the solution of the ODE was supposed to be the form suggested by the used method. The trial solution includes some unknowns to be found. The trial solution and its necessary derivatives were substituted into the ODE and equating the terms with the same coefficients to zero, a system of algebraic equations was derived. Solving the system, the unknowns in the trial solution and so diverse soliton solutions of the KP equation were extracted. It is validated that the obtained solutions in analytical form satisfy the generalized KP equation via a computer algebraic system, and some plots of the solutions are demonstrated. The obtained results might be significant in terms of gaining a better understanding of the dynamic features of the generalized KP equation in fluid mechanics.

Keywords: Generalized (3+1)-dimensionalKadomtsev-Petviashvili equation, soliton, shallow water.

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Modular Grad-Div Stabilization for Linearly Extrapolated Blended Three-Step Differentiation Scheme for the Incompressible Natural Convection

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Abstract

This paper proposes a modular grad-div stabilization method for solving multiphysics flow problems. The method proposed here adds a modular grad div step for the velocity into a numerical scheme for the incompressible natural convection flow problem. The proposed numerical scheme uses an extrapolated blended three-step Backward-differentitation (BDF) in time and finite element discretization in space. We obtain the scheme is unconditionally stable over finite time interval and has optimal convergence rates both in time and in space. We also provide some numerical tests in order to support our theoretical finding and show the efficiency of the scheme.

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Keywords: Modular grad-div, finite element, incompressible natural convection.

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Scattering analysis of Sturm-Liouville differential equation with sign-changing weight

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Abstract

The scattering analysis of Sturm-Liouville type singular operator with an impulsive condition and turning point will be presented in this study. Different from the classical literature [1-3] considering the positive values of the weight function, we focus on the case including an impulsive condition at the turning point. We obtain the scattering function, resolvent operator, and discrete spectrum of the operator using the hyperbolic representations of the fundamental solutions and give an example illustrating the main results [4].

Keywords: Sturm-Liouville equations, scattering theory, impulsive differential equations, turning point, discontinuous weight function.

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A New Transform Method and Its Application

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Abstract

Recently, different semi-analytical or numerical methods, such as the finite difference method, the Adomian decomposition method, the homotopy perturbation method, the differential transform method are of increasing interest due to the complexity of searching for analytical solutions to many initial or boundary value problems. Differential transform method (DTM) is one of the numerical methods which enables to find an approximate solution in case of linear and nonlinear systems of differential equations. The concept of the DTM was first proposed by Zhou, who solved linear and nonlinear initial value problems in electric circuit analysis. In this study, we propose a new generalization of DTM, which we call the α −parameterized differential transform method for the numerical solution of various type boundary value problems. In this work, we applied the proposed new method to solve the following illustrative differential equation

$$u''(x) + xu'(x) + \left(\frac{1}{4}x^2 + \frac{1}{2}\right)u(x) = 0, \qquad x \in [0,1]$$

together with the boundary conditions

$$u(0) = 0, \qquad u(1) = 1.$$

We have also, drew a graph of the approximate solution to demonstrate the reliability and effectiveness of our own method. The obtained results showed that the proposed new method can be alternative way to solve various type boundary value problems.

Keywords: Boundary value problems, differential transform method, numerical solution

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A Finite Element Method for Solving 2D Contact Problems with Tresca Friction low

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Abstract

In this work we give the mathematical model of our phenomena. Second, we describe the classical formulation for the antiplane problem and we give the corresponding variational formulation which is given by a method coupling an evolutionary variational quality for the displacement field and a time-dependent variational equation for the electric potential field. Then we prove the existence of a unique weak solution to the model.

Keywords: Antiplane problem, electro-viscoelastic material, contact problem, friction, weak solution.
Mathematics Subject Classification: 74M10, 74F15, 49J40.

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Bernstein type operators on elliptic domain and their interpolation properties

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Abstract

Motive of this paper is to construct univariate Bernstein-type operators $B_x^m G(x,z)$ and $B_z^n G(x,z)$, their Products $P_{mn}G(x,z)$, $Q_{nm}G(x,z)$ their Boolean sums $S_{mn}G(x,z)$, $T_{nm}G(x,z)$ on elliptic region which interpolate the given real valued function G defined on elliptic region on its boundary. The bound of the remainders of each approximation formula of corresponding operators are computed with the help of Peano's theorem and modulus of continuity, and rate of convergence for functions of Lipschitz class is computed.

Keywords: Bernstein type operators, elliptic domain, interpolation, product operators, Boolean sum operators, modulus of continuity, Peano's theorem.

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FIXED POINT THEOREMS UNDER LOCALLY T -TRANSITIVE BINARY RELATIONS EMPLOYING MATKOWSKI CONTRACTIONS

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Abstract

In this paper, we extend the relation-theoretic contraction principle due to Alam and Imdad (J. Fixed Point Theory Appl. 17 (2015) 693-702) for Matkowski contractions employing alocally *T* -transitive binary relation. Our results improve and enrich several fixed-point theoremsof the existing literature.

Keywords: Locally T-transitive binary relation, comparison function, R-connected sets.

References:

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Self Adaptive inertial Yosida approximation iterative algorithms for split variational inclusion and fixed point problems

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Abstract

We present two self-adaptive inertial iterative algorithms involving Yosida approximation to investigate a split variational inclusion problem (SVIP) and common solutions of a fixed point problem (FPP) and SVIP in Hilbert spaces. We analyze the weak convergence of the proposed iterative algorithm to explore the approximate solution of the SVIP and strong convergence to estimate the common solution of the SVIP and FPP under some mild suppositions. A numerical example is demonstrated to validate the theoretical findings, and comparison of our iterative methods with some known schemes is outlined.

Keywords:split variational inclusion; fixed point problem; Yosida approximation; algorithms; weak convergence; strong convergence

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On two sequential hybrid fractional q-differential inclusions

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Abstract

In this study, we investigate a new class of the sequential fractional hybrid q-differential inclusion in Caputo sence under three-point q-integro-derivative boundary conditions. To this aim, we employ various novel analytical techniques based on α-ψ-contractive mappings, endpoints, and the fixed points of the product operators to obtain the main results. Finally, we provide some examples to illustrate our main results

Keywords: Endpoint, α-ψ-contractive, Sequential hybrid q-inclusion problem, Nonlinear analysis

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Solving A Simple Harmonic Oscillator EquationBy Adomian Decomposition Method

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Abstract

In this paper, we will display Adomian decomposition method (ADM)for solving a simple harmonic oscillator equation. It is shown thatthe Adomian decomposition method (ADM) efficiency, simple, easy to use in solving physical equation. The proposed method can be applied to linear problem. Some examples were presented to show the ability of the method for linear ordinary differential physical equations·

Keywords: Adomian decomposition method, harmonic oscillator,schordinger equation, physical equation.

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Adomian decomposition method to Solve the second order ordinary differential equations with constant coefficient

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Abstract

In this paper, we will display Adomian decomposition method for solving second-order ordinary differential equations with constant coefficient. The Adomian decomposition method (ADM) is a creative and effective method for exact solution. It is important to note that a lot of research work has been devoted to the application of the Adomian decomposition method to a wide class of linear and non-linear problems. Some examples were presented to show the ability of method for linear and non-linear ordinary differential equations.

Keywords: Adomian decomposition method, second-order ordinary differential equations.

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Computational Analysis of Degree-Based Topological Descriptors of Triphenylene Benzenoid System

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Abstract

Topological descriptors are used to model various chemical and physical properties of molecules, such as boiling points, solubility, reactivity, biological activity, etc. By analyzing the relationship between the values of these indices and the properties of interest, QSPR and QSAR models can be developed to predict the properties of new molecules.Triphenylene is an aromatic hydrocarbon with the molecular formula $C_{18}H_{12}$. It is a planar molecule consisting of three fused benzene rings.The benzenoid triphenylene series consists of compounds derived from triphenylene by replacing one or more of its benzene rings with other aromatic rings.In this study, we computed some topological descriptors ofthe benzenoid triphenylene series S_r.

Keywords: Topological Descriptors, Molecular Graph, benzenoid triphenylene series.

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Blending type Approximations of Sz´asz-Mirakjan operators depending on parameterλ

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Abstract

In the present manuscript, we study the approximation properties of modified Sz´asz operators with a newmodification of Blending type polynomials which depends on parameters, λ and ρ >0. Further, we prove a Korovkintypeapproximation theorem and obtain the rate of convergence of these operators. Next numerically and graphically,error analysis and convergence of the operator for the different function are presented. Moreover, local and globalapproximation properties are studied via the first and second-order modulus of smoothness, also Peetre's K-functional
and weight functions for these sequences in different spaces of functions. Lastly, A-Statistical approximation resultsare investigated.

Keywords:Blending type operators, Local and global approximation, Peetre's K-functional, Rate of convergence, Korovkin theorem.

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A Novel Numerical Manner for Non-Linear Coupled Variable Order Reaction-Diffusion Equation

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Abstract

In this work, an efficient variable order Bernstein collocation technique, which is based on Bernstein polynomials, is applied to a non-linear coupled system of variable order reaction-diffusion equations with given initial and boundary conditions. The operational matrix of Bernstein polynomials is derived for variable order derivatives w.r.t. time and space. The Bernstein operational matrix and collocation technique are applied to the concerned non-linear physical model to achieve a system of non-linear algebraic equations, which are further solved by using Newton method. A few examples are presented to demonstrate the accuracy and stability of the scheme by comparing L2 and L∞ norm errors between the obtained numerical solutions and existing solutions. The important feature of this article is the graphical exhibitions of the effects of variable order derivatives on the solutions of the considered non-linear coupled reaction-diffusion equation for different particular cases.

Keywords: Variable order derivaties, diffusion equation, Bernstein Polynomials, convergence analysis, error bounds.

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Approximation by nonlinear Lupas type Bernstein operator of Max-Product kind

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Abstract

We construct a new analogue of nonlinear Lupas type Bernstein operator using max-product algebra and q-integers, which possess the endpoint interpolation property. We study the Shape-preserving property and the graphs have also been added to check the theory.

Keywords: Nonlinear max-product operators, Lupas type operators, Degree of approximation, Shape-preserving properties.

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New Auxiliary Filled Function without Parameter for Solving Optimization Problems

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Abstract

This study offers a new filled function method to solve unconstrained global optimization problems. First, we analytically show that our filled function holds all conditions to be a filled function. Then an algorithm constructed for this new filled function and apply constructed algorithm to an unconstrained global optimization problem. At the end we present the numerical results and compare with results of other competing algorithms in literature to show the efficiency of our filled function method.

Keywords: Globaloptimization,Filledfunction,Globalminimizer, Algorithm,Local minimizer.

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Risk Assessment of Autonomous Vehicles in terms of Public Health

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Abstract

Risk assessment is required to manage the negative consequences of Autonomous Vehicle (AV) implementation and maximize its benefits. In this study, which will be conducted on the beneficial and negative effects of AVs on public health, risk factors related to transportation that affect public health will be given first. When uncertainties are encountered in hazard assessment and risk assessment for transport-related exposures and risk factors that may affect public health, a new method will be developed to overcome these problems.Examining the health effects of AVs, identifying risks, and trying to reduce these risks will help produce strategies that are beneficial to overall public health.

Keywords: Autonomuous vehicles, public health, risk assessment, AHP, TOPSIS, MABAC

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Childhood Cancer Risk Analysis with Integrated Decision-Making Method

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Abstract

Childhood cancer is the leading cause of death in children, especially in low and middle-income countries. Their likelihood of survival heavily rests on the country where they live. The chance of curing childhood cancer in high-income countries is above eighty percent, whereas in low and in middle-income countries, it is a mere forty-five percent. The most productive way to reduce the effects of childhood cancer is through effective and evidence-based therapy with appropriate nurturing care.

To address the risk assessment process at the moment, a new risk evaluation technique will be offered. The suggested technique uses MCDM, which has a hybrid structure made up of the Neutrosophic AHP and Fermatean Fuzzy AHP methods, to enable dealing with ambiguity in the risk assessment process for children cancer.

Keywords: Childhood cancer, risk analysis, fermatean fuzzy AHP, Neutrosophic AHP.

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Some applications of Krasnosel'skii's theorem for multi-valued operators

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Abstract

In this work, we discovered some results about the existence of a solution of the sum of a multi-valued operator and a single-valued operator in the weak topology. The results are specifically presented using the weak non-compactness technique. Some previously known single-valued Krasnosel'skii-type theorems are extended into multivalued versions.

Keywords: Multivaluedoperator, Krasnosel'skii's theorem, Measure of weak noncompactness.

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Basicity of double system of exponents with linear phasein the weighted Lebesgue space

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Abstract

This paper considers double system of exponentials with linear phase in the weighted space $L_{p,\rho}$ with power weight $\rho(\cdot)$ on the segment $[-\pi,\pi]$. Under certain conditions on the weight function $\rho(\cdot)$and on the perturbation parameters, the completeness, minimality and basicity of this system in $L_{p,\rho}$ is proved. An explicit expression for the biorthogonal system in the case of minimality is derived and its integral representation is obtained. The obtained results generalize all previously known results in this direction.

Keywords: exponential system, basicity, weighted space.

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On Harmonic Summability of Difference Sequences of Fractional Order

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Abstract

In this work, we generalized the concept of lacunary $(H, 1)$ summability from real sequences to difference sequences of fractional order. The notaion of the lacunary harmonic summability, lacunary strongly harmonically summability and lacunary statistically logarithmic convergence of difference sequences of fractional order is introduced. Also we have established theorems presenting a connection between these notions.

Keywords: Harmonic convergence, lacunary sequence, difference sequence.

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Existence and blow up of solutions for a viscoelastic Petrovsky equation with varaible exponents

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Abstract

In this presentation, we consider a viscoelastic Petrovsky equation with varaible exponents. This type problem occurs in many mathematical models of applied science, such as electrorheological fluids, population dynamics, heat transfer, chemical reactions. We prove the existence and blow up of solutions.

Keywords: Blow up, existence, Petrovsky equation, variable exponents.

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Stability and stabilization of the implicit differential equations in Hilbertspaces

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Abstract

We apply the generalization of Lyapunov theorem for some stationary differential equations of the form:

$$A'x(t)=Bx(t), \text{ for all } t\geq 0;$$

Where A and B are bounded linear operators in Hilbert spaces, in order to obtain a necessary and sufficient conditions about the stability of those equations. The achieved results can be used also to study the stability of another type of differential equations called quasi-linear degenerate differential equations.

Keywords: Exponential stability, Operator theory, Implicit equations,Hilbert space.

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On the exponential stability of the stationary and perturbed implicit equations

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Abstract

In this work, we study the exponential stability of the stationary differential equations of the form: $Ax'(t) - Bx(t) = 0$ for all $t \geq t_0$, where A and B are linear bounded operators in Hilbert spaces. The obtained results on the one hand are the generalization of the Liapounov theorem for the spectrum of the operator pencil$\lambda A - B$. On the other hand, the establishment of the exponential stability conditions for the stationary and perturbed equation described by: $Ax'(t) - \big(B + B(t)\big)x(t) = 0$.

Keywords: Exponential stability, Operator pencil, Implicit stationary equation, Perturbed equation.

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Finite volume method for Seawater intrusion problem in Porous Media

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Abstract

In this paper, we are interested in studying the dynamics of seawater intrusion problem in heterogeneous porous media.This problem concerns immiscible fluids, where these fluids are separated by an abrupt interface. Here we propose a numerical approach to solve our problem by using finite volume method and then present numerical results.

Keywords: Seawater intrusion, Porous media, Finite volume method, Stability.

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Existence and nonexistence results of a fifth-order BVP

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Abstract

The aim of this talk, is to discuss the existence and nonexistence of solutions for a class of nonlinear fifth-order boundary value problems. The main tool of our analysis is the classical norm type compression-expansion fixed point theorem of Krasnoselskii.

Keywords: Existence, nonexistence, boundary value problem, Krasnoselskii fixed point theorem.

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Multiple Pursuers and One Evader in A Pursuit Differential Game with Gronwall-Type Constraints

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Abstract

We study a differential game with many pursuers and one evader in $\boldsymbol{R^n}$. The control functions of the players are constrained by Gronwall type constraints. If the state of a pursuer coincides with the state of the evader, then pursuit is considered completed. Pursuers try to complete the game and the aim of the evader is opposite. We obtain the conditions of completion of pursuit and possibility of evasion in terms of the convex hull of the initial positions of pursuers.

Keywords: Differential game, Gronwall constraints, pursuer, evader, strategy.

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Gauss Decomposition of $\mathbb{Z}_3$-Graded Quantum Group $\widetilde{\mathbf{GL}}_{\mathbf{q}}(\mathbf{2})$

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Abstract

The general linear group obtained by the matrix representations of the linear transformations is denoted by $GL(n)$. This group is deformed in two ways. In the classical and deformed cases, a matrix T belonging to the group $GL(n)$ can be written as $T = T_L T_D T_U$, where T_L, T_D and T_U are a lower triangular, a diagonal, and an upper triangular matrices, respectively. In the literature, it has been shown that this case is also valid for a matrix belonging to the quantum group $GL_q(n)$ and the quantum supergroup $GL_q(m|n)$.

In this study, we show that the Gauss decomposition is valid for the $\mathbb{Z}_3$-graded quantum group $\widetilde{GL}_q(2)$ as well. When the Gauss decomposition of a matrix in the quantum group $\widetilde{GL}_q(2)$ is performed, two new $\mathbb{Z}_3$-graded quantum subgroups will emerge and the properties of these quantum subgroups will be examined: If $T \in \widetilde{GL}_q(2)$, we can write $T = T_L T_D T_U$.Then, it can be seen that the product matrices $T_L T_D$ and $T_D T_U$ form both $\mathbb{Z}_3$-graded quantum groups. The coordinate algebras of both quantum subgroups have a $\mathbb{Z}_3$-graded Hopf algebra structure. Finally, it has been seen that the product of three matrices in the Gauss decomposition of a matrix belonging to the quantum group $\widetilde{GL}_q(2)$ also admits a Hopf algebra structure.

Keywords:
$\mathbb{Z}_3$-graded Hopf algebra,$\mathbb{Z}_3$-graded quantum group, Gauss decomposition.

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Inverse Boundary Problem for Construction of the Right Side in a Third Order Two-Dimensional Pseudohyperbolic Equation

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Abstract

In mathematics and mathematical modeling, tasks that require the determination of the coefficient (coefficients) of the equation itself or the right-hand side of equation in addition to solving a definite differential equation are called inverse problems.

In this paper, we study the inverse boundary problem for a third order two-dimensional pseudohyperbolic equation.When solving inverse boundary problem , a transition from a initial boundary problem to some auxiliary problem is performed.

After applying the formal Fourier scheme to the auxiliary problem, the auxiliary problem is reduced to a decomposable system of integral equations .Then the existence and uniqueness of the integral equation will be proved. It will also be shown that the solution of the integral equation is the solution of the auxiliary problem.

Keywords:inverse boundary problem, third-order pseudohyperbolic equation, Fourier method.

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A new family of symmetric functions of binary products of bivariate Mersenne Lucas polynomials with (p,q)-numbers

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Abstract

In this work, we study the generalized (p,q)-numbers and bivariate Mersenne Lucas polynomials defined in [4, 6]. We first give some new properties and results on the generalized (*p*,*q*)-numbers. Moreover, by using the symmetric functions we obtain the new generating functions for the products of bivariate Mersenne and bivariate Mersenne Lucas polynomials with (*p*,*q*)-numbers at positive and negative indices.
Keywords:(p,q) numbers; generating functions; explicit formula; Bivariate Mersenne Lucas polynomials.

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Quasilinear parabolic equations with partialy VMO coefficients

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Abstract

We study strong solvability of the Cauchy-Dirichlet problem for parabolic quasilinear equations with discontinuous principal coefficients. The dependence on x is of VMO type while with respect to t, the coefficients are only measurable. We obtain existence and uniqueness of the solution, under suitable structural conditions, and by the imbedding theorems also Holder regularity of the solution.

Keywords: Quasilinear parabolic equations, Fixed point theorem, strong solutions, VMOx coefficients.

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Impact of large claims on the stability bound of a bivariate risk model

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Abstract

In ruin theory, stochastic processes areused to model the surplus of an insurance company and to evaluate its ruin probability.This characteristic is a much studied risk measure in the literature. In general, this measure is very difficult or even impossible to evaluate explicitly. Thus, different approximation methods have been proposed to estimate this characteristic [2]. However, its assessment is not evident in several cases since it cannot be found explicitly in closed forms. Besides, it is not easy to determine the parameters governing these models since they are often unknown or partially known. For all these reasons, the stability analysis becomes crucial for studying such models.Hence, it is necessary to obtain explicit stability bounds. The strong stability method, which was developed by Aïssani and Kartashov (1983) [1], makes it possible to clarify the conditions for which the ruin probability of the complex risk model (real model) can be approximated by the corresponding ruin probability in the simple risk model (ideal model). In this work, we consider the problem of stability of the bivariate classical risk model, in particular at the stability bounds of the classical risk model established by Benouaret and Aïssani (2010) [4] using the approache based on the strong stability method developed for general Markov chains [1].Based on numerical and graphical results, we study the stability bounds of the ruin probability considering different heavy-tailed claim distributions [3], and we show the impact of large claims on the stability bound of a bivariate classical risk model.

Keywords: Risk model,Ruin probability,Approximation,Large claims, Strong stability, Markov chain.

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Global solvability of the Laplace equation in weighted Sobolev spaces

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Abstract

We consider a non-local boundary value problem for the Laplace equation in unbounded domain. Our interest is pointed on the weak solvability of that problem in the framework of the weighted Sobolev space with Muckenhoupt weight. We have proved that any weak solution heaving second generalized derivatives is also a strong solution and satisfies the corresponding boundary conditions, extending in such a way some classical results.

Keywords: Laplace equation, weak solutions, anisotropic Lebesgue spaces, Morrey spaces.

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On Evolution Equations and Operator Semigroups in Banach Spaces

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Abstract

The theory of operator semigroups is a field of study widely used in many areas of applied mathematics, including analysis, probability theory, partial differential equations, dynamical systems, and quantum theory. In this work, the qualitative properties of solutions of evolution equations correspondingto different types of initial value problems considered for applications will be analyzed through one-parameter semigroups on Banach spaces.

Keywords: Linear operator, Banach space, Semigroup, Evolution equation

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Data Dependence Result for A New Iterative Algorithm

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Abstract

In this work, we defined a different version of an iteration method known in the literature. We examined the convergence of this new iteration method under certain conditions. We also proved that this iteration method is data-dependent. Finally, we presented some examples for the obtained results.

Keywords: Iteration method, Convergence, Data dependence.

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An explicit Milstein-type scheme for interacting particle systems and McKean--Vlasov SDEs with common noise and non-differentiable drift coefficients

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Abstract

We propose an explicit drift-randomised Milstein scheme for both McKean–Vlasov stochastic differential equations and associated high-dimensional interacting particle systems with common noise. By using a drift-randomisation step in space and measure, we establish the scheme's strong convergence rate of 1 under reduced regularity assumptions on the drift coefficient: no classical (Euclidean) derivatives in space or measure derivatives (e.g., Lions/ Fréchet) are required.The main result is established by enriching the concepts of bistability and consistency of numerical schemes used previously for standard SDE.We introduce certain Spijker-type norms (and associated Banach spaces) to deal with the interaction of particles present in the stochastic systems being analysed. A discussion of the scheme's complexity is provided.

Keywords:stochastic interacting particle systems, McKean-Vlasov equations, common noise, Milstein scheme, non-differentiable drift,drift randomisation, bistability.

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Numerical Investigation of Free Rotor Aerodynamics for Ship-Rotor Interaction

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Abstract

Rotor aerodynamics is important for rotary-wing aircrafts especially located in naval surface combatants. The aerodynamic interaction between the helicopter, its rotor and the ship structure should be investigated precisely. This study focuses on the aerodynamic performance of 4-blade rotor geometry to be used in the further studies. Sikorksy S-76 main rotor geometry was analyzed numerically in free condition in an unbounded flow domain. RANS equations were solved by discretizing the computational domain with finite volume elements and using appropriate turbulence model (k-ω SST). The numerical results were obtained in terms of rotor thrust and rotor torque. The results were discussed for different wind-over-deck (WOD) angles. The results of the present study will provide information about the interaction between ship and rotor, which is to be carried out in further studies.

Keywords: Aerodynamics, Free rotor, RANS, Ship airwake, Ship-rotor interaction.

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Some Results on b_3-subbalancing Numbers

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Abstract

Subbalancing numbers were defined in [4] as the values of n satisfying the Diophantine equations

$$1 + 2 + \cdots + (n-1) + D = (n+1) + \cdots + (n+r)$$

for some positive integer r, where D is a fixed positive integer. In this study, we consider the b_3-subbalancing numbers obtained by taking the Dpositive integer as the 3^{th} cobalancing number. We give the recurrence relation, Binet formula and some algebraic identities of b_3-subbalancing numbers. Furthermore, we investigate algebraic relations between the sequence of b_3-subbalancing numbers and other integer sequences.

Keywords: Balancing numbers, Cobalancing numbers, Subbalancing numbers, Binet formula.

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Split Quaternion Sequences

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Abstract

In this study, we used the set of split quaternions with the metric $(+,+,-,-)$and we we worked on split quaternion sequences, concepts of their convergence and divergence. Also, we tested theconvergence of split quaternion sequences. Additionally, the properties of split quaternion sequences are discussed.

Keywords: Realquaternion sequence,split quaternions, split quaternion sequences,split quaternion series.

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A Bound Set of Chaotic Satellite System and Its Application in Chaos Synchronization

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Abstract

In this manuscript, we have estimated the bound set and achieved synchronization of the chaotic satellite system. To obtain the ultimate bound set of chaotic satellite system, we have employed Lagrange optimization method. The idea of the ultimate bound has been used to the chaos control and synchronization. By Lyapunov stability theory, synchronization has been achieved between two chaotic systems via a globally exponential scheme.We use the linear feedback control and applied inequality techniques to achieve the globally exponential synchronization of two identical chaotic satellite systems. To establish the efficiency of the developed method, we have performed the numerical simulations through MATLAB.

Keywords: Ultimate bound set, Lagrange optimization, Globally exponential synchronization, Lyanpunov stability theory.
MSC 2020 Classifications: 34D06, 34H10, 34D20.

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Optimal points in b- metric spaces endowed with graph

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Abstract

In this paper, we focus on the best proximity point theorems to prove their uniqueness on a b - metric space endowed with a graph. We also furnish some numerical examples to support our claims. As an application of our main result, we find the solution of a nonlinear integral equation.

Keywords: best proximity point, fixed point, weak P - property, graphical b-metric space.

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Solution of Nonlinear Integral Equations by Generalized Contractive Condition

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Abstract

In this paper, we prove the existence of a solution of some nonlinear integral equations with the help of common fixed-point theorems satisfying generalized contractive condition in complete metric space for two pairs of weakly compatible mappings.

Keywords: Nonlinear integral equation, Fixed point, Compatible mappings, Contractive condition.

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Fractional Mathieu-Duffing System with the stability condition and chaos control

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Abstract

In this paper, we introduce the chaotic fractional Mathieu-Duffing system and state a theorem to analyzestability of the system base on the Lyapunov secondmethod.Next, we eliminate the chaotic behaviors of the system by means of feedbackcontroller and presented theorem. We further present numerical simulationsand revealchaotic and asymptotic stability behaviors of the system to verify thetheoreticalanalysis.

Keywords: Chaos, Fractional Mathieu-Duffing System, Stability.

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DRBEM solutions of singularly perturbed MHD flow in a square duct with variably conducting and no-slip/slipping walls

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Abstract

In this study, the Dual Reciprocity Boundary Element Method (DRBEM) solutions of singularly perturbed magnetohydrodynamic (MHD) flow equations in a square duct with variably conducting and either slipping or no-slip walls are investigated. The MHD flow equations governed by the velocity *V(x,y)* of the fluid and the induced magnetic field *B(x,y)* are coupled and convection-diffusion type including the so-called Hartmann number *(Ha)* as a coefficient of the convection terms. When *Ha* is large because of the high intensity of the external magnetic field, then MHD flow equations become convection dominated. That is, the coefficients of the diffusion terms are very small giving the singularly perturbed MHD flow equations whose numerical solutions are difficult to be found especially on the thin boundary layer regions. These singularly perturbed MHD equations are solved using Shishkin mesh which consists of the transition points depending on Ha and the number of nodes taken on each side of the duct. DRBEM numerical results show that the well-known behaviors of *V(x,y)* and *B(x,y)* are deduced for large values of *Ha* such as 500, 700, and 1000. That is, the flattening flow and boundary layers formation are observed. For variably conducting and no-slip walls, for a fixed *Ha* and increasing wall conductivity *c*, the velocity *V(x,y)* decreases in magnitude whereas the profiles of *B(x,y)*become perpendicular to the duct walls. On the other hand, for variably conducting and slipping walls, the slip length α has such an impact on the velocity *V(x,y)* that, its magnitude increases with an increase in α for each fixed *Ha*. Moreover, it is seen that the induced magnetic field *B(x,y)* profiles is not much effected from the increase in the slip length.

Keywords:MHD flow, DRBEM, Hartmann number, Shishkin mesh, singular perturbation, transition point, slip length.

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Assessment of Bank Liquidity Risk with Artificial Neural Networks

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Abstract

Liquidity risk of bank is defined as the risk of not converting its short-term liabilities into cash. In this study, an estimation has been made for the current ratio, which is used as a liquidity risk indicator. A real-world case study is presented to demonstrate the applicability and exhibit efficiency, accuracy and flexibility of Artificial Neural Networks when modeling ambiguous occurrences related to bank liquidity risk measurement. To deal with these issues, we propose a model that uses Artificial Neural Networks and Time Series regression model. The implementation of these two systems comprises several algorithms and tests for validating the proposed model.In the current ratio estimation in both systems used, the results are discussed and compared. According to the results obtained time series regression model performed worse prediction than artificial neural networks.

Keywords: Current ratio, Artificial neural networks, Time series, Banking, Liquidity,

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On Modification of Hirota Method Through Transition Between Parameters

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Abstract

In this study, three different classes of solutions to a specific form of a new generalized fourth-order nonlinear partial differential equation are presented. This process appears as result of transition between real and complex parameters which provides an useful modification of well known Hirota method [1,2,3]. What enable us to obtain various solutions are restrictions on phase shifts.

Keywords: Modification of Hirota method, bilinear form, complexiton solutions, soliton solutions, soliton-complexiton solutions.

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Statistical Convergence of Sequences of Sets of Order (α, β)

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Abstract

In this paper we define Wijsman λ- statistical convergence of order (α, β) and studied some properties of this concept. We also make an effort to define Wijsman λ- statistical convergence of Musielak-Orlicz function of order (α, β) and examine some topological properties.

Keywords:Statistical convergence, λ-statistical convergence, Wijsman convergence, Musielak-Orlicz function.

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Prediction of HIV-1 Nucleoside Reverse Transcriptase Resistance with Artificial Neural Networks

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Abstract

HIV is a serious and chronic disease that affects millions of people worldwide. Despite improvements in life expectancy and quality of life for patients receiving antiretroviral therapy, drug resistance development remains a major challenge for effective treatment.Understanding the mechanism of resistance is crucial, as drug resistance is currently the biggest obstacle to the effective treatment of HIV/AIDS. To overcome these challenges, researchers use genotype and phenotype testing, which can be both time-consuming and expensive. Machine learning models are one of the methods used to overcome these challenges by interpreting the available dataappropriately. The purpose of this study is to develop artificial neural network (ANN) models for predicting the resistance profiles of nucleoside reverse transcriptase inhibitors (NRTIs) using the Stanford HIV drug resistance database. The pearson correlation coefficient and mean square error metrics are presented to measure the predictive performances of various ANN models.

Keywords: Artificial neural networks, HIV-1, Drug resistance, Machine learning.

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Proposing a New DNA and Music Powered Cryptology Technique

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Abstract

In today's completely digitalized world, cryptology techniques both in cryptography and cryptanalysis are needed. Thus, in this paper, the connection between biology, music, and cryptology was examined and three algorithms that can be used both in encryption and decryption processes were proposed.

The process lying behind these three algorithms is a process that matches every character to a three-digit DNA sequence which consists of 'A', 'T', 'G', and 'C' letters. After that, every organic base is matched to three notes. The first algorithm relies on a key that consists of 9 decimal digits. Plaintext is reflected according to this key. The second algorithm has a circular technique and with this technique order of the notes is changed. The third algorithm is a combination of these two algorithms. With these three algorithms, the cryptanalysis process (especially against brute force attacks) was hardened.

Keywords: Cryptology, Cryptography, DNA, Music

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A Study on T-Magnetic Curves

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Abstract

In this study we handled T-magnetic curves in three dimensional Kenmotsu manifolds. We obtained necessary and sufficient conditions of T-magnetic and T-magnetic Legendre curves to be biharmonic, f-harmonic and f-biharmonic. We have also introduced some non-existence theorems.

Keywords:T-magnetic curves, Legendre curves, Kenmotsu manifolds, harmonic maps.

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Solvability in the small and Schauder-type estimates for higher order elliptic equations in Banach-Sobolev spaces

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Abstract

In this work it is considered an elliptic operator***L***of m-th order with nonsmooth coefficients in Banach-Sobolev function spaces on a bounded domain. Under weaker restrictions on the coefficients of the operator, we prove the local solvability (in the strong sense), and also establish interior Schauder-type estimates for Banach-Sobolev function spaces.

Keywords:elliptic equations, Banach-Sobolev function spaces, local solvability, Schauder-type estimates.
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On Left Derivations of Generalized Matrix Algebras

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Abstract

Let U = $\begin{pmatrix} A & M \\ N & B \end{pmatrix}$ be a generalized matrix algebra defined by the Morita contex $(A,B,M,N,\Phi_{MN},\Psi_{NM})$ ([5]). Let R be a ring and M a left R-module. An additive map D : R → M is called a left derivation if D(xy) = xD(y) + yD(x) is fulfilled for all x, y ∈ R. The concept of left derivation was introduced by Breˇsar and Vukman in [2]. They proved every left derivation on a semiprime ring R is a derivation which maps R into its center. Furthermore, they also show that if A is a Banach algebra, then every continuous left derivation D : A → A maps A into its radical. The question under which conditions left derivation is zero on a given Banach algebra have attracted much attention of authors (for instance, see [1],[2],[4]). Recently in [3] Ghosseiri proved that if R is a 2-torsion free ring with identity, then any left derivation on the full matrix ring $M_n(R),(n \geq 2)$ is identically zero. In this talk we consider the problem of describing the form of left derivation of U and we show that under the certain conditions any left derivation on generalized matrix algebra is zero. Finally as its applications, we prove that the similar conclusion remains valid on full matrix algebras, unital prime rings with a nontrivial idempotents, unital standard operator algebras, triangular algebras and nest algebras.

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Results on Eigenvalue Problems of NonLinear Conformable Fractional Differential Equations

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Abstract

The basic theory on nonlinear conformable fractional boundary value problems is discussed. Necessary conditions for the existence of eigenfunctions are provided with the help of the maximum principle. Further, we present lower and upper bounds for the eigenvalues. A general existence and uniqueness result is obtained using the method of lower and upper solution. Two monotone sequences of lower and upper solutions that convergence to the exact solution of the problem are derived.

Keywords: Fractional differential equations, Maximum principle, Lower and upper solutions, Conformable fractional derivative.

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On Solution of Some Differential Equations Using Bicomplex Transformations

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Abstract

In this study, motivated by studies on integral transformations in bicomplex space, we derived a formula for bicomplex version of the Hartley transform and investigated some fundamental properties of bicomplex Hartley transform by this formula. Moreover, we gave a solution of the Bessel differential equation using bicomplex Hartley transformation.

Keywords: Integral transformations, Bicomplex functions, Bessel equation.

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Graphs of Bitonic Algebras

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Abstract

We introduce the concept of graphs associated with commutative bitonic-algebras,which is a bitonic-graph whose vertices are the elements of commutative bitonic-algebra andwhose edges are theassociation of two vertices, that is two elements from commutative bitonic-algebra.

Keywords: Bitonic algebras, graphs, subgraphs, filters.

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Inequalities of Hermite-Hadamard-Mercer Type for Twice Differentiable with Applications

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Abstract

In this paper, authors use Riemann-Liouville (R-L) fractional integrals to derive a useful lemma for twice differentiable functions. By using the derived lemma, we establish numerous fractional integral inequalities associated to Hermite-Hadamard (H-H) and Hermite-Hadamard-Mercer (H-H-M) type inequalities for twice differentiable in absolute values are convex. Some of these results also generalize findings from earlier research. Additionally, we can observe the efficiency of our inequalities through some applications on special means.

Keywords: Riemann-Liouville fractional integrals, Hermite-Hadamard inequality, Hermite-Hadamard-Mercer inequality, Jensen-Mercer Inequality, Convex function.

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Applied Mathematical Physics: Solving Real-World Problems

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Abstract

Mathematical physics is a field that has made significant contributions to our understanding of the physical world. The interplay between mathematics and physics has allowed us to model and solve real-world problems in a wide range of areas, from understanding the behavior of particles and systems at the quantum level to predicting the dynamics of astronomical objects and understanding the behavior of complex systems in engineering and other applied fields.

Keywords: Mathematical physics, Mathematics, Physics, Applied mathematics, Real-world problems.

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Soft Fractional Ideals and Soft Star-Operations ofIntegralDomains

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Abstract

The concept of soft modules was introduced by Q. M. Sun et al and carried out several properties of soft modules by utilising Molodtsov's concept of soft set theory and modules. In this paper, we demonstrate the operations from the set of soft fractionary ideals into itself. We also introduce the concept of soft star-operations on an integral domain and show that the set of all soft star-operations on the integral domain forms a complete lattice. We introduce a concept of valuation rings in terms of soft modules of the fraction field and demonstrate the equivalence of certain soft modules of the fraction field, called soft fractional ideals.

Keywords: Soft module, Valuation rings, Soft star-operation, Soft *v*-ideal, Invertible soft fractional ideal.
2010 AMS Subject Classification:13A15, 13G05, 03E75.

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Nabla Caputo Type q-fractional difference operators and their properties

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Abstract

In this section, initially we will mention that the definitions of fractional calculus. To give a detail as, Grunwald-Letnikov, Riemann-Liouville & Caputo's definitions will be given because, these definitions are connected with the difference operators. So, after these definitions are introduced, difference equations and linear type of difference equations will be given in this part. Later, definitions of fractional calculus that are our mentioning will be adapted in q-version as Riemann-Liouville and Caputo type on difference operators.

Keywords: Difference operators, q-Mittag Leffler funcitons, fractional operators, singular and non-singular kernel

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Applications of q-Mittag Leffler function on q-fractional differential operators

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Abstract

In this part, we will introduce definitions of special functions. Gamma, beta and Mittag-Leffler functions will be given. Then, derivatives and integration of Mittag-Leffler function will be defined before definitions of fractional operators will have been mentioned. Since, this topic are basic to introduce q-Mittag Leffler function and their applications on q-fractional differential operators. Finally, q-gamma, q-beta and q-Mittag Leffler functions will be mentioned before q-fractional differential operators.

Keywords:q-gamma function, q-beta function, Mittag-Leffler kernel, singular kernel, q-fractional operators, beta function, gamma function, fractional operators

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Applications of q-Mittag Leffler function on q-fractional differential operators

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Abstract

In this part, we will introduce definitions of special functions. Gamma, beta and Mittag-Leffler functions will be given. Then, derivatives and integration of Mittag-Leffler function will be defined before definitions of fractional operators will have been mentioned. Since, this topic are basic to introduce q-Mittag Leffler function and their applications on q-fractional differential operators. Finally, q-gamma, q-beta and q-Mittag Leffler functions will be mentioned before q-fractional differential operators.

Keywords:q-gamma function, q-beta function, Mittag-Leffler kernel, singular kernel, q-fractional operators, beta function, gamma function, fractional operators

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On the basis property of eigenfunctions of the indefinite Sturm-Liouville problem in Lebesgue spaces

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Abstract

We consider the spectral problem
$-y'' + p(x)y = \lambda r(x)y,\ x\epsilon \bigcup_{s=1}^{l}(x_{s-1}, x_s)$,(1)
$y(0) = y(1) = 0$ (2)
$\begin{cases} y(x_s + 0) - a_s y(x_s - 0) = 0 \\ y'(x_s + 0) - b_s y(x_s - 0) = c_s y(x_s - 0), s = \overline{1, l-1}, \end{cases}$ (3)
where$0 = x_0 < x_1 < \cdots < x_l = 1,\ p(x)\epsilon L_1(0,1),\ r(x) = r_sforx\epsilon(x_{s-1}, x_s),\ r_s\epsilon R\backslash\{0\},\ a_s, b_s,\ c_s\epsilon C,\ s = \overline{1, l}$.Problem (1)-(3) has two series of eigenvalues $\{\lambda_n^{\pm}\}_{n\epsilon N}$(see [1]), they correspond to eigenfunctions $\{y_n^{\pm}\}_{n\epsilon N}$. In this paper, we prove that the system$\{y_n^{\pm}\}_{n\epsilon N}$ forms a basis in the space$L_p(0,1)$, $1 < p < \infty$, equivalent to the system $\{sin\pi nx\}_{n\epsilon N}$. In particular, for $p = 2$this basis is a Riesz basis in $L_2(0,1)$.
Note that in the case when instead of conjugation conditions (3) the conditions of continuity of the functions themselves and their derivatives at the points $x_s$are taken, similar results were obtained in [2-4].
Keywords:indefinite Sturm-Liouville problems,eigenfunctions, basicity,Riesz basis.

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Describtion of domains of definition of fractional powers of a second –order differential operator with integral boundary conditions

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Abstract

We consider a differential operator L generated in the space $L_p(0,1)$, $1 < p < \infty$, differential expression

$$l(y) = p_0(x)y'' + p_1(x)y' + p_2(x)y, \quad x \in (0,1), \qquad (1)$$

and integral boundary conditions

$$U_v(y) = \sum_{j=0}^{2} \int_0^1 g_{vj}(x)y^{(2-j)}(x)dx = 0, v = 1,2, \qquad (2)$$

where$p_0(x) > 0, p_0(x) \in W_1^1(0,1), p_1(x), p_2(x) \in L_1(0,1), g_{vj}(x) \in C[0,1], v = 1,2, j = \overline{0,2}$.
Under the assumption of regularity of any conditions (see. [1]), the positivity of the operator L is proved and an estimate for the complex powers of the operator L is obtained. Depending on the regularity condition, Banach space X is chosen, which either coincides with the space $L_p(0,1)$ or is a subspace of finite codimension. Using the results of [2], we describe the domains of definition of the fractional powers of the operator L with the help of interpolation spaces corresponding to the complex method. Similar results in some special cases were obtained in [3].

Keywords:domains of fractional power, regularity conditions, integral boundary conditions, interpolation spaces, complex method.

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Weighted Hardy's Inequality Revisited

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Abstract

The characterization of weighted Hardy inequalities is well known. There are numerous proofs that combine Hölder's inequality, Fubini Theorem, Minkowski's integral inequality with discretization and duality techniques. We will provide a straightforward and basic proof of an equivalent condition that is motivated by some recent results on the proof of the two-weight Hardy inequality.

Keywords: two-weight Hardy inequality, equivalent conditions

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Sequential T_3 (regular Hausdorff) Spaces

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Abstract

The notion of sequential open set is a generalization of the notion open set in topological spaces since every open set is in fact a sequential open set. According to this, in 2019, Akız and Koçak introduced the notion of sequentially Hausdorff space which also a generalization of Hausdorff spaces. That is, every Hausdorff space is a sequentially Hausdorff space. It is very interesting a significant part of the properties provided by Hausdorff spaces are also provided for sequential Hausdorff spaces.

In this study, we introduce the notion of a sequentially T_3-space and investigate its properties. We also give the relation between sequentially T_3 property and other well-known separation properties.

Keywords: Sequential open set, Regular Hausdorff (T_3) space, Sequential space.

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Some Basic Results on Groups up to Congruence Relations

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Abstract

It is a well-known fact crossed modules and group-groupoids, i.e. strict categorical groups, are categorically equivalent algebraic structures. In 2020, Datuashvili et al. aim to obtain for categorical groups an analogous description in terms ofcertain crossed module type objects as strict categorical groups. Thus, they introduced the notion of c-group or also known as group up to congruence relation.

In this study, we explore most significant properties of groups up to congruence relations. Moreover, we give different definitions for homomorphisms, kernels, and images up to congruence relations.

Keywords: Group, Congruence relation, Kernel, Image.

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On boundedness of the Riesz potential and its commutators in local Orlicz-Morrey type spaces

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Abstract

In this paper, we shall give sufficient conditions for the boundedness of the Riesz potential and its commutator in local Orlicz-Morrey type spaces. We present Adams-type results for the Riesz potential and its commutator in local Orlicz-Morrey type spaces. Characterisation for the Riesz potential and its commutators on generalized Orlicz-Morrey spaces were obtained in [1].

Keywords: Local Orlicz-Morrey type spaces, Riesz potential, commutator, boudnedness, Adams-type results.

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On a class of nonlocal porous medium equations of Kirchhoff type

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Abstract

We study Dirichlet problem for a class of porous medium equations of Kirchhoff type. The equation under consideration provides a nonlocal coefficient and forcing term whose argument depends on $|u|$with variable nonlinearity. We prove existence of generalized solutions of the considered problem under appropriate and general conditions. Also sufficient conditions for uniqueness are found and the decay rates for $||u||_2$ are obtained.

Keywords: Nonlocal diffusion, Kirchhoff-type problem, variable nonlinearity, porous medium equation

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Construction of the asymptotics of the system of fundamental solutions for a class of unusual equations

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Abstract

In the present paper, the problem of construction of the asymptotics of the system of fundamental solutions of the equation of the mixed problem placed for a class of second order partial derivative differential equaition is studied. First, after the equation is converted by means of definite substitutions into a matrix equation, the problem of construction of the asymptotics of the system of fundamental solutions of this equation is brought to the construction of the asymptotics of the solution of the corresponding integral equation. One of the main features of this equation is that the arguments of the roots of the characteristic equation corresponding to the equation in the meaning of Birkhof are not constant.

Keywords: Mixed problem,differential equation,system of fundamental solutions, matrix, integral equation,characteristic equation

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A new type algorithm for finding a common solution of Cayley inclusion and *J*-fixed point problem in Hilbert Spaces

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Abstract

The objective of the article is to find the common solution of Cayley Inclusion problem and *J*-fixed point problems in the real Hilbert spaces. In addition, we support all our claims with numerical examples.

Keywords: Cayley Operator, Nonexpansive Mappings, Resolvent Operator, Inclusion Problem

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On the solution of the mixed problem posed for a class of equations degenerated by the type

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Abstract

In the present paper by the contour integralmethod, we study the existence and uniqueness of the solution of a mixed problem for a class of equations with complex-valued coefficients that behave as a parabolic, despite the fact that over "time" can change from parabolic type to Schrodinger type, or even to antiparabolic type. Note that in the paper [4], [5] it was shown that mixed problems can be both illposed for I.G. Petrovsky well-conditioned equations and well-posed for ill-conditioned equations.

Note that one of characteristic properties of these equations is the fact that for the equations of corresponding spectral problems, the argument of roots of characteristic polynomial J.Birkhoff are not constant.

Keywords: Cauchy problem, parabolic equation, classical solution, existence, uniqueness.

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Blow up of solutions for a logarithmic Petrovsky equation with damping term

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Abstract

In this presentation, we consider a logarithmic Petrovsky equation with damping term. We prove the blow up of solutions. The equation with the logarithmic term is related with many branches of sciences. Cause of this is interest in it occures naturally in inflation cosmology, nuclear physics, supersymmetric field theories and quantum mechanics.

Keywords: Blow up, Petrovsky equation, Damping term.

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Regular and Semiregular Hypermodules

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Abstract

Our main goal is to study regular and semiregular hypermodules which associated with small subhypermodules for a Krasner hypermodule. We present some results that give a connection between regular hyperrings and these hypermodules.

Keywords: Hyperring, Hypermodule, Regular hypermodule, Semiregular hypermodule.

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Some Fixed-Point Theorems for Continuous Functions

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Abstract

In this study, an iteration method that is constructed by using any continuous mapping defined on an arbitrary interval is discussed. The necessary and sufficient conditions for the convergence of this iteration method are analyzed. Finally, the comparison of the convergence rates of some iteration methods is examined through a numerical example.

Keywords: Iteration method, Continuous mapping, Convergence, Rate of convergence.

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On Some Different Representations of$q$-Catalan Numbers and Their Sums

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Abstract

In this study, we give some representations of qCatalan numbers using classical definition of q-Catalan numbers denoted by$\boldsymbol{C_n(q)}$. We examine the various sums of the sequence of $\boldsymbol{C_n(q)}$related to$q$-Central binomial coefficients and give some formulas for this sums. Furthermore, we give a new formula of the finite sum of $\boldsymbol{C_n(q)}$.

Keywords: Catalan numbers, q-identities, binomial coefficients.

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A Tauberian Theorem for the Weighted Mean Summability Method of Double Sequences in Ordered Spaces

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Abstract

In this study, we are interested in the relation between the weighted mean summability method, or briefly the $(\overline{N}, p, q)$ method, and convergence for double sequences. Accordingly, we extend a Tauberian theorem, given for the Cesàro summable single sequences by Maddox [4] and for the $(\overline{N}, p)$ summable single sequences by Çanak [3] in ordered spaces, to the $(\overline{N}, p, q)$ summability method.

Keywords: Double sequences, ordered linear space, the slow decrease condition, the weighted mean summability method.

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Fundamental Concepts in Variable Lebesgue SpacesAssociated with Laplace-Bessel Differential Operator

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Abstract

In this paper, we consider the concepts of convergence in$L_{p(\cdot),\gamma}(\mathbb{R}^n_{k,+})$. In variable Lebesgue spaces, there are three types of convergence:convergence in modular, convergence in norm and convergence in measure. We investigate the relationship between these convergences. Furthermore, we prove that $L_{p(\cdot),\gamma}(\mathbb{R}^n_{k,+})$ are Banach spaces.

Keywords: Completeness, convergence, variable Lebesgue spaces.

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The Exact Solutions of Some Difference Equations via Narayana Numbers

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Abstract

In this work, we obtain the form of the solutions of the following rational difference equations

$$x_{n+1} = \frac{1}{x_n(x_{n-1} - 1)}$$

associated with Narayana numbers. Furthermore, we deal with the asymptotic behavior of the equilibrium point of this equation. We find an interesting relation between the exact solution of the equations and the Narayana sequence.

Keywords: Narayana Numbers, difference equations, equilibrium point, asymptotic behavior, global asymptotic stability.

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Statistical Convergence of Asymmetric Metric Valued Sequences with Deferred Cesàro Mean

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Abstract

The aim of this study is to generalize the concept of statistical convergence of sequences with deferred Cesàro mean and deferred Cesàro summability of a sequnce to asymmetric metric spaces which was defined without symmetry property. Since, lackness of symmetry causes to be given some of the classical statements differently from the metric case, it can be interesting to give some properties of these concepts and investigate the inclusion relations between them in such spaces.

Keywords:statistical convergence, deferred statistical convergence,asymmetric metric space.

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Three weighted inequality for a superposition of some operators

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Weighted inequalities play an important role in solving various theoretical and practical problems of function theory and functional analysis.The validity of the three-weight inequality in Lebesgue spaces for certain values of the parameters p and q and characterizing weighted functions for this inequality holds for all nonnegative measurable functions are defined in this work. The result obtained is of interest to specialists in function theory and functional analysis.

Keywords: Three weighted inequality, superposition of operators, Hardy operator, Copson operator, Tandory operator.

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On the bilinear Riesz potential and its commutators on generalized Orlicz-Morrey spaces

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Abstract

In this paper, the authors give a characterization of the compactness for the bilinear Riesz potential commutator. More precisely, the authorsprove that the commutator of the bilinear Riesz potentialis a compact operator on generalized Morrey spaces.

Keywords: Riesz potential, Commutators, Compactness, VMO, Generalizaed Morrey space.

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Recursive Estimation of the Conditional Distribution Function on Riemannian Manifolds

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Abstract

The main of this paper is to treat the estimation of conditional distribution function on Riemannian manifolds. We defined the recursive version of the Nadaraya–Watson estimator. Under some assumptions in Riemannian Manifolds data analysis, we study the properties of a recursive family kernels regression, the asymptotic normality of estimator is established.
Keywords: Riemannian Manifold, asymptotic normality,conditional cummultative distribution function.

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Existence and Uniqueness of the strong Solution of the Time fractional integro-differential equation with integral boundary conditions

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Abstract

In this work, we study the existence and uniqueness of a solution for the fractional order partial fractional differential equations with integral conditions. Using the method of energy inequalities, we find a priori estimate and the density of the range of the operator generated by given the problem.

Keywords: Nonlocal problem; Time fractional differential equation; Nonlocal integral conditions; Strong solution.

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Banach Hardy classes and some Properties

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Abstract

In this work, rearrangement invariant space is considered and the norm generated by it of the Hardy classes of analytic functions inside and outside the unit ball, respectively. Using the shift operator, the subspace is distinguished, it is proved that infinitely differentiable and compactly supported functions are dense in this subspace. Some properties of functions from Hardy classes are studied. The classical Lebesgue spaces, the grand-Lebesgue spaces, the Orlicz spaces, and many other spaces are rearrangement invariant spaces.

Keywords: Rearrangement invariant spaces, Hardy classes, Boyd indices.

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An Inverse Coefficient Problem for a Two-Dimensional Hyperbolic Equation with Integral Overdetermination

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Abstract

The paper considers a classical solvability of a nonlinear inverse boundary value problem for a two-dimensional hyperbolic equation with an integral overdetermination condition. To investigate the solvability of the stated problem, we first consider an auxiliary inverse boundary value problem and prove its equivalence to the original problem. Then we prove the existence and uniqueness theorem for the auxiliary problem by the contraction mappings principle. Furthermore, based on the equivalency of these problems, the existence and uniqueness theorem for the classical solution of the original inverse problem is proved.

Note that the related inverse problems for one-dimensional hyperbolic equation was studied in the papers [1-3] and the references therein.

Keywords: Inverse problem, hyperbolic equation, classical solution, existence, uniqueness.

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A Compact Finite Difference Method for Fractional Equation Based on Caputo Derivative: Codes Matlab

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Abstract

Abstract. In this new work, we start by some definitions and notations are prepared about caputo derivative operator and their properties. First, we give a compact finite difference scheme is described and then the stability and convergence rates are rigorously analyzed for the. Finally, we give some numerical experiments are carried out.

Keywords:A time-fractional, Caputo operator, Compact finite difference scheme, Stability, Convergence, Codes Matlab.

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Recursive Estimation of the Conditional Distribution Function on Riemannian Manifolds

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Abstract

The main of this paper is to treat the estimation of conditional distribution function on Riemannian manifolds. We defined the recursive version of the Nadaraya–Watson estimator. Under some assumptions in Riemannian Manifolds data analysis, we study the properties of a recursive family kernels regression, the asymptotic normality of estimator is established.
Keywords: Riemannian Manifold, asymptotic normality,conditional cummultative distribution function.

References:

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Bruno Pelletier. (2006). Non-parametric regression estimation on closed Riemannian manifolds. Journal of Nonparametric Statistics 18(1):57-67.

Numerical Analysis Applied to Stiffened Shell Structures

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Abstract

To avoid large deformations caused by static or dynamic external loads on shell structures in civil and mechanical engineering; longitudinal or circumferential beams as stiffeners must reinforce the shells. The finite element method is the most powerful numerical method used for the numerical analysis of structures. In the presence of stiffeners; modeling has become a complicated task to solve, because of the use of two finite elements with different behavior (shell element – beam element). Moreover, the problem of incompatibility of the degrees of freedom at the junction when using two different finite elements poses a numerical problem on the programming side. To overcome these difficulties, the analysis can be carried out by a three-dimensional finite element (solid element). In this paper, the static response of a cantilever cylindrical shell with and without stiffeners under a concentrated static load is studied using the three-dimensional solid element based on quadratic formulation "C3D8IH" of the ABAQUS software. The results obtained are compared with those obtained by the recently developed finite elements; the triangular element based on the method of discrete shear deviations (DSG3), the finite element of triangular shell (MITC3), the union of finite elements Edge-based smoothed finite element union with the triangular shell (ES-MITC3) and the SAP2000 element used as a reference solution. The numerical results obtained with different elements are discussed and commented, and the presented approach to modeling this type of structure with the three-dimensional finite element of the ABAQUS software is confirmed.

Keywords: Numerical analysis, ABAQUS software, Incompatibility degrees of freedom, Shell shell structures, Solid finite element.

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AN INTERIOR-POINT ALGORITHM FOR CQP BASED ON TRIGONOMETRIC KERNEL FUNCTION

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Abstract

In this paper, we present a primal-dual interior-point algorithm for convex quadratic programming problem based on a new parametric kernel function with a hiperbolic–logarithmic barrier term. Using the proposed kernel function we show some basic properties that are essential to study the complexity analysis of the correspondent algorithm which we find it coincides with the best know iteration bounds for large-update method, namely, $O\left(\sqrt{n} \log n \log\frac{n}{\varepsilon}\right)$ by a special choice of the parameter $p>1$

Keywords:
Convex quadratic programming; kernel function; interior-point methods; iteration bound.

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On qualitative properties of some nonuniform elliptic equations

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Abstract

A talk on the qualitative properties of the weak solutions of a class of non-uniform elliptic equations

$$\mathrm{div}_x(b(x,y)\,\nabla_x u) + \mathrm{div}_y\ (\nabla_y u) = f$$

with a positive degeneration $b(x,y)$ satisfying some conditions. The proper function space, Poincare-Sobolev type inequalities, existence of the weak solution, Harnack inequality, regularity of solutions is discussed. The motivation for the proposeds comes from our early studies [1--4].

Keywords: non-uniform elliptic equation, Harnack inequality, regularity of solutions, Poincare-Sobolev inequality, weak solution, Dirichlet problem.

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Chelyshkov Polynomials with Applications in Approximation Theory

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Abstract

In this talk, our main motivation is to introduce a new modified and efficient numerical method to solve the fractional order derivative differential equations that are difficult to solve analytically when the source term is generalized and the boundary conditions are non-homogeneous. The framework of the proposed method is based on the newly derived fractional-order integral operational matrix of Chelyshkov polynomials which are the newest class of orthogonal polynomials. The numerical accuracy and the stability of the proposed method is demonstrated by solving various examples and comparing the results obtained otherwise in the literature.

Keywords: Orthogonal Polynomials, Sqaure-integrable functions, Chelyshkov polynomials, Operational matrices, Fractional order differential equations, Caputo fractional order derivative.

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On Λ-fractional variational calculus

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Abstract: Pointing out that Λ-fractional analysis is the unique fractional calculus theory including mathematically acceptable fractional derivatives, variational calculus for Λ-fractional analysis is established. Since Λ-fractional analysis is a non-local procedure, global extremals are only accepted. That means the extremals should satisfy not only the Euler–Lagrange equation, but also the additional Weierstrass-Erdmann corner conditions. Hence non-local stability criteria are introduced. The proposed variational procedure is applied to any branch of physics, mechanics, biomechanics, etc. The present analysis is applied to Λ-fractional refraction of light and in the Λ-fractional deformation of an axially extended bar and upon the bending problem of a cantilever beam.

Keywords:Λ-fractional derivative;Λ-fractional space; initial space; fractional stress; fractional deformation; fractional strain; local stability; global stability; coexistence of phases.

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On a boundary value problem for nonlinear diffusion equation with integral condition of the second kind

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Abstract

This work deals with the solvability of boundary value problem for nonlinear diffusion equation with integral condition of the second kind. Definition of classical solution for the considered boundary value problem is introduced. By the Fourier method, the problem is reduced to the system of integral equations. Using the contraction mappings method, the existence and uniqueness of the solution of the system of integral equations are proved. Finally, the existence and uniqueness of the classical solution of original problem are proved.
Keywords: boundary value problem, nonlinear diffusion equation, Fourier method, classical solution

Consider the following nonlocal boundary value problem in the rectangle $Q_T = \{(x,t):\ 0 < x < 1, \quad 0 \le t \le T\}$: find a function $u(x,t) \in C^{(2,1)}(\overline{Q}_T)$ which satisfies in Q_T the equation [1,2]

$$a(t)u_t(x,t) = u_{xx}(x,t) + p(t)u(x,t)(1-u(x,t)) + f(x,t), \quad (1)$$

the nonlocal initial conditions $$u(x,0) + \int_0^T q(t)u(x,t)dx = \varphi(x), 0 \le x \le 1, \quad (2)$$

and the boundary conditions $u(0,t) = 0$, $u_x(1,t) = 0 \quad (0 \le t \le T)$, (3) where $\delta \ge 0$ is a given number, and $p(t)$, $q(t)$, $f(x,t)$, $\varphi(x)$ are the given functions. The aim of this work is to prove the existence and uniqueness of solutions of the boundary value problem (1)-(3).

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Compilation of Method for Solving Partial Differential Equations of the First-Order by the Adomian Decomposition Method

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Abstract

In this paper, we present the compilation of Adomian analytical methods used in solving linear and nonlinear first-order partial differential equations(PDEs), and nonlinear single initial value questions. Moreover, some new examples have been shown.

Keywords: Adomian decomposition method, first-orderPDE, Singular nonlinear first-order PDEs.

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Blow up of Solutions for A Viscoelastic Wave Equations with Balakrichnan-Taylor Dampingand a Delay Term

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Abstract

In this paper, we consider a viscoelastic wave equation with Balakrishnan Taylor damping and a delay term

$$u_{tt} - \left(a + b \| \nabla u \|_2^2 + \alpha \int_\Omega \nabla u \nabla u_t dx\right)\Delta u + \sigma(t) \int_0^t g(t-s)\Delta u(s) ds + \mu_1 | u_t |^{m-2} u_t + \mu_2 | u_t(t-\tau) |^{m-2} u_t(t-\tau) = | u |^{p-2} u$$

The best of our knowledge, there is no blow-up results of solutions for the above equation. In the present paper, we study the global existence and a finite time blow-up results of solutions with negative initial energy.

Keywords: Viscoelastic wave equation, Balakrishnan-Taylor damping, delay term, Global existence, Blow up.

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Dynamics of Discretized Rosenzweig–MacArthur predator–prey model with a Holling type II functional response for constant immigration

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Abstract

In this paper, a discretized model for spatially interacting populations, adding constant immigration of prey to the Rosenzweig–MacArthur predator–prey model with a Holling type II functional response will be investigated. The analysis is started by determining the equilibrium points, existence, and conditions of the stability. Furthermore, it is shown that the model exhibits bifurcations of codimension 1 viz. flip bifurcation and Neimark–Sacker bifurcation on varying one parameter. Bifurcation theory and center manifold theory are used to establish the conditions for the existence of these bifurcations. An extensive numerical simulation is performed to demonstrate the analytical findings.

Keywords:

Rosenzweig–MacArthur predator–prey model, constant immigration**,** equilibrium points, Flip bifurcation, Neimark–Sacker bifurcation

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Approximation on Bivariate of Durrmeyer operator based on beta function

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Abstract

In this study, we construct a new sequence of bivariate Summation-Integral type hybridoperators and their approximation behavior. Moreover, the rate of convergence of these operators are given by using the modulus of continuity. Further, Lipschitz-maximal, Peetre's K-functional and global approximation results are investigated using weight functions. Furthermore, approximation behavior in Bo¨gel functional space are studied. Lastly, the Summation-Integral type hybrid operators for the function of two variables are used to validate the numerical results and obtain the graphical illustration of the convergence behaviour of the operators univariate and bivariate case separately.

Keywords: Durrmeyer operator; Peeter's K-functional; Lipschitz-maximal; Global approximation; Bo¨gel space.

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Solution in the Small and Interior Schauder-type Estimate for the *m*-th Order Elliptic Operator in Morrey-Sobolev Spaces

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Abstract

A higher order elliptic operator with non-smooth coefficients in Morrey-Sobolev spaces on a bounded domain in R^n is considered. These spaces are non separable and infinite differentiable functions are not dense in them. For this reason the classical methods for establishing interior estimates (and others including) with respect to these operators, the possibility of extending functions (with a bounded norm), determining the trace and results associated with this concept, etc. in Morrey-Sobolev spaces are not applicable, and to establish these facts a different research approach should be chosen. This work focuses on these issues. An extension theorem is proved, the trace of a function in a Morrey-Sobolev space on a $n-1$ dimensional smooth surface is defined, a theorem on the existence of a strong solution in a small is proved, an interior Schauder-type estimate in Morrey-Sobolev spaces is established. A constructive characterization of the space of traces of functions from the Morrey-Sobolev space is given, which differs from the characterization given earlier by S. Campanato. Earlier, S. Campanato [1] gave a different characterization of the space of traces based on different considerations. It should be noted that the approach proposed in this work differs from the classical approach to determining the trace.

Keywords: elliptic operator, Morrey-Sobolev spaces, solution in the small, Schauder-type estimates.

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Properties of solutions to linear differential equations near a singular point

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Abstract

In this paper, we investigate the local growth and oscillation, near the singular point $z = 0$, of solutions to the differential equation

$$f'' + \{A(z)\exp\{\tfrac{a}{z}\} + A_0(z)\}f' + \{B(z)\exp\{\tfrac{b}{z}\} + B_0(z)\}f = H(z),$$

where $A(z), A_0(z), B(z), B_0(z), H(z)$ are analytic functions in

$$D(0,R) = \{z \in \mathbb{C}: 0 < |z| < R\}$$

and a, b are non-zero complex constants.

Keywords **– Linear differential equations, growth and oscillation of solutions, finite singular point, Nevanlinna theory.**

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Study of onedimensional mixed problem for one class of third order nonilinear pseudoparabolic equations

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Abstract

This work is dedicated to the study of existence in small of almost everywhere solution of onedimensional mixed problem for one class of third order nonlinear pseudoparabolic equations. Conception of almost everywhere solution for mixed problem under consideration is introduced. After applying Fourier method, the solution of original problem is reduced to the solution of some countable system of nonlinear inteqro-differential equations in unknown Fourier coefficients of the sought solution. Besides, existence theorem in small of almost everywhere solution of the mixed problem is proved by contracted mappings principle.

Keywords: nonlinear, pseudoparabolic equations, mixed problem.

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Some Questions of Harmonic Analysis in Weighted Morrey Type Spaces

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Abstract

In the manufacturing process of free-form complex surfaces, various problems occur which degraded the performance and can be resolved by using an optimization technique. Thousands of real-world problems can be converted into optimization techniques with distinct objective functions to acquire the optimal solution. In this paper, an assembly of GHT-Bézier developable surfaces by using a nature-inspired particle swarm optimization technique combined with optimal parameters are constructed from two GHT-Bézier boundary curves to improve the efficiency of complex engineering products. For this purpose, the control points of GHT-Bézier surface are chosen as design variables. The objective function is defined as the developability degree of the ruled surface and the shape parameters are considered to be optimization variables. So, we search for the optimum shape control parameters within the value range of shape parameters by using the PSO technique, then the developable surfaces with highly accurate developability can be visualized. The modeling examples demonstrate the effectiveness of the proposed method with the fairness of the surfaces and its approximation to the original surface.

Keywords:
GHT-Bézier developable surface, Shape control parameters, Developability degree, Particle swarm optimization.

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A Mathematical Model for the Breast Cancer Diagnosis and its Prognosis using Fuzzy Expert System

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Abstract

Nowadays decision-making applications with complex issues and knowledge involving imprecision and uncertainty are very much important. Therefore, soft computing methods including Artificial Neural networks or Fuzzy Inference systems have been used broadly to model expert behaviour. Fuzzy soft computing applications are unexpectedly rising in numerous fields along with medical prognosis and diagnosis. There are several studies reported for breast cancer diagnosis, and a few types of research have also been completed on the prognosis of breast cancer. However, breast cancer prognosis suffers from vague input factors and incompleteness of information on the problem in addition to analysis. This study presents a fuzzy expert system for the diagnosis and prognosis of breast cancer, which is capable enough to record the ambiguity and imprecision regularly occurring in the interpretation of breast cancers. In this work, the Mamdani fuzzy inference model has been used as it is more practical and highly interpretable when interacting with professionals and experts during the prognosis process. This model aims to identify the risk factor for developing breast cancer in females of the age group 20-50 years. Furthermore, the fuzzy model is evaluated on a real dataset. This approach is promising for the prediction of growing the risk of breast cancer and early diagnosis of cancer, consequently, this will enhance the survival rate

Keywords: Fuzzy inference system, prognosis, diagnosis, breast cancer and Mamdani.

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Some numerical prensentation for a quadratic map

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Abstract

This documentwe base our work on polynomials of degree p and q greater than two, we generalize to move to a transformation in order to detect the attractors that exist, then we draw the bifurcation curves in different parametric planes, big bang bifurcation will appear.

Keywords: ***attractor, logistic, bifurcation, fixed point, transformation***

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Probability in Mathematical Physics: Theory and Applications

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Abstract

Probability theory plays a crucial role in mathematical physics, providing a framework for modeling and understanding random phenomena in physical systems. This extended abstract will provide an overview of the use of probability in mathematical physics, including both theoretical foundations and practical applications. The aim is to highlight the importance of probability in this field and to demonstrate how it has been applied to solve real-world problems.

Keywords: Probability, Mathematical Physics, Quantum Mechanics, Statistical Mechanics, Stochastic Processes, Monte Carlo Methods, Data Analysis.

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Problems of mathematical education in the curriculum in the Caucasian countries

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Abstract

In this research study, teaching of mathematics in the countries where both the teaching principles of the world are advanced and backward is analyzed in a comparative manner, also problems which related to the effect of creating the necessary conditions on the development of the educational program were investigated. One of the points of focus is the comparison of the differences between countries that are best in mathematics education and developing countries.

For example, the absence of the concept of "mean(avarge)" in mathematics (we are not talking about arithmetic or geometric mean) should be taken as an issue that needs to be investigated.

In short, the main purpose of this research is that during the explanation of any topic in secondary education, providing completeness of topics and teaching parts that are more difficult to understand with using curriculum principles to create interest in the subject and ensure that it will be easier to pass to the next level.

We focused on principles that should be re-established in our own country - Azerbaijan, for admission to the universities of developing countries.

Keywords:principles of education, comparison of teaching process, difference in education, “mean” concept in mathematics, curriculum.

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On strong solvability of the Dirichlet problem for a class of semilinear elliptic equations

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Abstract

We study a strong solvability of the Dirichlet problem for a class of second order of the non-divergent form semilinear elliptic equations, when the leading coefficients are discontinuous and satisfy Cordes's condition, the subordinate part $g(x,u_x)$ is a Charatheodory condition function satisfying some growth condition . We get an existence result for this problem in $\overset{\bullet}{W}{}_2^2(\Omega)$ Sobolev spaces, whenever the norm $\|f\|_{L_2(\Omega)}$ of the right hand side function of the equation is sufficiently small. For the proofs we have applied the Schauder's fixed point theorem on a continuous into mappings of a convex set in Banach space.

Keywords: semilinear elliptic equation, Cordes`s condition, Schauder`s principle.

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Parabolic Fractional Integral Operators with Rough Kernels in Parabolic Local Generalized Morrey Spaces

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Abstract

Let P be a real $n\times n$ matrix, whose all eigenvalues have positive real part, $A_t = t^P, t>0, \gamma = trP$ is the homogeneous dimension on R^n and Ω is an A_t - homogeneous of degree zero function, integrable to a power $s>1$ on the unit sphere generated by the corresponding parabolic metric. We study the parabolic integral operator $I^P_{\Omega,\alpha}$, $0<\alpha<\gamma$ with rough kernels in the parabolic local generalized Morrey space $LM^{\{x_0\}}_{p,\varphi,P}(R^n)$. We find conditions on the pair (φ_1,φ_2) for the boundedness of the operator $I^P_{\Omega,\alpha}$ from the space $LM^{\{x_0\}}_{p,\varphi_1,P}(R^n)$ to another one $LM^{\{x_0\}}_{q,\varphi_2,P}(R^n)$, $1<p<q<\infty$, $\frac{1}{p}-\frac{1}{q}=\frac{\alpha}{\gamma}$, and from the space $LM^{\{x_0\}}_{1,\varphi_1,P}(R^n)$ to the weak space $WLM^{\{x_0\}}_{q,\varphi_2,P}(R^n)$, $1\le q<\infty$, $1-\frac{1}{q}=\frac{\alpha}{\gamma}$.

Keywords: Parabolic fractional integral operator, parabolic local generalized Morrey space.

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Bifurcation analysis and complex dynamics of a New Fractional System

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Abstract

In this work we analyze the dynamical behaviors of a new chaotic fractional system consisting stability, Hopf bifurcation and chaotic attractors. We obtain some conditions under which a Hopf bifurcation may occur for the system and obtain a critical value of parameter for which a Hopf bifurcation emerges. By computing different orbits of the system, we support the validity of analytical results and reveal dynamical behaviors consisting stability, limit cycles, Hopf bifurcation and chaotic attractors. We also show that the order of fractional derivative plays important role as the Hopf bifurcation parameter.

Keywords: Hopf bifurcation, Caputo fractional derivative, Chaotic dynamical system.

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Basicity of sine-cosine systems in grand Lebesgue space

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Abstract

Basicity of trigonometric systems $\sin(n-\alpha)t$, n=1,2,... and $\cos(n-\alpha)t$, n=0,1,2,... in the subspace $G^{p)}(0,\pi)$ of grand Lebesgue space $L^{p)}(0,\pi)$ is considered in this work, where α is a real parameter. Criterions for minimality, completeness and basicity in $G^{p)}(0,\pi)$, $1<p<+\infty$, with respect to the parameter α are found.

Keywords: basicity, sine-cosine system, grand Lebesgue space.

Theorem 1. Let $2\alpha+\frac{1}{p}\notin\square$, $1<p<+\infty$. Sine system $\{\sin(n-a)t\}_{n\geq 1}$ forms a basis for the space $G^{p)}(0;\pi)$ if and only if $\left[\alpha+\frac{1}{2p}\right]=0$. If $\left[\alpha+\frac{1}{2p}\right]<0$, then the system is minimal but not complete. If $\left[\alpha+\frac{1}{2p}\right]>0$, then the system is complete but not minimal.

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Different Versions of Dirichlet Problems for Laplace equation in Non-standard Function Spaces

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Abstract

Non-standard grand-Lebesgue and Morrey spaces are considered in this work, together with grand-Sobolev and Morrey-Sobolev spaces generated by them. Dirichlet problems for Laplace equation in different versions are considered in these spaces in a bounded domain of n-dimensional space with sufficiently smooth boundary. These spaces are non-separable, so there arise some questions and differences in problem statements. We conduct a corresponding research and we illustrate the differences concerning the solvability in the classical Sobolev and Hardy spaces in two-dimensional case on the example of circle.

Keywords: non-standard Lebesgue, Morrey, grand Sobolev, Morrey-Sobolev spaces, Dirichlet problem, Laplace operator, Hardy space, solvability.

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