I am pleased to acknowledge that the 11th International Eurasian Conference on Mathematical Sciences and Applications (IECMSA-2022) was held online and simultaneously face-to-face at Yildiz Technical University, Istanbul, Turkey, on August 29-September 1, 2022. Also, it is a great pleasure for me to share the knowledge of the academic sponsorship of the conference by Yıldız Technical University, Sakarya University, Sakarya University of Applied Science, Kırklareli University, Society of Geometers, and Turkish World Mathematical Society.

Established in 2012, the series of IECMSA features the latest developments in the field of mathematics and applications. The previous conferences were held as follows: IECMSA-2012, Prishtine, Kosovo, IECMSA-2013, Sarajevo, Bosnia and Herzegovina, IECMSA-2014, Vienna, Austria, IECMSA-2015, Athens, Greece, IECMSA-2016, Belgrade, Serbia, IECMSA-2017, Budapest, Hungary, IECMSA-2018, Kyiv, Ukraine, IECMSA-2019, Baku, Azerbaijan, IECMSA-2020 (online), Skopje, North Macedonia and IECMSA-2021 (online), Sakarya, Turkey. These conferences gathered a large number of international world-renowned participants.

I would like to thank the members of the scientific committees. They have worked very hard in reviewing the process and making valuable suggestions for the authors to improve their works. I also would like to express our gratitude to the external reviewers for providing extra help in the review process and the authors for contributing their research results to the conference. At IECMSA-2022, the scientific committee members and the external reviewers accepted 70 face-to-face and 81 online presentations. 181 participants attended the conference from 24 different countries. The scientific program of the conference features 6 keynote talks, followed by 151 contributed presentations in three parallel sessions.

The conference program represents the efforts of many people. I would like to express my gratitude to all members of the organizing committee, sponsors, and honorary committee for their continued
support of the IECMSA. I also thank the invited speakers for presenting their talks on current research.

Also, the success of IECMSA depends on the effort and talent of researchers that have shared their studies on a variety of topics in mathematics and its applications. So, I would like to sincerely thank all participants of IECMSA-2022 for contributing to this great meeting.

Best Regards
Prof. Dr. Murat TOSUN
Chairman
On behalf of the Organizing Committee
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INVITED
SPEAKERS
Abstract. Hyperstructures were born as a generalization of an operation by the hyperoperation, from the single-valued operation to the multi-valued one. Indeed, in ordinary algebra the combination of two elements is an element, while in hyperstructures, the combination of two elements is a non-empty set. This article is devoted to connecting algebraic hyperstructures with other disciplines (fuzzy logic, soft set, rough set, topology, biology, chemistry, etc.) and with the real world. We review some parts of these subjects related to

- Preliminaries and basic concepts.
- Connections between algebraic hyperstructures and ordinary algebra by using the concept of fundamental relations.
- Fuzzy sets and their generalizations.
- Rough sets.
- Topology.
- Applications in biology, chemistry and physics.
- Graph and hypergraph.

Keywords: Algebraic hyperstructure; hypergroup; fuzzy set; rough set; graph; hypergraph.

Mathematics Subject Classification. Primary: 20N20; Secondary: 16Y99

References


1Department of Mathematical Sciences, Yazd University, Yazd, Iran, davvaz@yazd.ac.ir
Doubts on the recent publications on metric fixed point theory

Erdal Karapınar

Abstract. The main goal of this talk is to reveal the dilemmas of the fixed point theorems that were started to be constructed by Banach in 1922. It is possible to transform many of the real-world problems into fixed point theorems. This shows how the fixed point theory is useful and how huge application potential it has. On the other hand, a lot of results are repeated in this theory, which is of great interest. A substantial part of the new results suggested overlaps with the old results. To support this observation, I shall share a few examples from the current literature.

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The Finest Locally Convex Module Topology

Francisco Javier García Pacheco

Abstract. Two new concepts in Associative Ring Theory (unit segments and unit neighborhoods of zero) allow to transport the notion convexity to topological modules. We then define locally convex module topologies, which extend the classical locally convex vector topologies in the real or complex case. This way, the finest locally convex module topology is constructed. Connections with effect algebras and Quantum Mechanics are established.

Topological module; topological ring; balanced set; absorbing set; unit neighborhood of zero; unit segment; effect algebra.
Primary: 46H25; Secondary: 16W80, 54H13

References


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Solution of the qc Yamabe equation on a 3-Sasakian manifold, extremals of the Sobolev-Folland-Stein inequality on the quaternionic Heisenberg groups and the qc Yamabe problem

Stefan Petrov Ivanov

Abstract. A complete solution to the quaternionic contact Yamabe equation on the 4n+3-dimensional sphere as well as on the quaternionic Heisenberg group is given and a uniqueness result for a compact locally 3-Sasakian manifold is shown. Consequently, the best constant and all extremals of the Sobolev-Folland-Stein inequality on the quaternionic Heisenberg group are determined. The quaternionic contact Yamabe problem is solved on compact non-locally spherical quaternionic contact manifolds.

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Abstract. The mathematical logic in an uncertain environment with linguistic variables and uncertain inference rules should have an exact conclusion that coincides with the reality and essence of the environment. However, when considering linguistic real-world problems featuring several kinds of uncertainty, it becomes evident that a comprehensive definition of conventional uncertainties is severely lacking.

This talk discusses the novel concept of “Complete Uncertain Numbers” as the solution to this problem, independently combining the concepts of probability distributions, fuzzy numbers, interval numbers, and real numbers. To have a complete theory of them, it is necessary to establish the new algebraic constructions of “complete uncertain metric vector space” on “complete uncertain mathematical fields” by using the set of these numbers and defining advanced uncertain operations on them. Additionally, the concepts of uncertain transforms and their properties (e.g., the linearity property) must be characterized.
Marginally trapped and quasi-minimal surfaces in pseudo-Euclidean 4-spaces

Velichka Milousheva

Abstract. In recent times, great attention is paid to surfaces in pseudo-Euclidean spaces, since pseudo-Riemannian geometry has many important applications in Physics. The concept of marginally trapped surfaces was first introduced by Sir Roger Penrose in 1965 in connection with his study on black holes, which is closely related to the Einstein theory of relativity.

The basic problem in the study of black holes is the description of the surface separating the family of the so-called 'trapped' surfaces from the family of the 'untrapped' ones. From mathematical point of view, marginally trapped surfaces separate the family of the surfaces with spacelike mean curvature vector from the family of surfaces with timelike mean curvature vector.

In the mathematical literature, a codimension-two surface in the Lorentz-Minkowski 4-space is called marginally trapped if its mean curvature vector is lightlike at each point.

Recently, surfaces in pseudo-Euclidean spaces with neutral metric have also been studied for their physical interpretation. In pseudo-Euclidean geometry, the analogue of marginally trapped surfaces are the so-called quasi-minimal surfaces. Quasi-minimal surfaces in the 4-dimensional pseudo-Euclidean space with neutral metric are Lorentz surfaces with lightlike mean curvature vector field.

Marginally trapped surfaces satisfying some extra conditions have recently been intensively studied in connection with the rapid development of the theory of black holes in Physics. Most of the results give a complete classification of marginally trapped surfaces under some additional geometric conditions, such as having positive relative nullity, having parallel mean curvature vector field, having pointwise 1-type Gauss map, being invariant under spacelike rotations, under boost transformations, or under the group of screw rotations.

Quasi-minimal surfaces in the pseudo-Euclidean 4-space with neutral metric satisfying some additional conditions have also been studied actively in the last few years. Most of the results are due to Bang-Yen Chen and his collaborators.

In the present talk, we give some recent classification results on marginally trapped surfaces and present the Fundamental existence and uniqueness theorem for quasi-minimal Lorentz surfaces in the pseudo-Euclidean 4-space with neutral metric.

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Acknowledgements. The author is partially supported by the National Science Fund, Ministry of Education and Science of Bulgaria under contract KP-06-N52/3.
Dual Leonardo Numbers
Adnan Karatas

Abstract. In this study, we defined dual Leonardo numbers. In addition, we give some of their properties including Binet formula, generating function, Cassini and d'Ocagne’s identities. Also, we calculate summation formulas for dual Leonardo numbers involving dual Fibonacci and Lucas numbers.

Keywords: Fibonacci Sequence; complex numbers.
Mathematics Subject Classification. Primary: 11B37; Secondary: 11B39

References

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Some Remarks Regarding Generalized Quaternion and Octonion Algebras

Ana-Gabriela Nechifor

Abstract. In 1843, Hamilton proposed modeling a three-dimensional space with a structure similar to that of complex numbers, whose addition and multiplication are in two-dimensional space. On this line, he discovered a way to multiply in four dimensions, not in three, but with the condition of the lack of commutativity of operation. Therefore, he called his construction as been quaternions for real space, which are generated by the elements $1, i, j, k$ relative to multiplication.

In the early 1900’s, Dickson began to generalize the algebras in which each element satisfies a quadratic equation, set out a diagonalizable basis for such an algebra and analyzed the conditions to be a division algebra and therefore, this led him to the generalized quaternion algebra for which:

$$i^2 = \alpha, \quad j^2 = \beta, \quad ij = -ji = k$$

There is also an 8-dimensional non-associative algebra over $\mathbb{R}$, called octonions ($\mathbb{O}$). They were popularized by Cayley in 1845, but their discovery belongs to John T. Graves. In 1843, he proved that the product two sums of eight perfect squares is another sum of eight perfect squares. Octonions are considered to be the largest of the four division algebras standardized. Although they are rather neglected due to their non-association, they are at the intersection of many interesting areas of mathematics.

After meeting the quaternions in the first part of the presentation, we will see how they can be generated towards a construction called generalized quaternion algebra, but also their extension to octonions. We will define the norm form, trace form and we will also explore some of their properties related to the study of quadratic forms that lead us to classification of algebras.

Keywords: Quadratic forms; quaternion algebras; norm form; trace form; pure quaternions; octonions.
Mathematics Subject Classification. Primary: Algebra

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References

Some Remarks About the Cayley Graphs of Generalized Dihedral Groups

Alexandru Tânasă ¹

Abstract. In this research project we propose to describe the Cayley graphs of dihedral groups and the generalized dihedral groups that are essential for the group theory and for geometry and chemistry. Denoted by $D(G)$, which $G$ is any abelian group, the generalized dihedral group of $G$ is the semi-direct product of $\{\pm 1\}$ and $G$, where there are a homomorphism $\varphi$ which maps $C_2$ to the automorphism group of $G$, providing an action on $G$ by inverting elements. The Cayley graphs are an important concept relating group theory and graph theory. These graphs are associated to a group and a set of generators for that group. We want to study them to obtain the abstract structure of a group more visible by way of representing in a graph form.

Keywords: Cayley graphs; group theory; dihedral groups.
Mathematics Subject Classification. Primary: Algebra; Secondary: Group theory

References


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Matrix Representations of Quaternions and Octonions Algebra Over $\mathbb{Z}_p$

Baias Andreea-Elena

Abstract. In this paper, I will present the matrix representations of quaternions and octonions over the ring $\mathbb{Z}_p$. I will emphasize the connection between these two algebras based on applications and examples. Moreover, I will give some important properties of the nilpotent elements in the case of quaternions and in the case of octonions over $\mathbb{Z}_p$.

Keywords: Quaternions; octonions; ring.
Mathematics Subject Classification. Primary: 15A33, Secondary: 15A30

References


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Strongly $\oplus - g$-Supplemented Modules

Celil Nebiyev $^1$, Hasan Huseyin Okten $^2$

Abstract. In this work, every ring has an unity and every module is an unital left module. Let $M$ be a $g$-supplemented $R$-module. If every $g$-supplement submodule in $M$ is a direct summand of $M$, then $M$ is called a strongly $\oplus - g$-supplemented module. In this work, some properties of these modules are investigated.

Keywords: Essential submodules; small submodules; $g$-small submodules; $g$-supplemented modules.
Mathematics Subject Classification. 16D10, 16D80

Results

Proposition 1. Every strongly $\oplus - g$-supplemented module is $g$-supplemented.

Proposition 2. Let $M$ be an $R$-module and $M = X + Y$ with $X, Y \leq M$. If $X$ and $Y$ are strongly $\oplus - g$-supplemented, then $M$ is $g$-supplemented.

Corollary 1. Let $M = M_1 + M_2 + ... + M_n$. If $M_i$ is strongly $\oplus - g$-supplemented for every $i = 1, 2, ..., n$, then $M$ is $g$-supplemented.

Corollary 2. Let $M$ be a strongly $\oplus - g$-supplemented module. Then $M^{(\Lambda)}$ is $g$-supplemented for every finite index set $\Lambda$.

Proposition 3. Every factor module of a strongly $\oplus - g$-supplemented module is $g$-supplemented.

Corollary 3. Every homomorphic image of a strongly $\oplus - g$-supplemented module is $g$-supplemented.

Corollary 4. Every direct summand of a strongly $\oplus - g$-supplemented module is $g$-supplemented.

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Corollary 5. Let $M$ be a strongly $\oplus - g$–supplemented module. Then every finitely $M$–generated module is $g$-supplemented.

Proposition 4. Every strongly $\oplus - g$–supplemented module is $\oplus - g$–supplemented.

Proposition 5. Let $M$ be a supplemented module. If every $g$-supplement submodule of $M$ is a direct summand in $M$, then $M$ is strongly $\oplus - g$–supplemented.

Proposition 6. Let $M$ be an $R$–module and $M = M_1 \oplus M_2$ with $M_1, M_2 \leq M$. If $M_1$ and $M_2$ are strongly $\oplus - g$–supplemented, then $M$ is $\oplus - g$–supplemented.

Corollary 6. Let $M = M_1 \oplus M_2 \oplus \ldots \oplus M_n$. If $M_i$ is strongly $\oplus - g$–supplemented for every $i = 1, 2, \ldots, n$, then $M$ is $\oplus - g$–supplemented.

Corollary 7. Let $M$ be a strongly $\oplus - g$–supplemented module. Then $M^{(\Lambda)}$ is $\oplus - g$–supplemented for every finite index set $\Lambda$.

References


[8] C. Nebiyev and H. H. Ökten, Some Properties of $\oplus - g$–Supplemented Modules, Miskolc Mathematical Notes (Accepted).


Abstract. In this work, every ring has an unity and every module is an unital left module. Let $M$ be an $R$–module. If every essential submodule of $M$ has a supplement that is a direct summand of $M$, then $M$ is called a $\oplus - e$–supplemented module (See also [6]). In this work, some new properties of these modules are investigated. Let $M$ be an $R$–module. If every essential submodule of $M$ has a weak supplement that is a direct summand in $M$, then $M$ is $\oplus - e$–supplemented.

Keywords: Essential submodules; radical; small submodules; $\oplus$–supplemented modules
Mathematics Subject Classification. 16D10, 16D80
Acknowledgement: This research was in part supported by grants from Ondokuz Mayı́s University. (Project No : PYO.EGF.1901.19.002).

Results

Proposition 7. Every strongly $\oplus$–supplemented module is $\oplus - e$–supplemented.

Corollary 8. Every direct sum of a strongly $\oplus$–supplemented module is $\oplus - e$–supplemented.

Proposition 8. Let $M = M_1 \oplus M_2$. If $M_1$ and $M_2$ are strongly $\oplus$–supplemented, then $M$ is $\oplus - e$–supplemented.

Corollary 9. The finite direct sum of strongly $\oplus$–supplemented modules is $\oplus - e$–supplemented.

Corollary 10. Let $M$ be a strongly $\oplus$–supplemented module. Then $M^{(\Lambda)}$ is $\oplus - e$–supplemented for every finite index set $\Lambda$.

Proposition 9. Every $\oplus - e$–supplemented module is essential supplemented.

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Proposition 10. Every $\oplus - e-$supplemented module is weakly essential supplemented.

Proposition 11. Let $M = M_1 \oplus M_2$. If $M_1$ and $M_2$ are $\oplus - e-$supplemented, then $M$ is weakly essential supplemented.

Corollary 11. The finite sum of $\oplus - e-$supplemented modules is weakly essential supplemented.

Corollary 12. Let $M$ be a $\oplus - e-$supplemented module. Then $M^{(\Lambda)}$ is weakly essential supplemented for every finite index set $\Lambda$.

Proposition 12. Let $M$ be a $\oplus - e-$supplemented module. Then every factor module of $M$ is weakly essential supplemented.

Corollary 13. Let $M$ be a $\oplus - e-$supplemented module. Then every homomorphic image of $M$ is weakly essential supplemented.

Corollary 14. Let $M$ be a $\oplus - e-$supplemented module. Then every finitely $M-$generated module is weakly essential supplemented.

Proposition 13. Let $M$ be an $R-$module. If every essential submodule of $M$ has a weak supplement that is a direct summand in $M$, then $M$ is $\oplus - e-$supplemented.

References


Automorphisms Of Differential Polynomial Algebras of Rank 2

Duisengaliyeva Bibinur

Abstract. It is proved that the tame automorphism group of the differential polynomial algebra $k\{x, y\}$ over a field $k$ of characteristic 0 in two variables $x, y$ with $m$ commuting derivations $\delta_1, \ldots, \delta_m$ is a free product with amalgamation. An example of the wild automorphism of the algebra $k\{x, y\}$ in the case of $m \geq 2$ derivations is constructed.

The main results of the work are the following:

Theorem 1. Let $A = k\{x, y\}$ be the differential polynomial algebra over a field $k$ of characteristic 0 in two variables $x, y$ with $m$ commuting derivations $\delta_1, \ldots, \delta_m$. The tame automorphism group of the algebra $A = k\{x, y\}$ is a free product of the affine automorphism subgroup $Af_2(A)$ and the triangular automorphism subgroup $Tr_2(A)$ with an amalgamated subgroup $C = Af_2(A) \cap Tr_2(A)$, i.e.,

$$T(A) = Af_2(A) \ast_C Tr_2(A).$$

Lemma 1. Let $\Delta = \{\delta_1, \ldots, \delta_m\}$ be a basic set of derivation operators and let $|\Delta| \geq 2$. The endomorphism $\delta$ of the algebra $A = k\{x, y\}$ given as

$$\delta(x) = x + w^2\delta_1, \delta(y) = y + w^2,$$

where $w = x\delta_1 - y\delta_2$, is an automorphism.

Theorem 2. The automorphism $\delta$ of the algebra $A = k\{x, y\}$ is wild.

Keywords: differential polynomial algebra; tame and wild automorphisms; free product.

Mathematics Subject Classification: 13N15, 16S99.

This is a joint work with professors A.S. Naurazbekova, U.U. Umirbaev.

References


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A Classification Method For Lie Crossed Modules: Isoclinism

Elif Ilgaz Caglayan

Abstract. The notion of isoclinism, which is an equivalence relation on groups weaker than isomorphism, was introduced in [3], for a classification of finite groups whose orders are prime powers, and was detailed in [2]. This notion has since been further studied by a number of authors, including [4, 5, 6, 8, 10, 12]. [7] gave a Lie algebra analogue of isoclinism. The structure of all Lie algebras occurring in an isoclinism family has been extensively studied in [10] and also some applications have been given in [1, 9, 10]. Furthermore, [11] generalized the notion of isoclinism to the notion of \( n \)-isoclinism, that is the isoclinism with respect to the variety of nilpotent Lie algebras of class at most \( n \).

In this work, we consider the 2-dimensional Lie algebra version, called “crossed module of Lie algebra” or shortly “Lie crossed module”, of isoclinism and give some basic results. By this construction, we have a new classification of Lie crossed modules and the resulting equivalence classes, called isoclinism families.

Keywords: Isoclinism, Lie crossed modules, Lie algebras.
Mathematics Subject Classification. 18C99, 18D99, 16W25

References

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On a Relation Between GAG Codes and AG Codes

Engin Senel ¹, Figen Oke ²

Abstract. In this paper, we first give a relationship between generalized algebraic geometry codes (GAG codes) and algebraic geometry codes (AG codes). More precisely, we show that a GAG code is contained (up to isomorphism) in a suitable AG code. Next we recall the concept of an \( N_1 N_2 \)-automorphism group, a subgroup of the automorphism group of a GAG code. With the use of the relation, we show that the \( N_1 N_2 \)-automorphism group is a subgroup of the automorphism group of an AG code.

Keywords: algebraic geometry codes; generalized algebraic geometry codes; geometric Goppa codes; code automorphisms; algebraic function fields.

Mathematics Subject Classification. Primary: 94B27; Secondary: 14H05, 14G50

References


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ON FOURTH ORDER $\bar{h}$-JACOBSTHAL AND FOURTH ORDER $\bar{h}$-JACOBSTHAL LUCAS SEQUENCES, AND NEW QUATERNIONS VIA THESE NUMBERS

Faruk Kaplan ¹, Arzu Ozkoc Ozturk ²

ABSTRACT. In this study, inspired by recent article of G. Anatriello and G. Vincenzi [1], we will introduce the fourth order $\bar{h}$-Jacobsthal and fourth order $\bar{h}$-Jacobsthal Lucas sequences and their associated quaternions. Also, we drive Binet formulas, various results and identities related to them.

Keywords: Jacobsthal numbers; Jacobsthal Lucas numbers; fourth order recurrences; quaternions.

Mathematics Subject Classification. Primary: 11B39; Secondary: 11R52

REFERENCES


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ON CERTAIN VERTEX OPERATOR ALGEBRAS

Gordan Radobolja

ABSTRACT. In this talk I will present the concept of vertex operator algebras and show some applications to the representation theory of Lie (super)algebras. The emphasis will be on algebras of Virasoro type.

Keywords: Vertex algebra; Virasoro algebra; intertwining operators.

Mathematics Subject Classification. Primary: 17B69; Secondary: 17B68; 17B65

REFERENCES


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ON SOME TRANSCENDENTAL CONTINUED FRACTIONS IN $\mathbb{F}_q((T^{-1}))$

Khalil Ayadi

Abstract. The aim of the present paper is to give a new transcendence criteria for power series of $\mathbb{F}_q((T^{-1}))$, depending only on the length of specific blocs of partial quotients appearing in their continued fraction expansions. As applications, we construct families of transcendental continued fractions having the property that their partial quotients have bounded degrees.

Keywords: Continued fraction, formal power series, transcendance.
Mathematics Subject Classification. Primary: 11A55; Secondary: 11J81

References


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LIFTING OF ISOMORPHIC IDEMPOTENTS

Meltem Altun Ozarslan

Abstract. Two idempotents e and f of a ring R are called isomorphic if \( eR \cong fR \) as right \( R \)-modules. It is easy to see that this relation is an equivalence relation on the set \( \text{id}(R) \) of idempotent elements of \( R \). Recall that an ideal \( I \) in a ring \( R \) is called idempotent lifting if, whenever \( a \in R \) is an idempotent modulo \( I \), then there exists an idempotent \( e \in R \) with \( e - a \in I \).

In a recent work [4], Khurana et al. extended the usual lifting property of idempotents and introduced a new kind of lifting property for ideals, that is, an ideal \( I \) of a ring \( R \) is said to be isomorphic idempotent lifting if \( x \) and \( y \) are elements in \( R \) such that their images in the factor ring \( R/I \) are isomorphic idempotents, then there exist isomorphic idempotents \( e, f \in R \) such that \( x - e, y - f \in I \). In this work, as a continuation of our previous article [2], we deal with this newly-appeared lifting property and investigate isomorphic idempotent lifting ideals of formal triangular matrix rings.

Keywords: Isomorphic idempotent; lifting of idempotents; formal triangular matrix ring.

Mathematics Subject Classification. Primary: 16U40, 16U99; Secondary: 16S50, 16D25

References


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\(^2\)August 29–September 1
Yildiz Technical University, Istanbul, Turkey.
Abstract. Poisson algebras can be defined as Lie algebras that satisfy the Leibniz rule. In our research, we classified a large class of Poisson algebras \( A = (D, \alpha, \beta, c, u) \) that appears in [3, Lemma 1.3].

In specific, our class \( A = K[t][x, y] = (K[t], \alpha, \beta, c, u) \) is a Poisson polynomial algebra in two variables \( x \) and \( y \) with coefficients on the Poisson polynomial algebra \( K[t] \), where \( K \) is an algebraic closure field with zero characteristic. Our aim is to classify some finite dimensional Poisson modules over class \( A \). Also, we are interested in the Poisson spectrum of \( A \), minimal and maximal Poisson ideals of \( A \). The classification of \( A \) consists of three main cases and each case has several subcases. In this talk, I will give some background in Poisson algebras, introduce the Poisson algebra class \( A \), talk about the first part of the second case and its Poisson spectrum.

Keywords: Poisson algebras; Poisson spectrum; Poisson prime ideals.

Mathematics Subject Classification. Primary: Non-commutative algebras; Secondary: Poisson algebras

References

Exact Bracket in Polynomial Algebras

Maram Alossaimi 1

Abstract. This short talk is based on [4] paper. This talk will discuss a new Poisson bracket structure in polynomial algebras over the complex field. This structure was introduced in this paper. I will give some facts and then illustrate the results in some examples.

Keywords: Poisson bracket; Polynomial algebras; Poisson spectra.
Mathematics Subject Classification. Primary: Algebras; Secondary: Non-commutative algebras

References


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Automorphisms of Free Braided Associative Algebras in Two Variables

Mutalip Riza

Abstract. We describe the groups of automorphisms of two generated free braided associative algebras with involutive diagonal braidings over a field of characteristic \( \neq 2 \). Depending on the form of the diagonal involutive braiding, five different automorphism groups arise as automorphism groups of two generated free braided associative algebras.

The main results of the work is the following:

Definition 1. If \( x_1, x_2, \ldots, x_n \) is a basis of a linear space \( V \), then for arbitrary parameters \( q_{is} \in K, 1 \leq i, s \leq n \), the linear map \( \tau : x_i \otimes x_s \mapsto q_{is}x_s \otimes x_i \) is a braiding and is called a diagonal braiding. Denote by \( \tau = (q_{ij}) \in M_n(K) \) this diagonal braiding. A braiding \( \tau: V \otimes V \rightarrow V \otimes V \) is called involutive if \( \tau^2 = id \). The diagonal braiding \( \tau = (q_{ij}) \in M_n(K) \) is involutive if and only if \( q_{ij}q_{ji} = 1 \) for all \( 1 \leq i, j \leq n \).

Theorem 3. Let \( A = (K\langle x_1, x_2 \rangle, \tau) \) be a free braided associative algebra in two generators \( x_1, x_2 \) over a field \( K \) of arbitrary characteristic \( \neq 2 \) with an involutive diagonal braiding \( \tau = (q_{11}, q_{12}, q_{21}, q_{22}) \). Then

1. \( \text{Aut}A = \text{Aut}K \langle x_1, x_2 \rangle \) if \( q_{ij} = 1 \) for all \( i, j \);
2. \( \text{Aut}A = G_{\text{odd}} \) if \( q_{ij} = -1 \) for all \( i, j \), where \( G_{\text{odd}} \) is the group of all odd automorphisms of \( K\langle x_1, x_2 \rangle \);
3. \( \text{Aut}A \cong (K^* \times K^*) \circ \mathbb{Z}_2 \) if \( q_{11} = q_{22}, q_{12} = q_{21}, \text{ and } q_{11}q_{12} = -1 \), where the \( \circ \) is symbol of the semidirect product;
4. \( \text{Aut}A \cong G_4 \) if \( q_{12} = 1 \) and \( q_{11}q_{22} = -1 \);
5. \( \text{Aut}A \cong (K^* \times K^*) \) if \( q_{12} \neq \pm 1 \) or \( q_{12} = -1, q_{11}q_{22} = -1 \).

Keywords: Yang-Baxter equation; braiding; free associative algebra; automorphism.
Mathematics Subject Classification (2010): 16W20, 16T20, 16T25

This is a joint work with professors A.S. Naurazbekova, U.U. Umirbaev.

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References

**Strongly Irreducible Submodules in the Arithmetical and Noetherian Modules**

Monireh Sedghi

Abstract. Let $R$ be a commutative ring and let $M$ be an arbitrary $R$-module. In this talk, we will introduce the concept of the strongly irreducible submodules of $M$ and we will prove some properties of them, whenever $M$ is either an arithmetical or a Noetherian module. In the case when $R$ is Noetherian and $M$ is finitely generated, several characterizations of strongly irreducible submodules are included. Among other things, it is shown that when $N$ is a submodule of $M$ such that $N :_R M$ is not a prime ideal, then $N$ is strongly irreducible if and only if there exist submodule $L$ of $M$ and prime ideal $p$ of $R$ such that $N$ is $p$-primary, $N \subseteq L \subseteq pM$ and for all submodules $K$ of $M$ either $K \subseteq N$ or $L_p \subseteq K_p$. In addition, we show that a submodule $N$ of $M$ is strongly irreducible if and only if $N$ is primary, $M_p$ is arithmetical and $N = (pM)^{(n)}$ for some integer $n > 1$, where $p = \text{Rad}(N :_R M)$ with $p \notin \text{Ass}_R R/\text{Ann}_R(M)$ and $pM$ is not subset of $N$. As a consequence we deduce that if $R$ is integral domain and $M$ is torsion-free, then there exists a strongly irreducible submodule $N$ of $M$ such that $N :_R M$ is not prime ideal if and only if there is a prime ideal $p$ of $R$ with $pM$ is not subset of $N$ and $M_p$ is an arithmetical $R_p$-module.

Keywords: Arithmetical module, irreducible submodule, multiplication module, strongly irreducible submodule.

Mathematics Subject Classification. Primary: 13C05; Secondary: 13E05

### References


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METHOD OF INTRODUCING MULTIPLICATION OPERATION INTO ALGEBRA DOBLED IN SIZE

Remus Boboescu

Abstract. Given an n-dimensional algebra A over a field F, enter an algebra doubled in size as a direct sum of vector spaces. This doubling in size can be considered as a "complexification" of the elements of algebra A. The elements of algebra can be considered as algebraic forms consisting of a real and an imaginary part. For a non-commutative and non-associative algebra A the algebraic product of these forms is not an element of algebra. The introduction of an involution function in algebra A allows the product to be arranged as an element of algebra. Written in the form of two-dimensional vectors this product obtains the relation for multiplication in the Cayley-Dickson construction. The paper thus examines the relationship between algebraically defined multiplication and that defined in the Cayley-Dickson construction. The doubling in size of algebra A can be conceived by introducing in it an element "foreign" to which a two-dimensional linear space structure is developed. The introduction of this element requires that it have certain algebraic properties.

Keywords: Algebra over a field, Cayley-Dickson construction, complexation of algebra, multiplication into algebra
Mathematics Subject Classification. Primary: 17A50; Secondary: 17A60

References


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On the Annihilator of Local Cohomology Modules

Reza Naghipour

Abstract. Let $R$ be an arbitrary commutative Noetherian ring (with identity), $a$ an ideal of $R$ and let $M$ be a finitely generated $R$-module. An important problem concerning local cohomology is determining the annihilators of the $i$th local cohomology module $H^i_a(M)$. An important problem concerning local cohomology is determining the annihilators of the $i$th local cohomology module $H^i_a(M)$. This problem has been studied by several authors. In this talk, we determine the annihilators of the top local cohomology module $H^\dim_M(M)$.

Keywords: Annihilator, arithmetic rank, attached prime, cohomological dimension.

Mathematics Subject Classification. Primary: 13D45; Secondary: 14B15, 13E05

References


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Abstract. First, we mention that this presentation is based on results from [9].

BCK-algebras were first introduced by Imai and Iseki in [3]. Recently, error-correcting codes have been attached to these algebras (see [4] and [2]). Given these new applications, it has become important to study how BCK-algebras of a certain order can be constructed, or generated. On the other hand, the literature is poor in examples of BCK-algebras, because of their difficult construction process.

In this presentation, we will introduce a computer algorithm that generates all BCK-algebras up to 7th order ([9]). We will show how math results combine with computer science in order to obtain interesting new results.

Keywords: BCK-algebra; BCK-algebra computer algorithm.

Mathematics Subject Classification. Primary: 06F35; Secondary: 18B35

References


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Linear Diophantine Fuzzy Substructures of Semirings

Saba Al-Kaseasbeh ¹, Madeleine Al Tahan ²

Abstract. As an extension of the fuzzy set, linear Diophantine fuzzy set (LDFS) was recently introduced. In this study, we apply the concept of LDFS in semirings by introducing some new related concepts. More precisely, we introduce LDF-subsemirings, LDF-left ideals, LDF-right ideals, and LDF-ideal of semirings. Moreover, we illustrate our new concepts by non-trivial examples. Furthermore, we investigate various properties of these concepts.

Keywords: Semiring, linear Diophantine fuzzy set (LDFS), LDF-subsemiring, LDF-left ideal, LDF-right ideal, LDF-ideal.

Mathematics Subject Classification. Primary: 16Y60; Secondary: 08A72

References


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ON SOME CAUCHY PRODUCTS OF $q$–CENTRAL DELANNOY NUMBERS

Serpil Halici $^1$

Abstract. In this study, we discussed the central Delannoy numbers and their Cauchy products. We have given the $q$– analog representation of these numbers. Using quantum calculus, we have given some fundamental and important identities provided by the elements of this sequence.

Keywords: Recurrences, Delannoy numbers, $q$– integers.
Mathematics Subject Classification. 11B37, 11R52, 11Y55

References

[9] Sulanke R. A. Objects counted by the central Delannoy numbers. J. Integer Seq. 6(1), 2003

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Abstract. Let \( p \) be an odd prime number. Let \( \mathbb{F}_q \) be a finite field of \( q \) elements of characteristic \( p \). For \( V \) an algebraic variety defined over \( \mathbb{F}_q \), the zeta function of \( V \) is defined by \( Z(V, T) := \exp \left( \sum_{r \geq 1} N_r \frac{T^r}{r} \right) \), where \( N_r \) is the number of \( \mathbb{F}_q^r \)-points of \( V \). Dwork, in his paper [3] proved the rationality of this zeta function. In this proof, Dwork formulated \( N_r \) in terms of an additive character on \( \mathbb{F}_q^r \). Then he expressed analytically this additive character by means of a Dwork splitting function (cf.[3], §1). At the end, he used a trace formula to express \( N_r \). Our purpose here is to give an analog of Dwork trace formula for Gauss sums on Witt vector ring over \( \mathbb{F}_q \) of finite length 2, \( \mathbb{W}_2(\mathbb{F}_q) \) (cf. the paper [5], Theorem 5.14). Our basic tool is a generalisation of the exponential series of Pulita (cf. [8], Definition 2.6).

Keyword: Gauss sums, Witt vectors rings, generalized Pulita series, splitting functions.

References


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On Finite Groups with (ss)-µ Supplemented Subgroups

Yildiz Aydin

Abstract. A subgroup $H$ of a group $G$ is called $s$–permutable (or quasinormal) in $G$ if it permutes with each Sylow subgroup of $G$. A subgroup $H$ is called $µ$–supplemented in a finite group $G$ if there exists a subgroup $B$ of $G$ such that $G = HB$ and $H_1B$ is a proper subgroup of $G$ for any maximal subgroup $H_1$ of $H$, here $B$ is a $µ$–supplement of $H$ in $G$. In this work (ss)–$µ$–supplemented subgroup of $G$ is defined. A subgroup $H$ is called (ss)–$µ$–supplemented if $H \cap B$ is $s$–permutable in $B$ where $H$ is $µ$–supplemented in $G$ and. Some basic results and some relations between nilpotency and p-nilpotency of groups are obtained.

Keywords: S-permutable subgroup, Sylow subgroup, supplement, X-permutable subgroup
Mathematics Subject Classification. Primary: 20A05; Secondary: 08C05, 08A30

References


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AN EXPLICIT MATRIX FORM FOR IA-AUTOMORPHISMS OF $F/R'$ LEIBNIZ ALGEBRAS

Zeynep Ozkurt 1

Abstract. Let $F$ be the free Leibniz algebra generated by the set $X = \{x_1, ..., x_n\}$ over the field $K$ of characteristic 0. $R$ is an ideal of $F$. In this study it is obtained an explicit matrix form for the IA-automorphisms of the Leibniz algebra $F/R'$.

Keywords: Wreath product; Leibniz algebra; automorphism.

Mathematics Subject Classification. Primary: 17A32

References


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Detecting Non-Automorphisms of $F/R'$ Leibniz Algebras

Zeynep Ozkurt 1

Abstract. Let $F$ be the free Leibniz algebra generated by the set $X = \{x_1, \ldots, x_n\}$ over the field $K$ of characteristic 0. $R$ is an ideal of $F$. In this study we give a necessary condition for an $IA$-endomorphism of the Leibniz algebra $F/R'$ to be an $IA$-automorphism. This method explicitly based on Dieudonné determinant.

Keywords: Dieudonné determinant; Leibniz algebra; automorphism.

Mathematics Subject Classification. Primary: 17A32

References


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ANALYSIS
ON THE EXISTENCE AND UNIQUENESS OF POSITIVE SOLUTIONS FOR CLASS OF FRACTIONAL BOUNDARY VALUE PROBLEM INCLUDING P-LAPLACIAN OPERATOR

Asghar Ahmadkhanlu 1

ABSTRACT. In this work, the fractional boundary value problem

\[ D^\beta_0^+ \left[ \varphi_p(D^\alpha_0^+ u(t) + I^\gamma_0^+ g(t, u(t)) \right] + f(t, u(t)) = 0 \]
\[ \varphi_p(D^\alpha_0^+ u(0) + I^\gamma_0^+ g(t, u(t)))_{t=0} = u(0) = u'(0) = u'(1) = 0 \]

will be investigated, where \(2 < \alpha \leq \gamma \leq 3, 0 < \beta < 1, t \in [0,1]\) and the \(D^\alpha_0^+\) is the standard Riemann–Liouville fractional derivative of order \(\alpha\), \(I^\gamma_0^+\) is the Riemann–Liouville integral of order \(\gamma\), \(\varphi_p(u) = |u|^{p-2}u, p > 1\) and \(f, g \in C([0,1] \times [0,\infty))\). Some conditions on functions \(f\) and \(g\) will be imposed to conclude the existence and uniqueness of the positive solutions of problem (1). This will be done by use of two fixed point theorems of a sum operator in partial ordering Banach space. The main results obtained can not only guarantee the existence of a unique positive solution, but also be applied to construct an iterative scheme for approximating it.

Keywords: Fractional boundary value problem; positive solutions; p-Laplacian operator.

Mathematics Subject Classification. 34Axx, 34Bxx, 34B18

REFERENCES


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Abstract. The aim of this talk is to give an extended version of the Fredholm alternative, by including the B-Fredholm case. Among other things, we define unbounded closed B-Fredholm operators acting on Banach spaces and we quote some results and properties concerning this definition. Moreover, we express the relationship between the before-mentioned notion and the concept of Drazin invertibility for closed linear operators. At the end, we present some illustrative perspectives extending our theoretical results.

Keywords: Unbounded operator; Fredholm alternative; B-Fredholm; index; Drazin invertibility.

Mathematics Subject Classification. Primary: 47A10; Secondary: 47A25, 47A53, 47B01

References


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INTERPOLATIVE CONTRACTIONS OF SUZUKI TYPE

Andreea Fulga

Abstract. In this study, we present some fixed point theorems for interpolative contractions using admissible maps which satisfy Suzuki type conditions. Further, some results are given. These results generalize several new results present in the literature.

Keywords: fixed point, interpolative contractions, Suzuki type contractions.

Mathematics Subject Classification. Primary: 47H10; Secondary: 54H25

REFERENCES

An Esthetic Filled Function for Global Optimization

Ahmet Şahiner 1, Temel Ermiş 2, Muhammad Wasim Awan 3

Abstract. Auxiliary function methods have been considered to be practical approaches for finding the global minimizer of multi-modal functions. The filled function method is a typical representative of auxiliary function methods. Traditional algorithms used in solving optimization problems are often stuck at local minima. The filled function method is an effective approach that is often used to overcome such problems. However, when the traditional and existing filled functions in the literature are examined, it is seen that they have some disadvantages such as overflows in calculations and difficulties in parameter adjustment, since they contain exponential/logarithmic terms and are sensitive to parameters. In this work, we have proposed a new filled function that is continuously differentiable, insensitive to parameters, and not easy to cause overflow. Then, we performed numerical experiments in which we compared the new method with some frequently used methods in the literature to demonstrate the effectiveness and efficiency of our proposed method.

Keywords: Global optimization; filled function method; auxiliary function.
Mathematics Subject Classification. Primary: 90C26, 65K05; Secondary: 90C30, 65K10, 65D10.

References


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Iterative Manner Involving Sunny Nonexpansive Retractions for Nonlinear Operators as Concerns Convex Programming Applicable in Differential Problems, Image Restoration and Signal Recovery

Chonjaroen Chairatsiripong 1, Damrongsak Yambangwai 2, Tanakit Thianwan 3

ABSTRACT. In this present article, using sunny nonexpansive retractions which are different from the metric projection in Banach spaces, we develop the CR iteration algorithm in view of two quasi-nonexpansive nonself mappings and also give the convergence analysis for the proposed method in the setting of uniformly convex Banach spaces. Furthermore, our results can be applied for finding common zeros of accretive operators, convexly constrained least square problems and convex minimization problems. As application, some numerical experiments in real world problems are provided, focused on differential problems, image restoration problems and signal recovery problems.

Keywords: Convexly constrained least square problem; convex minimization problem; signal recovery problem; image restoration problem; sunny nonexpansive retract.
Mathematics Subject Classification. Primary: 47H10; Secondary: 47H09

REFERENCES


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Common fixed points of generalized Meir-Keeler contraction on non-Archimedean modular metric spaces

Ekber Girgin ¹, Mahpeyker Ozturk ²

Abstract. In this study, we establish the existence and uniqueness of common fixed point of \((\alpha, \beta)-\psi\)-Meir-Keeler contraction on non-Archimedean modular metric spaces. Our results generalize and extend various comparable results in the existing literature.

Keyword: Meir-Keeler contraction, non-Archimedean modular metric.

Mathematics Subject Classification. 47H10, 54H25

References


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Approximation in Modular Spaces via Statistical Convergence with Respect to Power Series Method

Emre Tas 1, Tugba Yurdakadim 2

Abstract. In this paper using the $P_r$-statistical convergence which is recently introduced in [6], we give some Korovkin-type approximation theorems for a sequence of positive linear operators on modular spaces. As an application, we present an example which shows that our theorems are efficient to use since $P_r$-statistical convergence provides a nonconvergent sequence to converge. It is noteworthy to express that $P_r$-statistical convergence and statistical convergence are incompatible.

Keywords: Korovkin type approximation, power series method, statistical convergence, modular spaces.

Mathematics Subject Classification. Primary: 40C15; Secondary: 40A35, 41A36

References


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Abstract. The idea of statistical convergence was given by Zygmund [1] in the first edition of his monograph published in Warsaw in 1935. Later on, Fast [2] introduced the statistical convergence of number sequences in terms of the density of subsets of \( \mathbb{N} \). Steinhaus [3] also defined, independently, the notion of statistical convergence. Kolk [4] initiated the study of applications of statistical convergence to the scope of Banach spaces. Later in [5], there are important results that relate the statistical convergence to classical properties of Banach spaces.

The notion of a modulus function was introduced by Nakano [6]. Maddox [7] and Ruckle [8] have introduced and discussed some properties of sequence spaces defined by using a modulus function. Pehlivan [9] generalized the strong almost convergence with the help of modulus functions. Connor [10] considered strong matrix summability with respect to a modulus and statistical convergence.

The aim of this work is to go several steps further and extend the statistical convergence by moduli to the scope of uniform spaces, obtaining particular cases of statistical convergence by moduli on pseudometric spaces and topological modules.

Keywords: \( f \)-statistical convergence; statistical convergence; uniform space; topological module.

Mathematics Subject Classification. 46H25, 16W80, 54H13

References


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The Finest Locally Convex Module Topology

Francisco Javier García Pacheco

Abstract. Two new concepts in Associative Ring Theory (unit segments and unit neighborhoods of zero) allow to transport the notion convexity to topological modules. We then define locally convex module topologies, which extend the classical locally convex vector topologies in the real or complex case. This way, the finest locally convex module topology is constructed. Connections with effect algebras and Quantum Mechanics are established.

Keywords: Topological module; topological ring; balanced set; absorbing set; unit neighborhood of zero; unit segment; effect algebra.
Mathematics Subject Classification. Primary: 46H25; Secondary: 16W80, 54H13.

References


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ON THE FILTER BORNOLGICAL CONVERGENCE OF THE NESTED SEQUENCES OF SETS

Huseyin Albayrak

Abstract. In recent years, the concept of bornological convergence and different types of convergence on a bornology have been studied for nets of sets in metric spaces (see [3, 4, 5, 6]). In [2], this concept was studied on topological vector spaces. Also, the concept of filter bornological convergence (briefly, $FB$-convergence), which is a generalization of bornological convergence, was defined for sequences of sets on topological vector spaces where $\mathcal{F}$ is a filter on $\mathbb{N}$. Recently, it was shown the equivalence of Hausdorff convergence and ideal Hausdorff convergence and the equivalence of Wijsman convergence and ideal Wijsman convergence for the nested sequences of sets ([1]). Using similar technique, in this work, we show the equivalence of filter bornological convergence and bornological convergence for the nested sequences of sets on topological vector spaces. Then we investigate the filter bornological limit of the nested sequence of sets.

Keywords: Bornological convergence; filter bornological convergence; nested sequences of sets.

Mathematics Subject Classification. Primary: 40A35, 46A17; Secondary: 54A20

References


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Applications of Infinite Series and Trigonometric Fourier Series

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Abstract. Let $f$ be a periodic function with period $2\pi$ and Lebesgue integrable over $(-\pi, \pi)$. The trigonometric Fourier series of $f$ is defined as

$$f(x) \sim \frac{1}{2}a_0 + \sum_{n=1}^{\infty} (a_n \cos nx + b_n \sin nx) = \sum_{n=0}^{\infty} A_n(x).$$

Let $\sum a_n$ be an infinite series with its partial sums $(s_n)$. Let $A = (a_{nv})$ be a lower triangular matrix of nonzero diagonal entries and $(\varphi_n)$ be any sequence of positive real numbers. The series $\sum a_n$ is said to be summable $\varphi - |A, \beta; \delta|_k$, $k \geq 1$, $\delta \geq 0$ and $\beta$ is a real number, if (see [1])

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

In the present paper, two theorems on absolute Riesz summability (see [2]) are generalized to the $\varphi - |A, \beta; \delta|_k$ summability of infinite series and Fourier series.

Keywords: Absolute matrix summability; Fourier series; infinite series; summability factors.
Mathematics Subject Classification. Primary: 40F05; Secondary: 26D15, 40D15, 40G99, 42A24.

References


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Korovkin Type Theorems for Lebesgue Spaces via Statistical Convergence with Respect to A Power Series Method

Ilknur Ozguc 1, Tugba Yurdakadim 2, Emre Tas 3

Abstract. In the present paper we consider the problem of approximating a function in the spaces $L_q[a,b]$ and $L_{q,ω}(\mathbb{R})$. In order to solve this problem our main tool is $P$-statistical convergence which is recently introduced in [6] and effective to use since it makes a nonconvergent sequence to converge. It is already shown that $P$-statistical convergence is not included by previously known methods. Here it is noteworthy to mention that the approximation on the whole real axis differs radically from the one on bounded intervals.

Keywords: Korovkin type approximation, power series method, statistical convergence, Lebesgue spaces.

Mathematics Subject Classification. Primary: 40C15; Secondary: 40A35, 41A36

References


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Order and Topological Convergence in Vector Lattices

Kazem Haghnejad Azar

Abstract. Let $E$ be a Banach lattice. A functional $f : E \to \mathbb{R}$ is un-continuous, if $x_n \xrightarrow{wn} 0$ implies $f(x_n) \to 0$ for each norm bounded net $(x_n) \subseteq E$. We denote the vector space of all un-continuous functionals on $E$ by $E^\triangleleft$ and we call it un-dual of Banach lattice $E$. In this paper, we study the un-dual (in symbol, $E^\triangleleft$) of Banach lattice $E$ and compare it with the topological dual; i.e. $E^\ast$. For example, we show that if $E^\ast$ has order continuous norm, then $E^\ast = E^\triangleleft$. We introduce and study weakly unbounded norm topology (wun-topology) on Banach lattices and compare it with weak topology and uaw-topology. It should be noted that the inclusion of $E^\triangleleft$ in $E^\ast$ can be proper. For example, let $E = \ell^1$, the functional $f : \ell^1 \to \mathbb{R}$ defined by $f(x_1, x_2, x_3, \ldots) = \sum_{i=1}^{\infty} x_i$ is continuous but is not un-continuous. Therefore, $(\ell^1)^\triangleleft \subset (\ell^1)^\ast$.

Let $f \in E^\triangleleft$, we define $\|f\|_{E^\triangleleft} = \sup\{|f(x)| : x \in E, \|x\|_E \leq 1\}$. It is clear that $E^\triangleleft$ is a normed space, and so $E^\triangleleft$ is a Banach space. Let $E$ be a Banach lattice. Then we have the following assertions.

1. $E^\triangleleft$ is an ideal in $E^\ast$.
2. If $E^\ast$ has order continuous norm, then $E^\ast = E^\triangleleft$.
3. If $E$ is an AM-space, then $E^\triangleleft$ is AL-space.

References


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Fixed Point Theorem For Simulation Mappings

Karima Hammache

Abstract. In this paper, we establish some fixed point theorem for some simulation type mappings in Banach spaces using the Index Fixed point. Then we get the best proximity point for some Darbo type simulation mappings which are defined by the measure of non compactness. Applications are given at the end of the paper.

Keywords: Fixed point; noncompactness measure; simulation function.
Mathematics Subject Classifications: 47H07, 47H08, 47H09, 47H10

References


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Estimates for Steffensen-type Differences Using Hermite-Hadamard Inequality

Ksenija Smoljak Kalamir

Abstract. Steffensen’s inequality [6] is often used in inequality theory. During the last decade, many papers have been written on Steffensen’s inequality not only in the classical Riemann sense but also in time scale, quantum calculus, fractional calculus and so on. A detailed overview of the achievements is given in the monographs [1] and [3].

Using various interpolation polynomials such as Hermite, Abel-Gontscharoff, Lindstone and other, many identities for Steffensen-type differences were obtained, see [8], [7], [2] and monograph [1]. In this talk, we will show how using weighted Hermite-Hadamard’s inequality and convex or concave functions can yield estimates for various Steffensen-type differences.

Keywords: Steffensen’s inequality; weighted Hermite-Hadamard’s inequality; estimates; convex functions.

Mathematics Subject Classification. Primary: 26D15; Secondary: 26A51

References


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Some Results On Uniform Statistical Convergencer

Mustafa Gulpırat $^1$, Nilay Sahin Bayram $^2$

**Abstract.** In the present paper, we first give characterize two inequalities concerning uniform statistical limit superior that lead to two core inclusion results for bounded real sequences. One of which is the characterization of the inequality:

$$\limsup_n \sup_{i} \frac{1}{n} \sum_{j=i+1}^{i+n} (Ax)_j \leq \text{st} \limsup x,$$

for every $x \in l_\infty$.

The next section is devoted to a criterion which is analogous to that of Schoenberg’s criterion given for the statistical convergence, whereupon we improve this result.

Keywords: Uniform statistical convergence, Knopp’s core theorem.

Mathematics Subject Classification. Primary: 40A35; Secondary: 40G15

**References**


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SEGHAL-GUSEMAN TYPE CONTRACTIONS ON NON-ARCHIMEDEAN QUASI MODULAR METRIC SPACES

Mahpeyker Ozturk 1, Ekber Girgin 2

Abstract. In this study, we establish fixed point of Sehgal-Guseman type contractions on non-Archimedean quasi modular metric spaces. Our results generalize and extend various comparable results in the existing literature.

Keywords: Sehgal-Guseman contraction; non-Archimedean quasi modular metric.
Mathematics Subject Classification. 47H10, 54H25.

References


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Some Generalizations of the Jensen-Type Inequalities with Applications

Mirna Rodić

Abstract. Motivated by some results about reverses of the Jensen inequality for positive measure, in this talk we give generalizations of those results for real Stieltjes measure $d\lambda$ which is not necessarily positive using several Green functions. Utilizing these results we define some new mean value theorems of Lagrange and Cauchy type, and derive some new Cauchy-type means.

Keywords: Jensen’s inequality; converse Jensen’s inequality; Green function; means; exponential convexity.
Mathematics Subject Classification. Primary: 26D15; Secondary: 26E60; 26A51

References


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ON BOUNDED SOLUTIONS OF A SECOND-ORDER DIFFERENTIAL EQUATION WITH PIECEWISE CONSTANT OPERATOR COEFFICIENTS

Oleksii Pecherytsia

ABSTRACT. Let $X$ is a complex Banach space with norm $\|\cdot\|$ and zero element $0$; $\mathcal{L}(X)$ is the Banach space of bounded linear operators acting on $X; C_b(\mathbb{R}, X)$ is the Banach space of all continuous and bounded on $\mathbb{R}$ functions $f: \mathbb{R} \to X$ with norm $\|f\|_{C_b} := \sup_{t \in \mathbb{R}} \|f(t)\|$.

Consider differential equation

\begin{align}
  x''(t) &= A_1 x'(t) + A_2 x(t) + y(t), \quad t \geq 0, \\
  x''(t) &= B_1 x'(t) + B_2 x(t) + y(t), \quad t < 0,
\end{align}

(2)

where $y \in C_b(\mathbb{R}, X), A_k, B_k, k = 1, 2$, are fixed operators belonging to $\mathcal{L}(X)$.

Necessary and sufficient conditions are obtained under which the differential equation (2) has a unique solution bounded on the entire axis.

For the first-order differential equation analogous to the equation (2) the conditions for existence of a unique bounded solution are studied in [1]. The investigation of the existence and some properties of bounded on $\mathbb{R}$ solutions to the second-order differential equation with constant operator coefficients can be found in [2].

Keywords: Banach space; second-order differential equation; piecewise constant operator coefficients; bounded on $\mathbb{R}$ solution.

Mathematics Subject Classification. Primary: 34G20; Secondary: 34G99

REFERENCES


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Integrated Fuzzy-Analytical Hierarchy Process (F-AHP) and Technique for Preference by Similarity to the Ideal Solution (TOPSIS) in Recommending Extra Curricular Program Selection

Okfalisa¹, Tito Fernando ², Dwi UtariIswavigra³, Mahyarni ⁴ Saktioto⁵, Khairunnas Rajab ⁶

ABSTRACT. School Extracurricular Program provides students with self-development activities. The extensive options of the extracurricular program are due to the bewilderment for students and parents in selecting the proper program, thus impacting an un-optimal student’s potential construction [1]. This paper considers the parents, schools, and Psychiatric Test evaluation through the determination of the student’s level of intelligence, concentration, memory, commitment to the task, willingness, creativity, experience, health history, and parents’ recommendation as criteria for the Decision Support System (DSS) establishment [2-5]. Two stakeholders from the counseling experts are asked their opinions on weighting the significant values of the criteria using an F-AHPo of a 1 to the 9-scale questionnaire [6 and 7]. As a result, the powerful values of criteria contribution to selection are then performed. Meanwhile, the TOPSIS approach is used for the alternative proposed ranking that includes basketball, football, volleyball, choir, dance, music, theater, mathematics and natural sciences Olympiad, social science Olympiad, National Flag Hoisting Troop, and debate programs. By touching on the momentous level of F-AHP criteria, the TOPSIS formula ranks 30 students' performance to obtain the matchless program preference [8]. A prototype integrated multi attributes DSS system has been successfully developed as an automatic recommendation system in aiding the students' selection for the alternative program. Herein, Black Box, User Acceptance Test (UAT), and sensitive analysis testing showed the potential contribution of this DSS system in presenting the optimal solution.

Keywords: School Extracurricular Program; Fuzzy-Analytical Hierarchy Process; Technique for Preference by Similarity to the Ideal Solution; Decision Support System; Multi-Criteria Decision Making.

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References


On Lexicographic and Lightly Max-Ordering Robust Solution Concepts for Uncertain Multi-Objective Optimization Problems

Pornpimon Boriwan ¹, Matthias Ehrgott ², Daishi Kuroiwa ³, Thanathorn Phoka ⁴, Narin Petrot ⁵

Abstract. We will discuss two concept solutions for the considered uncertain multi-objective optimization problem. The first one is the lexicographic tolerable robust solution. This concept is suited for the practical implementation of problems in which the solution should satisfy priority levels in the objective function and the worst performance vector of the solution obtained by the proposed concept is close to a reference point of the considered problem, within an acceptable tolerance threshold. While the second concept is called the lightly robust max-ordering solution. This solution the concept will aim to offer the best option for solving issues based on the maximum cost in the worst-case scenario. By introducing a tolerable relaxation parameter, it can be used to increase the robustness of the solution but, at the same time, the desirable property of such solution with respect to the nominal scenario might be decreased. Subsequently, the two measurements, which are the ‘gain in robustness’ and the ‘price to be paid for robustness’, are considered.

In the above two concepts, important properties of the solution sets and algorithm for finding such solutions will be presented and discussed.

Keywords: Uncertain multi-objective optimization; robustness concept; lexicographic tolerable robust; lightly robust solution.

Mathematics Subject Classification. Primary: 47H10; Secondary: 54H25

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REFERENCES


A New Iterative Hybrid Methods With Linesearch for Solving Multiple Set Split Equilibrium Problems of Pseudomonotone Mappings In Hilbert Spaces

Preeyanuch Chuasuk ¹, Anchalee Kaewcharoen ²

Abstract. In this paper, we introduce some iterative methods for solving multiple set split equilibrium problems in Hilbert spaces. The weak and strong convergence theorems of the proposed iterative methods are obtained under certain assumptions for parameters and equilibrium bifunctions which are pseudomonotone and avoid Lipschitz-type condition which is assumed to hold on a equilibrium bifunction when the iteration comes from the extragradient method. Finally, we also present a numerical example to supporting the convergence of the proposed iterative methods.

Keywords: Multiple set split equilibrium problems; pseudomonotone mappings; Lipschitz-type condition; extragradient methods; proximal point methods.

Mathematics Subject Classification. 90C33, 47H05

References


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On Inversion of Generalized Flett Potentials by the Method of Balakrishnan-Rubin

Simten Bayrakci¹, Guldane Yildiz ²

Abstract. In Fourier (or Fourier-Bessel) Harmonic analysis, one of the important problems is to obtain an explicit inversion formula for potentials such as Riesz, Bessel, parabolic, Flett potentials, etc. The hypersingular integral technique, which is a very powerful tool for inversion of potentials was studied by Stein, Lizorkin, Samko, Wheeden, Rubin and others.

In this article, we consider the Laplace-Bessel differential operator is defined by

\[ \Delta_B = \sum_{k=1}^{N} \left( \frac{\partial^2}{\partial x_k^2} + \frac{2\nu_k + 1}{x_k} \frac{\partial^2}{\partial x_k} \right) + \sum_{k=N+1}^{n} \frac{\partial^2}{\partial x_k^2}, \quad \left( \frac{\nu_k > -\frac{1}{2}}{k = 1, \cdots, N} \right). \]

and we introduce the "truncated" hypersingular integral operators \( D_\varepsilon^\alpha f, \varepsilon > 0 \) generated by the modified B-Poisson integral. Moreover, we obtain the explicit inversion formula for the generalized Flett potentials associated with the Laplace-Bessel differential operator \( \Delta_B \).

Keywords: Laplace-Bessel differential, Flett potentials.
Mathematics Subject Classification. Primary: 26A33; Secondary: 44A35

References


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Abstract. In this work, we introduce and study the modified inertial Mann’s algorithm and inertial hybrid algorithm for approximating some fixed points of a $k$-strict pseudo-contractive mapping in Hilbert spaces. Weak convergence to a solution of fixed-point problems for a $k$-strict pseudo-contractive mapping is obtained by using the modified inertial Mann’s algorithm. In order to obtain strong convergence, we introduce an inertial hybrid algorithm by using the inertial extrapolation method mixed with the convex combination of three iterated vectors and forcing for strong convergence by the hybrid projection method for a $k$-strict pseudo-contractive mapping in Hilbert spaces. The strong convergence theorem of the proposed method is proved under mild assumptions on the scalars. For illustrating the performance of the proposed algorithms, we provide some new nonlinear $k$-strict pseudo-contractive mappings which are not nonexpansive to create some numerical experiments to show the advantage of the two new inertial algorithms for a $k$-strict pseudo-contractive mapping.

Keywords: $k$-strict pseudo-contractive mapping; modified inertial Mann’s algorithm; inertial hybrid algorithm; weak convergence; strong convergence.

Mathematics Subject Classification. 47H05, 47H09, 47H10, 47J25, 49M37

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Approximation to Functions by Using a Sequence of Operators Containing Generalized Sheffer Polynomials

Sezgin Sucu

Abstract. Approximation theory is related to how functions can be approximated with uncomplicated functions such as polynomials, wavelets or special functions. The purpose of this talk is to study the approximation properties of a sequence of operators including generalized Sheffer polynomials. Approximation of this sequence of operators is examined with the help of Korovkin theorem and the order of approximation is investigated by means of classical modulus of continuity, second modulus of smoothness and Lipschitz class of functions.

Keywords: Szasz operators; generalized Sheffer polynomials; analytic functions; Boas-Buck polynomials.

Mathematics Subject Classification. Primary: 41A10; 41A36; Secondary: 33C45

References


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A Generalization of Szasz Operators Constructed by a Special Kind of Appell Polynomials

Serhan Varma

Abstract. In this talk, we extend Szasz operators by using Appell polynomials of class $A^{(2)}$. First, we give the convergence of this sequence of operators via Korovkin theorem. Then, some approximation results are presented. Finally, a numerical example is obtained.

Keywords: Szasz operator; Appell polynomials of class $A^{(2)}$; modulus of continuity; Steklov function.

Mathematics Subject Classification. Primary: 41A10, 41A36; Secondary: 33C45

References

A Modified Algorithm for Solving Split Feasibility Problem in Real Hilbert Spaces

Uamporn Witthayarat

Abstract. In this work, we mention the well-known problem called Split Feasibility Problem (SFP) which takes the most interest from many researchers not only mathematicians but also from other disciplines. There are many methods for solving this problem and the selected one is the iteration method. We propose the new modified iterative algorithm for solving the SFP in the real Hilbert spaces. The convergence analysis is also established and we can exactly verify that the sequence generated by our algorithm converges to the solution of SFP under some mild conditions. Moreover, we give a numerical example to illustrate the performance of our algorithm. Our result extends and generalize the existing results in the literature.

Keywords: Split Feasibility Problem; iterative algorithm; Hilbert Space.
Mathematics Subject Classification. Primary: 41A65; Secondary: 65D15

References


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NEW CHARACTERIZATIONS OF OPERATORS VIA BEREZIN NUMBER AND RELATED QUESTIONS

Ulas Yamanci 1

ABSTRACT. In this paper, we characterize some operators in terms of Berezin number on reproducing kernel Hilbert spaces. Also, some problems related with Berezin symbols are discussed.

Keywords: Reproducing kernel; Berezin symbol; Berezin number.
Mathematics Subject Classification. Primary: 47B32

REFERENCES


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Abstract. Let \((\Omega,\mathcal{F},P)\) be a complete probability space, \(X\) a complex separable Banach space, \(\mathcal{L}(X)\) the Banach algebra of bounded linear operators defined on \(X\).

Consider the difference equation
\[
\begin{align*}
\xi_{n+1} - 2\xi_n + \xi_{n-1} &= A\xi_n + \eta_n, \quad n \geq 1, \\
\xi_{n+1} - 2\xi_n + \xi_{n-1} &= B\xi_n + \eta_n, \quad n \leq 0,
\end{align*}
\]
where \(A, B\) are fixed operators belonging to \(\mathcal{L}(X)\), \(\{\eta_n, n \in \mathbb{Z}\}\) is the given bounded in the mean sequence of \(X\)-valued random elements defined on \((\Omega,\mathcal{F},P)\).

Sufficient conditions are obtained for the operators \(A, B\) under which the difference equation (1) has a unique bounded in the mean solution \(\{\xi_n, n \in \mathbb{Z}\}\) for each bounded in the mean sequence \(\{\eta_n, n \in \mathbb{Z}\}\).

These conditions, in particular, for the operators \(A = G + G^{-1} - 2I, B = -G - G^{-1} - 2I\) are satisfied, where \(G\) is a such operator in \(\mathcal{L}(X)\), that the spectrum of the operator \(G\) lying outside the unit circle \(\{z \in \mathbb{C} \mid |z| = 1\}\).

Some applications of difference equations with operator coefficients and random right-hand side are given in [1] and in references therein.

Keywords: Difference equation; Banach space; operator coefficients; bounded in the mean solution.
Mathematics Subject Classification. 60H99, 39A10

References


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APPLIED MATHEMATICS
Numerical Solution for Fractional Equations with Volterra Type
Ayse Anapali Şenel

Abstract. Nowadays, significant contributions have been made in theory and applications of fractional differential equations and Volterra equations. Fractional differential equations with the Volterra term are examined in this study. The fractional Volterra differential equation can solve problems like signal processing, electromagnetics, and oscillation of earthquakes [1–3]. There are many methods to solve the fractional Volterra type differential equation in the literature. Such as the Euler method [4], Adomian decomposition method [5], spline collocation method [6]. In this study, the fractional differential Volterra type equation are solved using the Taylor collocation method with the Fractional Taylor series [7].

Keywords: Fractional volterra equation; Collocation method; fractional Taylor Series.

Mathematics Subject Classification. Primary:34A08; Secondary:26D15

References


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Abstract. In this presentation, we studied a class of the fractional periodic Sturm-Liouville problem. First, we defined the problem as a fractional periodic Sturm-Liouville problem with some special boundary values. Then, we extended some spectral properties of the classical Sturm-Liouville problem to the fractional derivative case. We have shown the simplicity of eigenvalues, orthogonality of eigenfunctions, and proved some other fundamental theorems.

Keywords: Fractional Sturm-Liouville problem, eigenvalue, eigenfunction.

Mathematics Subject Classification. Primary: 34B24; Secondary: 34A08

References

Abstract. In this study, we consider eigenvalues and eigenfunctions of fractional Sturm-Liouville problem with transmission conditions. The eigenvalues and corresponding eigenfunctions are calculated by using numerical method. At the end of the study, we have illustrated our approximation by some examples.

Keywords: Fractional Sturm-Liouville problem; eigenvalue; eigenfunction.

Mathematics Subject Classification. Primary: 34B24; Secondary: 34A08

References

ABSTRACT. In this paper we consider a non-autonomous Navier-Stokes-Voigt model including a variety of delay terms in a unified formulation. Firstly, we prove the existence and uniqueness of solutions by using a Galerkin scheme. Next, we prove the existence and eventual uniqueness of stationary solutions, as well as their exponential stability by using three methods: first, a Lyapunov function which requires differentiability for the delays; next we exploit the Razumikhin technique to weaken the differentiability assumption to just continuity; finally, we use a Gronwall-like type of argument to provide sufficient conditions for the exponential stability in a general case which, in particular, for a situation of variable delay, it only requires measurability of the variable delay function.

Keywords: Navier-Stokes-Voigt model; delay; stationary solutions; exponential stability; Razumikhin.

Mathematics Subject Classification. 35B40, 35B41, 35Q30, 35Q35, 76F20.

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Supporting Vectors and Its Applications in Multivariate Statistics

Alberto Sánchez Alzola 1, Soledad Moreno Pulido 2, Almudena Márquez Lozano 3, Francisco Javier García Pacheco 4

Abstract. Supporting vector analysis is a powerful technique that allows the resolution of optimisation maxmin problems with great applicability in different fields such as engineering and statistics [1, 2, 3]. This methodology is very useful to solve analytically a wide variety of problems, previously solved with heuristic methods. In several works such as [4, 5] it was proven that singular value decomposition (basis of principal component analysis) can be seen as a particular case of supporting vector in the perspective of Functional Analysis and Operator Theory. In this communication we present the main notions of supporting vector analysis, the relations with multivariate statistics and its applications with principal component analysis. We also include several examples and real-world problems with data freely available obtained from institutional databases.

Keywords: Supporting vector; principal component analysis; multivariate statistics; optimisation maxmin problems.

Mathematics Subject Classification. 51F30, 54E35, 54E45

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Abstract. COVID-19 (Coronavirus-disease-2019) is a respiratory infectious disease transmitted from human to human, so the human mobility plays an essential role in the spread of this disease. Moreover, with easy access to mobility between regions, the mobility of the population is increasing. It makes COVID-19 spread rapidly worldwide and results in a pandemic [1,2]. Many researchers build mathematical models to study and analyze the stability of the dynamics of the spread of COVID-19 [3,4]. At the end of December 2020, WHO noted more than 81 million positive cases of COVID-19 and more than 1.7 million deaths from COVID-19 worldwide. Therefore, appropriate control strategies are needed to overcome the COVID-19 pandemic, one of which is through vaccination. Applying optimal control using control variables in the form of vaccination can reduce the number of exposed and infected individuals with COVID-19 [5]. This study examines the SEIR (Susceptible, Exposed, Infected, Removed) mathematical model of the spread of COVID-19 with the mobility aspect. The aspect of mobility reviewed is the displacement of each compartment S, E, I, and R between two cities [2]. In actual conditions, the dynamics of the model can be disturbed by internal and external factors that are not covered by the mathematical model, resulting in differences from actual conditions. The next step is constructing a mathematical model of COVID-19 with the disturbance aspect. The disturbance construction in the model refers to [6]. Next, the optimal control problem will be formulated by applying two control variables, vaccination and treatment, to minimize the number of exposed and infected individuals. The control design is constructed based on the Lyapunov quadratic function by first forming a reference model.
The quadratic Lyapunov function contains an error between the actual model (the SEIR model) and the reference model [7]. The reference model in this study is in the form of a linear system with selected parameter values so that the system meets disease-free conditions. The parameter values in the controller design usually are obtained by tuning but in this study the parameter values are estimated using a genetic algorithm to obtain a controller that can achieve control objectives and stabilize the system [7,8,9]. Based on numerical simulation results using cumulative data on positive cases of COVID-19 in DKI Jakarta and West Java province, Indonesia, the simultaneous application of vaccination control and treatment strategies can reduce the population of infected individuals in DKI Jakarta province by 81.47% and in West Java by 73.98%.

Keywords: COVID-19; mobility; disturbance; Lyapunov control; genetic algorithm.
Parameter Estimation for a SEIRS Covid-19 Model With Turkey Data

Arzu Unal 1, Elif Demirci 2

Abstract. COVID-19 has taken its place in the history of the world as an epidemic disease that causes a lot of damage to people health, economy and psychology. The results of this destruction appeared independent of the economic and socio-cultural differences of the countries. Today, it is accepted by many scientists that the control strategies against Covid-19 such as vaccination, use of masks, social distance and hygiene rules, etc. play the most important role in preventing this epidemic. In this study, the parameters of a SEIRS model has been estimated using real Turkey data. The numerical solutions corresponding to the parameter values determined by the least squares approach and the actual data demonstrated with graphs.

Keywords: Epidemic models; parameter estimation, COVID-19.

Mathematics Subject Classification. Primary: 37N25; Secondary: 65C30, 65D10

References


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Dynamical Behavior of Rational Difference Equation $x_{n+1} = \frac{x_{n-1}x_{n-7}}{x_{n-5}(\pm 1 \pm x_{n-1}x_{n-7})}$

Burak Ogul 1, Dagıstan Simsek 2

Abstract. We explore the dynamics of adhering to rational difference formula

$$x_{n+1} = \frac{x_{n-1}x_{n-7}}{x_{n-5}(\pm 1 \pm x_{n-1}x_{n-7})}, \quad n \in \mathbb{N}_0$$

where the initials are arbitrary nonzero real numbers. Specifically, we examine global asymptotically stability.

Keywords: Difference equation; local stability; recursive sequences.

Mathematics Subject Classification. Primary: 39A10

References


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Dynamical Behavior of Rational Difference Equation $x_{n+1} = \frac{x_n-17x_{n-7}}{x_{n-5}(\pm 1 \pm x_{n-1}x_{n-7})}$

Burak Ogul 1, Dagıstan Simsek 2

Abstract. We explore the dynamics of adhering to rational difference formula

$$U_{m+1} = \pm 1 \pm U_{m-4}U_{m-9}U_{m-14}U_{m-19}U_{m-24}U_{m-29}, \quad m \in \mathbb{N}_0$$

where the initials are arbitrary nonzero real numbers. Specifically, we examine global asymptotically stability.

Keywords: Difference equation; local stability; recursive sequences.

Mathematics Subject Classification. Primary: 39A10

References

[6] B. Ogul, D. Şimşek, H. Öğünmez, A.S. Kurbanlı, Dynamical Behavior of Rational Difference Equation $x_{n+1} = \frac{x_n-17}{\pm 1 \pm 2x_n-5x_n-8x_n-11x_n-14x_n-17}$, Boletín de la Sociedad Matemática Mexicana, 27(2), 1-20, 2021.
[7] B. Oğul, D. Şimşek, A.S. Kurbanlı, H. Öğünmez, Dynamical Behavior of Rational Difference Equation $x_{n+1} = \frac{x_n-15}{\pm 1 \pm 2x_n-3x_n-7x_n-11x_n-15}$, Differential Equations and Dynamical Systems, 1-16, 2021.

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98
Abstract. This paper deals with the problems of fixed-time stabilization for a class of Clifford neural networks (CNNs) with mixed delays by direct method ie we do not transform the CRNNs with mixed delays into real neural networks. By using a new fixed-time stability theorem of dynamical systems, two different control protocols are designed to ensure the fixed-time stabilization of CNNs with mixed delays. The proposed theoretical results can lead to a better upper settling-time estimation compared to existing results. Finally, a simulation example is provided to illustrate the validity of the proposed theoretical results.

Keywords: Clifford neural networks; finite time stabilization; fixed-time stabilization.

References

AN EFFICIENT ITERATIVE ALGORITHM FOR SOLVING THE SPLIT FEASIBILITY PROBLEM IN HILBERT SPACES
APPLICABLE IN DIFFERENTIAL, IMAGE DEBLURRING AND SIGNAL RECOVERING PROBLEMS
Chonjaroen Chairatsiripong 1, Damrongsak Yambangwai 2, Tanakit Thianwan 3

ABSTRACT. In the present article, we propose an efficient iterative algorithm for solving the split feasibility problem (SFP) in Hilbert space. Then we prove convergence theorems of a sequence generated by our new method for finding a solution of the SFP. We also present numerical examples to illustrate that the acceleration of our algorithm is effective. Furthermore, we apply our results to find solutions of differential problems. As applications, we use our proposed algorithm to solve image deblurring and signal recovering problems.

Keywords: Split feasibility problem; strong convergence; differential equations; signal recovering; image deblurring problem.
Mathematics Subject Classification. 47H10, 47H09, 47E10

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A STUDY OF A GENERALIZED HIROTA-SATUMA COUPLED KORTEweg-De VRIE5 SYSTEM

Chaudry Masood Khalique

ABSTRACT. In this talk, a generalized Hirota-Satsuma coupled Korteweg-de Vries system shall be investigated from the group standpoint [1, 2]. This system represents an interplay of long waves with distinct dispersion correlations. We present solitary wave solutions for the underlying system.

Keywords: A generalized Hirota-Satsuma coupled Korteweg-de Vries system; Lie group theory; conservation laws.
Mathematics Subject Classification. 35B06, 35L65, 70H33

REFERENCES


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Abstract. In this talk, we investigate an extended Kadomtsev-Petviashivili equation of fluid dynamics [1] by using Lie symmetry analysis [2, 3]. The similarity reductions and new exact solutions are obtained via the simplest equation method. Exact solutions including solitons are presented. In addition, the conservation laws are derived using multiplier approach.

Keywords: Extended Kadomtsev-Petviashivili equation; Lie symmetry analysis; conservation laws.
Mathematics Subject Classification. 35B06, 35L65, 70H33

References
Exact Solutions and the Conservation Laws of the (1+1)-Dimensional Boussinesq Equation

Christina Majola 1, Letlhogonolo Daddy Moleleki 1, Chaudry Masood Khalique 1

Abstract. In this talk, we study a nonlinear evolution partial differential equation, namely, the (1+1)-dimensional Boussinesq equation [1]. We use Lie symmetry method together with simplest equation method to find the exact solutions of the new (1+1)-dimensional Boussinesq equation. Furthermore, multiplier method will be used to construct the conservation laws of the new (1+1)-dimensional Boussinesq equation.

Keywords: (1+1)-dimensional Boussinesq equation; exact solutions; simplest equation method; conservation laws; multiplier method.

Mathematics Subject Classification. 35B06, 35L65, 70H33

References


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Symmetry Analysis and Exact Solutions of an Extended Kadomtsev-Petviashivili Equation in Fluid Dynamics

Dunja Arsić \(^1\), Maja Nedović \(^2\)

**Abstract.** The class of \(\{P_1, P_2\}−\)Nekrasov \(B−\)matrices is a class of matrices obtained through a special rank one perturbation. We obtain infinity norm bound for the inverse and error bounds for linear complementarity problems. These error bounds are compared to some already known error bounds for other classes of matrices. Numerical examples illustrate the benefits of the new bounds.

Keywords: Linear complementarity problem; Nekrasov matrices; Infinity norm bounds.
Mathematics Subject Classification. Primary: 15A18; Secondary: 15B99

**References**


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NUMERICALLY SOLVING THE MOTZ PROBLEM THROUGH PSEUDO-SPECTRAL MESHLESS RADIAL POINT HERMITE INTERPOLATION

Elyas Shivanian

Abstract. The Motz problem is well-known as a benchmark problem for examining the performance of numerical techniques in the solution of elliptic problems with boundary singularities. This article develops pseudo-spectral meshless radial point Hermite interpolation (PSMRPHI), which is a modification to pseudospectral meshless radial point interpolation (PSMRPI), with the purpose of applying to the Motz problem. Based on this problem, we aim also to compare PSMRPHI with PSMRPI because it belongs to more effective type of meshfree techniques. PSMRPI method is based on a combination of meshless methods and spectral collocation techniques. The point interpolation method with the help of radial basis functions are used to construct shape functions which act as basis functions in the frame of PSMRPI and PSMRPHI methods. Although PSMRPHI method has been infrequently used in applications, we prove it is more accurate and trustworthy than PSMRPI method.

Keywords: Pseudospectral meshless radial point Hermit interpolation (PSMRPHI); pseudospectral meshless radial point interpolation (PSMRPI); radial basis function; Motz problem.
Mathematics Subject Classification. 65Mxx

References


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Hopf Bifurcation in Oncolytic Therapeutic Approache Modeling: Viruses as Anti-Tumor Weapons

F. Najm, R. Yafia, M. A. Aziz Alaoui

Abstract. In this paper, we propose a delayed mathematical model describing oncolytic virotherapy treatment of a tumour that proliferates according to the logistic growth function. The tumour population cells is divided into uninfected and infected cells sub-populations and the virus spreading is supposed to be in a direct mode (i.e., from cell to cell). Depending on time delay, we analyze the stability of virus free equilibrium and tumour-virus equilibrium, and we prove that, delay can lead to "Jeff's phenomenon" and causes oscillations in tumour size whose phase and period change over time. We prove the occurrence of Hopf bifurcation by using time delay as a parameter of bifurcation and we end with numerical simulations in order to illustrate our results.

Keywords: DDE, stability/instability, Jeff’s phenomenon, Hopf bifurcation, anti-tumour viruses.

Mathematics Subject Classification. Primary: 34C23; Secondary: 35B32

References


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The Nonlinear SSOR-Like Method for Solving the Absolute Value Equations

Ghodrat Ebadi 1, Somayeh Seifollahzadeh 2

Abstract. In this paper, utilizing the symmetric SOR method (SSOR method), a two step iteration method named nonlinear SSOR-like method is proposed to solve the absolute value equations \(Ax - |x| = b\), where \(A \in \mathbb{R}^{n \times n}\) and \(b \in \mathbb{R}^n\) and \(|x|\) denotes the vector in \(\mathbb{R}^n\) with absolute values of components of the vector \(x\). The convergence of the presented method is studied under suitable assumptions when matrix \(A\) is a symmetric positive definite. Moreover, to demonstrate the feasibility and effectiveness of the method, the numerical properties of the nonlinear SSOR-like are examined and compared experimentally by the nonlinear HSS-like[1], MN[2], Picard-HSS[3], AOR[4], GGS[5] iteration methods.

Keywords: SSOR method; absolute value equation.
Mathematics Subject Classification. Primary: 65F45; Secondary: 65F10

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NEW WAVE SOLUTIONS FOR (3+1)-DIMENSIONAL BOITI-LEON-MANNA-PEMPINELLI EQUATION

Gulsum Gulcin Ersoy 1, Ilker Burak Giresunlu 2

ABSTRACT. This paper investigated the (3+1)-dimensional Boiti-Leon-Manna-Pempinelli (BLMP) equation which describes fluid propagation and can be exhibited significant spectral energy transfer for finite-amplitude waves in shallow areas above the flat seafloor. We give new solutions to (3+1)-dimensional BLMP equation with multiple exp-function method, modified extended direct algebraic method, and generalized extended \( \tanh \)-function method.

Finally, the attained results show different physical natures in various conditions which have been presented graphically.

Keywords: exact solution; multiple exp-function method; modified extended direct algebraic method; generalized extended \( \tanh \)-function method; nonlinear evolution equations.
Mathematics Subject Classification. Primary: 83C15; Secondary: 47J35

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A Novel Neutrosophic Score and Accuracy Function Proposal in the Context of Decision Making

Gurkan Isik 1

Abstract. The collected data for some of the real-life problems can include uncertainty, indeterminacy, and inconsistency together. There are several fuzzy set (FS) alternatives for modeling such scenarios in the literature. The most flexible alternative is Neutrosophic Set (NS) because it does not put a limit for inconsistency unlike the others such as Pythagorean FS. NS theory assumes that the inconsistency is caused by collecting data from multiple sources. For this reason, it considers membership, non-membership, and indeterminacy grades as separate terms and gives ability to set values in [0,1] for them independently. On the other hand, this independency makes the ranking of multiple NSs complicated, so an extra approach is needed. In the literature, ranking approaches have been suggested based on several score and ranking functions. However, the available score and accuracy functions may yield different rankings from the others in some scenarios. These may also result different ranking from the score and accuracy functions of intuitionistic FS (IFS) that is a subset of NS. In this study, several score and accuracy functions are compared for some example NSs, and novel score and accuracy functions are proposed to make the ranking results of IFS and NS theories identical. The performance of the proposed functions is illustrated on numerical examples.

Keywords: Fuzzy sets; neutrosophic sets; score function; accuracy function.
Mathematics Subject Classification. Primary: 03E72; Secondary: 90B50

References


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Mathematical Modeling of the COVID-19 Pandemic

Hsiu-Chuan Wei

Abstract. The coronavirus disease (COVID-19), discovered in Wuhan, China, in late 2019, has been spreading swiftly worldwide since the beginning of the year 2020. As of 21 December 2021, the number of cases and deaths with COVID-19 have reached 275 million and 5.36 million worldwide, respectively. Mathematical models of evolution of COVID-19 pandemic have been proposed to predict peaks and total numbers of infections in different countries, predict the number and locations of new epicenters, study the impacts of non-pharmaceutical factors such as lockdown and social distancing, and study coronavirus DNA sequences for discovery of new drugs. As COVID-19 continues to spread, it has been proven that the models attempting to predict the future of COVID-19 pandemic failed to make reliable predictions. In contrast to predictive models, mathematical models studying pharmaceutical or non-pharmaceutical factors are more practical and can provide strategies to help with reducing infection cases and fighting COVID-19 pandemic. In this talk, I will propose a two-stage model to study the impacts of pharmaceutical and non-pharmaceutical factors on COVID-19 pandemic.

Keywords: COVID-19; global sensitivity analysis; health care capacity planning; lock-down; mathematical model; social distancing; vaccination.

Mathematics Subject Classification. Primary: 92D25, 92B05

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Existence Theorems for Micropolar Viscous Real Gas Flow With Homogeneous Boundary Conditions

Ivan Dražić ¹

Abstract. We analyze a one-dimensional micropolar, viscous, polytropic, and heat-conducting real gas flow, where the pressure depends as a power function on the mass density. The associated model in Lagrangian description is given by the parabolic system of four partial differential equations coupled by homogeneous boundary conditions for velocity, microrotation and heat flux.

Local existence is established using the Faedo-Galerkin method and a series of apriori estimates, which we use to prove that the sequence of approximate solutions is bounded in suitable function spaces. We show that the corresponding limit is a local generalized solution to the given problem.

To prove global existence, we first obtain a set of time-independent a priori estimates. Using the extension principle and the local existence theorem already obtained, as well as the a priori estimates, we show that this problem has a generalized solution globally in time.

Keywords: micropolar fluid; real gas; existence theorem.
Mathematics Subject Classification. Primary: 76N10; Secondary: 35Q35

References


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Abstract. The novel coronavirus disease (COVID-19), which emerged in China in December 2019 and was identified on January 13 in 2020, affects our country as well as all countries in the world. Epidemic models are often used to predict the future of an infectious disease in a population and the effects of the proposed control methods on the spread of the disease. In this study, we discuss a modified epidemic model for the spread of COVID-19 in the populations. Unlike the previously proposed COVID-19 models, this model is a general model in which the population is not constant and vaccination and social isolation parameters are included. The model which is constructed in this study is analyzed mathematically and the basic reproduction number is obtained. In addition, the stability of the equilibrium points of the system is investigated. (This work is a part the research that is supported by the Scientific and Research Council of Turkey (TÜBİTAK) with in the scope of the 1001-Scientific and Technological Research Project (120F307).)

Keywords: COVID-19; epidemic model; basic reproduction number; stability.

Mathematics Subject Classification. Primary: 37N25; Secondary: 34D20

References


Asymptotic Properties of Natural Orbitals From a Zero-Energy Schrödinger Equation

Jerzy Cioslowski

Abstract. Let \( \Psi(\vec{r}_1, \vec{r}_2, \ldots, \vec{r}_N) \) be a solution of the time-independent Schrödinger equation describing \( N \) electrons confined by the potential \( \sum_{k=1}^{N} v(\vec{r}_k) \) (note that here and in the following, the spin coordinates are suppressed for the sake of clarity). Let
\[
\Gamma(\vec{r}_1'\mid\vec{r}_1) = N \int \cdots \int \Psi^*(\vec{r}_1', \vec{r}_2, \ldots, \vec{r}_N) \Psi(\vec{r}_1, \vec{r}_2, \ldots, \vec{r}_N) \, d\vec{r}_2 \cdots d\vec{r}_N
\]
be the corresponding one-electron reduced density matrix with the Schmidt decomposition
\[
\Gamma(\vec{r}_1'\mid\vec{r}_1) = \sum_{\nu_j} \nu_j \psi_n^*(\vec{r}_1') \psi_n(\vec{r}_1), \quad \forall \nu_j \geq \nu_{j+1}.
\]
It is shown that at the limit of \( n \to \infty \), the \( n \)th natural orbital \( \psi_n(\vec{r}) \) and the \( n \)th occupation number \( \nu_n \) approach the solution \( \phi_n(\vec{r}), \mu_n \) of the zero-energy Schrödinger equation
\[
\hat{T} \left[ \rho_2(\vec{r}, \vec{r}) \right]^{-1/8} \phi_n(\vec{r}) - \left( \sum_{\nu} \right)^{1/4} [\rho_2(\vec{r}, \vec{r})]^{1/4} \left( \sum_{\nu} \right)^{-1/8} \phi_n(\vec{r}) = 0,
\]
where \( \hat{T} \) is the kinetic energy operator and \( \rho_2(\vec{r}, \vec{r}) = \left( \frac{N}{2} \right) \int \cdots \int \Psi^*(\vec{r}, \vec{r}, \ldots, \vec{r}_N) \Psi(\vec{r}, \vec{r}, \ldots, \vec{r}_N) \, d\vec{r}_3 \cdots d\vec{r}_N \) is the "on-top" two-electron density. The resulting formalism, in which \( \rho_2(\vec{r}, \vec{r}) \) solely controls the asymptotic behavior of both \( \psi_n(\vec{r}) \) and \( \nu_n \) at the limit of the latter becoming infinitesimally small, produces surprisingly accurate values of both quantities even for small \( n \). It opens entirely new vistas in the elucidation of their properties, including single-line derivations of the power laws governing the asymptotic decays of \( \nu_n \) and \( \langle \psi_n(\vec{r}) \mid \hat{T} \mid \psi_n(\vec{r}) \rangle \) with \( n \), some of which have been obtained previously with tedious algebra.

Keywords: Schrödinger equation; density matrices.
Mathematics Subject Classification. 41A60

References

Convergence Theorem for Optimization Problem and Applications

Kunrada Kankam ¹, Prasit Cholamjiak ²

Abstract. The forward-backward algorithm is a splitting method for solving convex minimization problems of the sum of two objective functions. It has a great attention in optimization due to its broad application to many disciplines, such as, image and signal processing, optimal control, regression and classification problems. In this work, we aim to introduce new forward-backward algorithms for solving convex minimization problems by using linesearch technique. Finally, we provide some applications to solve compressive sensing.

Keywords: forward-backward algorithm; compressive sensing; minimization problem.
Mathematics Subject Classification. 65K05; 90C25; 90C30

References


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Solutions and Conserved Vectors for the Yu-Toda-Sasa-Fukuyama Equation of Plasma Physics

Karabo Plaatjie 1, Chaudry Masood Khalique 1

Abstract. In this talk, we study the two-dimensional Yu-Toda-Sasa-Fukuyama equation [1] using Lie symmetry analysis [2]. Firstly, Lie point symmetries are obtained and used to perform symmetry reductions. As a result of symmetry reductions, equation is reduced to several nonlinear ordinary differential equations, which we solve with the help of different techniques. Moreover, the derived solutions are illustrated graphically for some parametric values. Furthermore, the conserved vectors are computed using the classical Noether's theorem [3].

Keywords: The two-dimensional Yu-Toda-Sasa-Fukuyama equation; Lie symmetry analysis; conservation laws; Noether theorem.
Mathematics Subject Classification. 35B06, 35L65, 70H33

References

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μ-Synchronization of Quaternion-Valued Recurrent Neural Networks With Fuzzy Logic and Mixed Delays
Meryem Abdelaziz 1, Farouk Cherif 2

Abstract. In this paper, we investigate a class of memristor-based fuzzy Cohen-Grossberg neural networks with general mixed delays involving both time-varying delays and distributed delays. By using the Mawhinlike coincidence theorem, together with the differential inclusion theory, M-matrix properties and differential inequality techniques, some novel conditions are given in order to study the periodicity and global stability for the considered system. Finally, an example is presented to demonstrate the effectiveness of the theoretical results.

Keywords: Fuzzy Cohen-Grossberg; memristive neural networks; global stability; Mawhin-like coincidence theorem.

Mathematics Subject Classification. Primary: 92B20, 34D06; Secondary: 03B52

References


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Abstract. Cancer is one of the main and growing causes of death in the world. Classical mathematical models have improved our understanding of the tumor microenvironment (TME). This knowledge can be extremely useful in tumor classification and treatment dose scheduling. These models are able to capture the mechanisms in the TME. On the other hand, in recent years, machine learning has also been widely used to study these issues. The methods based of machine learning have very high accuracy, but unfortunately they are not interpretable. The combination of mathematical and machine learning approaches can result in a powerful tool that is both mechanistic and interpretable. In this work, we solve some validated ODE and PDE models using artificial neural networks (ANNs). We show it is possible to reproduce the clinical trial results by applying a limited knowledge of the system, i.e. having a small set of noisy measurements. Our observations illustrate that the new method is robust to noise.

Keywords: Mathematical oncology; machine learning; cancer treatment.

Mathematics Subject Classification. 92B05, 92C42, 68T07

References


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MULTI-ADJOINT LATTICE LOGIC. AN AXIOMATIZATION OF MULTI-ADJOINT ALGEBRAS ON LATTICES.

M. Eugenia Cornejo 1, Luis Fariñas del Cerro 2, Jesús Medina 3

ABSTRACT. A logical characterization of multi-adjoint algebras [3, 4, 5] was already introduced in [1] to define a propositional logic on a bounded poset. Studying multi-adjoint algebras from a logical perspective allows to provide a sound and complete axiomatization for these algebras, which is key to analyze them from another point of view and to be capable of extracting new properties. Defining an extension of the axiomatization given in [1], based on a lattice instead of a poset, was the following step in this research topic. Multi-adjoint lattice logic (MLL) was introduced in [2] as a many-valued propositional logic framework defined on a multi-adjoint algebra, whose underlying algebraic structure is a bounded order-right multi-adjoint lattice. MLL embeds the well-known basic logic (BL) given by Hájek on residuated lattices [9]. Notice that, BL is one of the most elegant axiomatizations of fuzzy logic, considered as base logic for other developments, such as the logic for left-continuous t-norms presented by Esteva and Godo in [7], its extension considering right-continuous t-conorms [8], or the logics of subresiduated lattices from Epstein and Horn [6], among others. However, this axiomatization cannot be straightforwardly applied when more general and flexible algebras, for example multi-adjoint algebras [3, 4, 5], are considered. In this work, we continue with the analysis of MLL and its comparison with BL, studying more properties and showing the natural translation of different properties of BL into formulas in MLL.

Keywords: Fuzzy sets; fuzzy logic; lattice; multi-adjoint algebra.
Mathematics Subject Classification: 03B50, 03B52, 06-XX

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A Quadratic Equation Over Real Quaternions

Geanina-Mariana Zaharia

Abstract. We have given some solutions to the monic quadratic equation $x^2 + Ax + B = 0$ with $A, B \in \mathbb{H}(-1, -1)$ being two elements of the Fibonacci quaternion. We have shown that using such elements we can choose simpler forms of the solution.

Paper [5] presents solutions of the monic equation $x^2 + bx + c = 0$.

I studied the cases in which the discriminant is negative and then positive and $b$ and $c$ are real numbers. The solutions of the equation are very interesting in cases where one of the coefficients $b$ or $c$ is quaternion or when both coefficients are quaternion.

I will also presented a computer program to find these solutions. The program makes the transition from the mathematical model to the numerical one, it can calculate the solutions of the equation for the cases described above by replacing the coefficients $b$ and $c$ with quaternions.

Keywords: Quaternions, equations, Fibonacci quaternions.

Mathematics Subject Classification. Primary: 17A35, 17A45; Secondary: 68W40

References


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Fermatean Fuzzy Type Similarity and Distance Measures With TOPSIS Method

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Abstract. Distance and cosine similarity measures are the most convenient ways to verify the degrees of similarity and distinction between two sets. In this study, new measures of distance and cosine similarity between Fermatean fuzzy sets are given. Initially, the definitions of the new measures based on Fermatean fuzzy sets were given and their properties were examined. There may be cases where the similarity measure conditions of the cosine measure do not apply. In this case, a method is proposed to create new similarity measures between two sets according to the initially given measures. The new method provides the similarity measure condition. The new measure between Fermatean fuzzy sets is derived from the idea of the association between the distance and cosine measures.

Keywords: similarity measure; Euclidean distance; multi-criteria decision-making; Fermatean fuzzy set; cosine distance; TOPSIS.

Mathematics Subject Classification. Primary: 03E72; Secondary: 60A86; 91B06

References


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NEW STATISTICAL CONCEPTS AND THEIR APPLICATIONS

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ABSTRACT. If a correlation is mentioned between datasets, it is understood from this expression that it measures how well these datasets are related. Meanwhile, this coefficient is a prominent measure to evaluate the relationship between two sets. The Fermatean fuzzy set is an influentially widening of the available intuitionistic and Pythagorean fuzzy sets, whose benefit is to better exhaustively characterize ambiguous information. That is, Fermatean fuzzy sets are powerful and valuable tools to represent imprecise information. This study, it is aimed to give new correlation coefficients by using Fermatean fuzzy sets. These coefficients identify the degree as well as the nature of correlation (positive or negative) between two Fermatean fuzzy sets. The new coefficient values will also be in the closed interval of \([-1; 1]\). Pairs of membership and non-membership degree as a vector representation with the two elements have been considered during formulation. In addition, the new method was compared with known methods.

Keywords: Variance; covariance; correlation coefficient; Pearson correlation coefficient; Fermatean fuzzy set.

Mathematics Subject Classification. Primary: 03E72; Secondary: 60A86; 91B06

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ON LINEAR COMPLEMENTARITY PROBLEMS
Maja Nedović

Abstract. Mathematical models of many problems in economy, ecology and engineering could be presented as linear complementarity problems. It is well-known that a linear complementarity problem has the unique solution for any given vector if the matrix involved is a P-matrix, a real square matrix with all principal minors positive. Having this in mind, we use infinity norm bounds for the inverse matrix to obtain upper error bounds for the solution of linear complementarity problems involving some special H-matrices. We compare the results to previously known error bounds for different subclasses of H-matrices.

Keywords: Linear complementarity problem; H-matrices; error bounds.
Mathematics Subject Classification. Primary: 15A18; Secondary: 15B99

References

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Approximation of Steklov Eigenvalue Problems by Finite Difference Methods

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Abstract. In this study, the finite difference method is used to numerically analyze the Steklov eigenvalue problem (EVP) on square domains. Steklov EVPs arise in mathematical physics and have applications for instance in the study of surface waves, mechanical oscillators submerged in viscous fluids, and vibration modes of structures in contact with compressible fluids [1]. We consider two Steklov eigenproblems that are distinct from one another due to the associated boundary conditions. Specifically, the standard Steklov EVP with a mixed type boundary condition involving a spectral parameter is analyzed as the first problem, whereas in the second problem, the boundary of the computational domain is divided into two parts; one with Neumann type boundary condition and the other with spectral boundary condition [2, 3]. The discretization of the problem is performed by various orders of finite difference formulas for the first time to the best of our knowledge. The agreement between the approximate and exact eigenfunctions is shown using contour plots, and the rate of convergence of the approximate eigenvalues to the reference ones is explored. It has been noted that the use of higher order finite difference approximations -of at least second order- for not only the differential equation but also the boundary conditions advance the rate of convergence. Consequently, the present study demonstrates how a second-order convergence can be obtained by the application of fourth-order finite difference formulas for both the Laplace operator and the accompanying boundary conditions.

Keywords: Steklov eigenvalue problems; finite difference method; fourth order schemes.
Mathematics Subject Classification. Primary: 65N25; Secondary: 65N06

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Numerical Solution of Nonlinear PDEs With Proportional Delay Using RBF Method Based on Variable Shape Parameter Strategy

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Abstract. This work introduces a radial basis functions (RBFs) method to obtain numerical solutions of the nonlinear PDEs with proportional delay that have various applications in biology, medicine, control theory, climate models and many others. Numerical methods for delay partial differential equations bring specific difficulties, which do not appear for equations without delays. There is so little experience with numerical methods for solving delay PDEs. Several RBFs contain a free shape parameter, and choosing an optimal one plays an important role in the accuracy of the method. In this article, we apply the Gaussian RBFs method based on symmetric variable shape parameter (SVSP) to solve a class of the delay PDEs. Sample results show that the proposed method is very accurate. Moreover, the proposed method is compared with the same method with the constant shape parameter (CSP) as well as other analytical and two other numerical methods. Finally, numerical rate of convergence of the numerical approximation will also be obtained.

Keywords: Delay partial differential equations, proportional delay, radial basis function, variable shape parameter, rate of convergence.

Mathematics Subject Classification. 34Kxx, 65D12, 65M70

References


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Fitting a Stochastic Model to Data

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ABSTRACT. In the modeling of dynamical biological systems are usually used to deterministic ordinary differential or partial differential equations. Deterministic means that if you know the state of the system at a certain point in time t, you can determine all future states by solving the corresponding model. Sometimes, however, stochastic effects play a dominant role and these type deterministic systems not consider the noise effect of the system dynamics often present in biological systems. Noise effect arises in biological systems such as hormonal oscillations, variations of the stress level, variable muscular activity, etc. When a random noise is introduced into ordinary differential equations (ODEs) Stochastic differential equations (SDEs) arise. Stochastic differential equations have been shown useful in describing random continuous time processes. In present work a simple stochastic SIS model was fitted to data and the system parameters is estimated by means of a maximum likelihood procedure.

Keywords: Stochastic differential equations; parameter estimation.
Mathematics Subject Classification. Primary: 37A50, 60H10; Secondary: 65C30, 62J02

References

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Analytical Approach to Study the Mathematical Models on Dynamics of Tobacco Use

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Abstract. In the current analysis, our attention will be on the analytical approach to study the epidemiological model of drug use. Under the imposed assumptions equations governing the tobacco use will be modelled. Variational Iteration Method (VIM) is performed to give approximate the dynamics of the epidemiological model of drug use among adolescents, specifically tobacco use. Analytical solutions are continuous solutions that can be used to predict the phenomena without the involvement of interpolation or extrapolation errors. On the other hand, their use in derived equations, depending upon the solution itself, is far easier. We took Specific models by considering other factors to identify the effect on the growing trend of tobacco use. Smokers who quit smoking can become potential smokers again. We also consider people health impact of smoking related diseases as well. The element involved to be peer pressure, relapse, counseling and treatment.

Keywords: Epidemiological model; dynamics; potential smokers; peer pressure; relapse.
Mathematics Subject Classification. Primary: 68Q07; Secondary: 00A71

References


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THE GENERAL SYSTEM OF CHEN-LEE-LIU EQUATION
Mehmet Unlu

ABSTRACT. In this study, the Marchenko method is developed for a first-order system of two linear ordinary differential equations. We construct the potentials and the scattering solutions to the linear system from the solution to the Marchenko system. Such a linear system arises in the solution to a pair of integrable nonlinear partial differential equations known as the derivative nonlinear Schrödinger equations via the so-called inverse scattering transform method. We specially analyze the derivative nonlinear Schrödinger II system (also called Chen-Lee-Liu system) here.

Keywords: Marchenko method, general derivative NLS system, inverse scattering transform, Chen-Lee-Liu system.
Mathematics Subject Classification. 35Q55, 37K10, 37K15, 37K30, 34A55, 34L25

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ON THE DECAY PROPERTY FOR THE SYSTEM OF THE KLEIN-GORDON EQUATIONS IN THE CURVED SPACETIME

Muhammet Yazici

Abstract. This contribution is concerned with the initial value problem for the system of the Klein-Gordon equations in de Sitter spacetime. In [1], energy estimate is used for the global existence of the solutions to the semilinear Klein-Gordon equation. Yagdjian [2] proved the small data global solutions for the semilinear Klein-Gordon equation by using the $L^p - L^q$ estimate. Pointwise decay estimate is also showed in [4]. Yagdjian [3] proved global existence of the solutions for the system of semilinear Klein-Gordon equations in the de Sitter spacetime. We prove global existence of the solutions to the system of semilinear Klein-Gordon equations by using the pointwise estimate.

Keywords: Klein-Gordon equations; de Sitter spacetime; pointwise decay estimate.

Mathematics Subject Classification. Primary: 35L52; Secondary: 35L71

References


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Abstract. In this study, the Boiti-Leon-Manna-Pempinelli Equation which is modeled wave phenomena in the incompressible fluid is examined by the tanh-coth method. The novel solutions have been established to the literature with significant physical properties of the (4+1) dimensional Boiti-Leon-Manna-Pempinelli Equation. Moreover, the dynamical behaviours and physical significance of some soliton solutions at appropriate values of parameters are demonstrated. We indicated that the presented method are effective, easily computable, and reliable in solving such nonlinear problems.

Keywords: (4+1) dimensional Boiti-Leon-Manna-Pempinelli equation; the tanh–coth method; soliton solutions.
Mathematics Subject Classification. Primary: 35C08; Secondary: 35Q51

References


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A Hybrid Inertial Parallel Subgradient Extragradient-Line Algorithm of Variational Inequality Problems With Applications

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Abstract. In this paper, we propose hybrid inertial parallel subgradient extragradient-line algorithm for solving variational inequalities of $L$-Lipschitz continuous and monotone mappings but $L$ is unknown. We prove a strong convergence result under some mild conditions in Hilbert space. We then give numerical examples to demonstrate the performance of our algorithms better than some of the algorithms mentioned in the literature. Finally, we apply our proposed algorithm to image recovery and show that our algorithm is flexible and has good quality when the number of subproblems is increasing.

Keywords: Variational inequality; parallel algorithm; strong convergence; extragradient algorithm; image recovery.
Mathematics Subject Classification. Primary: 46T99; Secondary: 47H05

References


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A New Accelerated Algorithm for Bi-Level Convex Minimization Problems and Applications in Data Prediction and Classification

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ABSTRACT. In this work, we consider the following bi-level convex minimization problem:

$$\min_{x \in X^*} \omega(x),$$

(6)

where $\omega : \mathcal{H} \to \mathbb{R}$ is a strongly convex differentiable function on a Hilbert space $\mathcal{H}$ and $X^* := \arg \min_{x \in \mathcal{H}} (f(x) + g(x))$ when $f, g : \mathcal{H} \to (-\infty, +\infty]$ are proper convex lower semicontinuous functions such that $f$ is differentiable. We introduce a new accelerated algorithm for solving the problem (6) based on a common fixed point algorithms of two families of nonexpansive operators. A strong convergence of the proposed algorithm is established under some suitable conditions. As an application, we apply our main results for data prediction and classification. Moreover, we compare performance of our proposed algorithm with other existing algorithms in the literature.

Keywords: Convex bi-level minimization; data classification; fixed point algorithm; nonexpansive mapping.

Mathematics Subject Classification. Primary: 47H10; Secondary: 65K05

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Investigation of Linear and Nonlinear Advection-Diffusion Processes by a New Combined Method

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Abstract. In this study, numerical solutions of linear and nonlinear advection-diffusion equations are analyzed using a new combined approach based on the cubic B-spline collocation and fourth-order compact finite difference method. The standard finite difference approach is applied to discretize the temporal derivatives while spatial derivatives are discretized by the combined method. Since the present method uses the second-order derivatives in fourth-order accuracy unlike the cubic B-spline method, it appears to be successful in improving solutions. The obtained results have been compared with available literature and the exact solution. The numerical results are found to be in good agreement with the literature and exact solution. Furthermore, the present method is quite easy to implement with minimal computational effort.

Keywords: cubic B-spline collocation; high-order compact finite difference scheme; advection-diffusion processes.

Mathematics Subject Classification. 65M22, 35G99

References


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A Modified Inertial Proximal Gradient Method for Minimization Problems and Applications

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Abstract. In this paper, the aim is to design a new proximal gradient algorithm by using the inertial technique with adaptive stepsize for solving convex minimization problems and prove convergence of the iterates under some suitable assumptions. Some numerical implementations of image deblurring are performed to show the efficiency of the proposed methods.

Keywords: Convex minimization problem; forward-backward method; adaptive stepsize; inertial method; weak convergence.
Mathematics Subject Classification. 65K05, 90C25, 90C30

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Assessment of Geothermal Energy Potential in The World and in Turkey with Mathematical Prediction Models

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ABSTRACT. The increase in the world population, industrialization, and technological developments taking an active role in our lives increases the need for energy day by day. Energy production from fossil fuels has been widely used since very negative times. It is an important problem that using these resources will cause serious environmental problems for the world and our country, and the reserves will expire soon. In order to eliminate this problem, traditional energy production technologies are being replaced by renewable energy sources in the world. The primary renewable energy sources are wind, solar, biomass, wave, hydroelectric, tidal, and geothermal energy. Since these resources are both clean and environmentally friendly, their use is becoming more and more common today. Turkey’s location in the Alpine-Himalayan Tectonic Belt and the presence of active fault lines make our country an important place in the world ranking in terms of geothermal energy sources. The fact that our country has these advantages makes the installation and use of geothermal power plants widespread.

In this study, by giving general information about geothermal energy, a renewable energy source, the current use of geothermal energy potential in the world and in Turkey and future use targets have been made using current data. The geothermal energy in the world [1] and the geothermal energy potential values in Turkey[2] are taken from official sources. By applying the trend analysis method according to the geothermal energy production values in the previous years, the geothermal energy production values in the world and in Turkey for the years 2030 and 2050 were estimated. For trend analysis[3], the R2 value of 0.9958 was found suitable by applying the second-order differential equation. The coefficients of the second order equation were determined as 178.43, 138.71, and 5688.3, respectively. Keywords: Geothermal energy; Turkey; world; trend analysis.

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References


Mathematical Analysis of an HIV Viral Infection Model with Two Modes of Transmission

Vahid Roomi

Abstract. It is well known that dynamical systems are very useful tools to study the viral disease such as HIV, HBV, HCV, Ebola and Influenza. This paper deals with the model

\[
\begin{align*}
\frac{dT(t)}{dt} &= s - dT + rT \left( 1 - \frac{T}{T_M} \right) - \frac{b_1 TV}{1 + aV} - b_2 TI, \\
\frac{dI(t)}{dt} &= \frac{b_1 TV}{1 + aV} + b_2 TI - \delta I, \\
\frac{dV(t)}{dt} &= hI - lV,
\end{align*}
\]

which is a mathematical model of the cell-to-cell and the cell-free spread of HIV with both linear and nonlinear functional responses and logistic target cell growth. The reproduction number of each mode of transmission has been calculated and their sum has been considered as the basic reproduction number. Based on the values of the reproduction number, the local and global stability of the rest points have been investigated. Choosing a suitable bifurcation parameter, some qualifications for the occurrence of Hopf bifurcation around the parameter have also been obtained. Moreover, numerical simulations are presented to support the analytical results. Finally, to study the effect of the drug on the disease process, some control conditions are determined. Since two modes of transmission and both linear and nonlinear functional responses have been included in this manuscript, our obtained results are generalization of those in the literature. Moreover, the results have been obtained with weaker assumptions in comparison with the previous ones.

Keywords: HIV-1 infection; Hopf bifurcation; Global stability.

Mathematics Subject Classification. Primary: 34D23; Secondary: 37B25

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DISCRETE MATHEMATICS
Abstract. The \( m \)-oriented recursive trees, as a type of recursive trees, have been less studied. A random \( m \)-oriented recursive tree (RMORT) of order \( n \) is constructed as follows. One starts from a root node holding the label 1. At stage \( 2 \leq i \leq n \) a new node \( i \) is attached to any previous node \( j \) of outdegree \( d_j \) of the already grown tree \( T_{i-1} \) of order \( i-1 \) with probability \( \frac{(m-1)d_j+1}{m(d-2)+1} \). The main goal of this paper is to study the modified \( F \)-indices (modified first Zagreb index and modified forgotten topological index) of random \( m \)-oriented recursive trees (RMORTs) of order \( n \). First, through two recurrence equations, we compute the mean and the variance of these indices in our random tree model. Second, we show four convergence in probability based on these indices. Third, the asymptotic normalities, through the martingale central limit theorem, are given.

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A New Configuration of Sturmian Words
Shamsa Ishaq

Abstract. The article aims to present a new configuration of Sturmian words. This configuration links with a bispecial word \( W \) (fixed), and its corresponding factor loops \( S_1^W \) and \( S_2^W \), in the Rauzy graph of order \(|W|\). Moreover, we will prove some new combinatorial results concerned with the new configuration of Sturmian words.

Keywords: Sturmian words; Rauzy graph; bispecial words.
Mathematics Subject Classification. Primary: 68R15; Secondary: 68R10

References

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Abstract. The modular group theory plays an important role in many areas of mathematics, such as number theory, graph theory, automorphic function theory and combinatorics. A natural action of the modular group on extended rationals, yields interesting results in number theory. In [1], by using this action, Jones e.t. al. studied the suborbital graphs known as the Farey graph for the modular group. In the recent study [2] investigated the orbit of a special subgroup of the modular group and revealed the results in relevant to the Fibonacci sequence. In this study, some new sequences produced by acting of the Modular group on the extended rationals were investigated and determined their relations to the orbit of infinity in suborbital of the action.

Keywords: Modular group; sequence; suborbital graphs.
Mathematics Subject Classification. 20H05, 05C25

References


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Some Applications of the Partial Bell Polynomials

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Abstract. This paper discusses an innovative class of partial Bell polynomials. We provide an explicit formula for such polynomials, generating function, and deduce several recurrence relations as well as some specific cases.

Keywords: The 2-associated r-Stirling numbers; the exponential partial Bell polynomials, generating function.

H. Belbachir and A. Tebtoub [1] invent a new class of Stirling numbers known as the 2-successive associated Stirling numbers, denoted by \( \left\{ \begin{array}{l} n \\ k \end{array} \right\}^{[2]} \), count the number of partitions of the set \{1, 2, \ldots, n\} into \( k \) non-empty blocks, so that each block contains at least two consecutive numbers. Moreover, the last element \( n \) must either form a part with its predecessor or belong to another part satisfying the previous property. The ordinary generating function of these numbers is given by

\[
\sum_{n \geq 2k} \left\{ \begin{array}{l} n \\ k \end{array} \right\}^{[2]} x^n = \frac{x^{2k}}{(1 - x)(1 - 2x) \cdots (1 - kx)}.
\]

They satisfy the following recurrence relation:

For \( n \geq 2k \)

\[
\left\{ \begin{array}{l} n \\ k \end{array} \right\}^{[2]} = k \left\{ \begin{array}{l} n - 1 \\ k \end{array} \right\}^{[2]} + \left\{ \begin{array}{l} n - 2 \\ k - 1 \end{array} \right\}^{[2]},
\]

(8)

with

\[
\left\{ \begin{array}{l} 0 \\ 0 \end{array} \right\}^{[2]} = 1, \quad \left\{ \begin{array}{l} n \\ n - 1 \end{array} \right\}^{[2]} = 0 \text{ and } \left\{ \begin{array}{l} n \\ 0 \end{array} \right\}^{[2]} = 0 \quad (n \geq 1).
\]

The Bell polynomials studied by Bell [2, 3] are special polynomials in combinatorial analysis that have a wide range of applications in mathematics. They have interested many authors (can see [4, 5] The partial exponential Bell polynomials are defined by

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\[
\sum_{n \geq k} B_{n,k}(\varphi) \frac{t^n}{n!} = \frac{1}{k!} (\varphi(x))^k, \quad \varphi(x) = \sum_{i \geq 1} a_i x^i
\]

With
\[
B_{n,k}(\varphi) = B_{n,k}(a_j) := B_{n,k}(a_1, a_2, \ldots)
\]

They are given explicitly by the formula
\[
B_{n,k}(\varphi) = \sum_{\pi(n,k)} \frac{n!}{k_1! \cdots k_n!} \left( \frac{a_1}{\Pi} \right)^{k_1} \left( \frac{a_2}{\Pi^2} \right)^{k_2} \cdots,
\]

when
\[
\pi(n,k) = \left\{ K := (k_1, k_2, \ldots) : k_j \in \mathbb{N}, \sum_{i \geq 1} k_i = k \text{ and } \sum_{i \geq 1} i k_i = n \right\}.
\]

The exponential partial Bell polynomials have been well to reduce to some special combinatorial sequences when the variables \(x_j\) are appropriately chosen. We notice the following exceptions:

\[
\begin{align*}
\binom{n}{k} & = B_{n,k}(0!, 1!, 2!, \ldots), \text{ unsigned Stirling numbers of the first kind} \\
\binom{n}{k} & = B_{n,k}(1, 1, 1, \ldots), \text{ Stirling numbers of the second kind,} \\
\binom{n}{k} & = B_{n,k}(1!, 2!, 3!, \ldots), \text{ Lah numbers,} \\
\binom{n}{k} \cdot k^{n-k} & = B_{n,k}(1, 2, 3, \ldots), \text{ idempotent numbers.}
\end{align*}
\]

Numerous researchers had already interested the above numbers, as evidenced by the articles [7, 6].

Inspired by this works, in this manuscript, we propose a new family of special numbers named by the 2-successive partial Bell polynomials denoted by \(B_{n,k}^{[2]}(a_j)\). We prove properties of this numbers, derive several identities and discus some special cases. This family includes well-known numbers and polynomials such as Stirling numbers, Bell numbers and polynomials, and so on. We investigate their properties by employing generating functions.

\textbf{References}

ON SPATIAL QUATERNIONIC B-LIFT CURVES

Anil Altinkaya ¹, Mustafa Çalışkan ²

Abstract. In this study, we introduce the spatial quaternionic B-Lift curve and we obtain the Frenet apparatus. Also, we give an example and illustrate with MATLAB program.

Keywords: spatial quaternion; b-lift; Frenet frame.
Mathematics Subject Classification. 53A04, 14H45

References


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Applications of Commutative Elliptic Octonion Matrices in Image Restoration

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Abstract. In this article, norm concepts of the commutative elliptic octonion matrices are introduced. The least-squares solution, the pure-imaginary least-squares solution and the pure-real least-squares solution of the equation $AX = B$ are obtained by using the elliptic quaternion matrix representation of the commutative elliptic octonion matrix. In addition, some illustrative examples proving the authenticity of solutions are given and algorithms for these solutions are established. Finally, the applications of the whole study in image restoration are studied and the results are compared with the existing studies.

Keywords: Commutative elliptic octonion matrix; least-squares solution; image restoration.

Mathematics Subject Classification. 15A09, 30G35, 94A08

References


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Rotation Surfaces in Semi-Euclidean 5-Space With Index 2

Ali Ucum 1

Abstract. In this study, we consider rotation surfaces with spacelike axis in semi-Euclidean 5 space with index 2. So we obtain the necessary and sufficient condition for these surfaces to be minimal, flat, of zero normal curvature tensor or of parallel mean curvature vector, which are ordinary differential equations.

Keywords: Rotation surface; minimal surface; flat surface.
Mathematics Subject Classification. Primary: 53C50; Secondary: 53C42

References


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ABSTRACT. In this paper, we introduce Bertrand and Mannheim curves of framed curves, which are a special singular curve in three-dimensional Lie groups. We explain the conditions for framed curves to be Bertrand curves and Mannheim curves in three-dimensional Lie groups. We give relationships between framed curvatures and Lie curvatures of Bertrand and Mannheim curves of framed curves. In addition, we obtain the characterization of Bertrand and Mannheim curves according to the adapted frames of framed curves in Lie groups.

Keywords: Framed curves; Bertrand curves; Mannheim curves; Lie groups.

Mathematics Subject Classification. Primary: 22E15; Secondary: 58K05

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Smarandache Curves of Fronts in the Sphere

Bahar Dogan Yazıcı 1, Siddika Ozkaldi Karakus 2, Murat Tosun 3

Abstract. In this paper, we define Smarandache curves of singular curves in the unit sphere. Also, we give the Smarandache spherical Legendre curve definition. If the spherical Legendre curve is a front, it has been shown that the Smarandache curve is a regular curve and related theorems and propositions are given. It has been shown that if the spherical Legendre curve is a frontal, the Smarandache curve may not be regular. Finally, we give examples and interesting figures supporting the theories.

Keywords: Front; frontal; Legendre curves; Smarandache curves.
Mathematics Subject Classification. Primary: 53A04; Secondary: 58K05

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[16] B. D. Yazıcı, O. Z. Okuyucu, M. Tosun, Electromagnetic curves and Berry phase construction of a polarized light wave along an optical fiber which is a singular curve on $S^2$, Optik, 264, 169329, 2022.
ON THE COMPLETE \((k,2)\)-ARCS OF \(\text{PG}(2,5)\)

Elif Altintas Kahriman \(^1\), Ayse Bayar \(^2\)

**Abstract.** In this study, we introduce a method to find arcs in the projective plane of order 5 labeled by the elements \(0, 1, 2, -2, -1\) of GF(5) by the numbers \(0, 1, 2, 3, 4\) respectively with \(x^3 + 2x^2 + x - 1\) irreducible polynomial over GF(5). We give an algorithm for checking arcs in this projective plane and apply the algorithm (implemented in C#) to determine and classify arcs.

**Keywords:** Complete arcs; \((k,n)\)-arcs; projective plane.

**Mathematics Subject Classification.** Primary: Geometry; Secondary: Projective geometry

**References**


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Some Characterizations of Rectifying Curves in the 4-Symplectic Space

Esra Cicek Cetin 1, Mehmet Bektas 2

Abstract. In the present work, we have dealt with the properties of rectifying curves in symplectic space. In addition to this, we define rectifying curves of a given Frenet curve by using position vector of 4-dimensional symplectic space. Then we introduce some characterizations and obtain theorems for rectifying curves in symplectic space.

Keywords: Rectifying curve; Frenet vector; symplectic space.
Mathematics Subject Classification. Primary: 53B05; Secondary: 53B15

References


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New Type Slant Helices in Equiform Symplectic Space

Esra Cicek Cetin ¹, Mehmet Bektas ²

Abstract. In the present work, we have dealt with the properties of new type slant helices in equiform symplectic space. Firstly, we defined Frenet frame and some definitions for equiform frame by using frame of 4-dimensional symplectic space. Then we express new type slant helices for equiform symplectic space. Finally, we obtain some theorems and their characterizations for new types slant helices in equiform symplectic 4-space.

Keywords: Frenet vectors; equiform frame; symplectic space.
Mathematics Subject Classification. Primary: 53B05; Secondary: 53B15

References


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²Department of Mathematics, Firat University, Elazığ, Turkey, mbektas23@firat.edu.tr
PH-Helical Curves in Minkowski Space

Eren Can Ozbal 1, Mehmet Gumus 2

Abstract. In differential geometry, the theory of curves is one of the most fundamental areas. Helices are curves that we encounter in many areas of our daily life and have a wide range of uses and applications in many different sciences. Helices were defined as curves whose tangent vectors make a constant angle with a fixed direction. The Pythagorean-Hodograph curves were defined by Farouki and Sakkalis in [1]. In 1999, Moon expressed the Pythagorean-Hodograph curves (PH-curves) according to the Minkowski metric and defined the Minkowski Pythagorean-Hodograph curves (MPH-curves) in [2]. Izumiya and Takeuchi gave a method of obtaining a helix curve from a planar curve in a 3-dimensional Euclidean space $E^3$ [3]. This method was generalized to Pythagorean-Hodograph curves by Mollaoğulları et al. at all [4]. In this study, we defined Minkowski Pythagorean-Hodograph Helical curves and study the basic geometric properties of these curves and the relationships between their curvatures in 3-dimensional Minkowski space $E^3$.

Acknowledgement: This work was supported by the Office of Scientific Research Projects Coordination at Canakkale Onsekiz Mart University, Grant Number: FYL-2021-3818.

Keywords: Ph-curve; Ph-helical curve; Minkowski Space.

Mathematics Subject Classification. Primary: 53A04; Secondary: 53A35

References


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Some Notes on Parallel Transport

Fatma Karakus ¹, Yusuf Yayli ²

Abstract. In Special Relativity, for accelerated observers, the rest space are not transported by the Levi-Civita parallelism anymore. Therefore, in order to define “constant” directions, we use the Fermi-Walker transport that is an isometry between tangent space along the curve. Fermi-Walker derivative can contain lots of condition to have parallel transport or non-rotating frame. The condition of parallel transport any vector field depends on a solution that contains differential equation system which is not always easy to find a solution. The main aim of this study is to investigate Fermi Walker transport which is a parallel transport in a Lie groups with a bi-invariant metric. Especially, we have examined Fermi-Walker derivative and non-rotating frame concepts. We also consider parallel transported any vector field with respect to the Frenet frame in Lie groups with a bi-invariant metric. As an application, we examined the necessary conditions for a Frenet frame to be a non-rotating frame when the Lie group is an Abelian group and a special orthogonal group.

Keywords: Parallel transport; Fermi-Walker derivative; non-rotating frame.
Mathematics Subject Classification. Primary: 53B20, 53B21; Secondary: 53Z99, 53Z05

References


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ON THE APPLICATIONS ALTERNATIVE FRAMES

Fatma Karakus 1

ABSTRACT. The aim of this study is to examine the geometric properties and applications of alternative moving frames. Therefore, first of all, the properties of the alternative moving frame have given. The applications of the alternative moving frame have made along the spherical indicatrix curves of a space curve. Along the tangent indicatrix, principal normal and binormal indicatrix curves, it has been investigated whether this frame is a non-rotating frame. Finally, the relationship between helix and moving frame is shown.

Keywords: Alternative moving frame; Spherical indicatrix curves; Non-rotating frame; helix.
Mathematics Subject Classification. Primary: 53B20; Secondary: 53Z99

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Revested Result for Spacelike Bertrand Curves in Minkowski 3-Space

Hatice Altin Erdem 1, Kazim İlarslan 2

Abstract. In the theory of curves in Euclidean 3-space, it is well known that a curve $\beta$ with non-zero curvatures is said to be a Bertrand curve if for another curve $\beta^*$, there exists a one-to-one correspondence between $\beta$ and $\beta^*$ such that both curves have common principle normal line. These curves have been studied in different space over a long period of time and found wide application in different areas. Therefore, we have a great knowledge of the geometric properties of these curves. In [2], the authors gave a new perspective to Bertrand curves. This point of view was also carried to curves in Minkowski 3-space [1, 3]. In [4], new results for Cartan null and pseudonull Bertrand curves were given in the light of recent studies on Bertrand curves. In this talk, revested results for spacelike Bertrand curves with spacelike and timelike principle normal will be given with the previous studies on Bertrand curves and related examples that meet these results will be given.

Keywords: Bertrand curves; spacelike curves; Minkowski 3-space.
Mathematics Subject Classification. Primary: 53C40; Secondary: 53C50

References


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Abstract. In this paper, definitions of singular value decomposition of elliptic quaternion matrices are given, and related theorems are expressed and proved. As a result of singular value decomposition of elliptic quaternion matrices, pseudo (generalized) inverses and least squares solutions of elliptic quaternion matrices are obtained. In addition, the reconstruction and compression of color images with the help of singular value decomposition of elliptic quaternion matrices are discussed.

Keywords: Elliptic quaternion matrix; singular value decomposition; color images; pseudo (generalized) inverses; least squares solutions.

The study was supported by TUBITAK with the project number of 121F289.

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[8] S. C. Pei, J. H. Chang, J. J. Ding, Commutative reduced biquaternions and their Fourier transform for signal and

[9] H. H. Kosal, M. Tosun, Some equivalence relations and results over the commutative quaternions and their matrices,

[10] H. H. Kosal, Least-squares solutions of the reduced biquaternion matrix equation and their applications in color
Abstract. In the theory of curves in Euclidean 3-space, it is well known that a curve $\beta : I \rightarrow \mathbb{E}^3$ with non-zero curvatures is said to be a Mannheim curve if there is a curve $\beta^* : I^* \rightarrow \mathbb{E}^3$ such that the principal normal vectors of $\beta(s)$ coincide with the binormal vectors of $\beta^*(s^*)$ at $s \in I$, $s^* \in I^*$. These curve have been studied in different space over a long period of time and found wide application in different areas. Therefore, we have a great knowledge of the geometric properties of these curves. In [1], Mannheim partner curves were studied 3-dimensional space. This point of view was also carried to curves in Minkowski 3-space [2, 3]. In [4], the authors gave a new approach to Mannheim curves. Thanks to this new approach, new Mannheim curve examples, which are not known in the literature, are obtained and new results are given. In this talk, spacelike Mannheim curves are reconsidered from the perspective of this new approach. The new results obtained were supported with examples.

Keywords: Mannheim curves; spacelike curves; Minkowski 3-space.
Mathematics Subject Classification. Primary: 53C40; Secondary: 53C50

References

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m-POINT INVARIANTS UNDER PSEUDO-SIMILARITY TRANSFORMATIONS

Idris Oren 1, Kader Ozbektas 2, Elif Yildirim 3

ABSTRACT. In this work, the generalized linear pseudo-similarity groups and the generalized pseudo-similarity motion groups in two dimensional Lorentzian similarity geometry are introduced. Invariants of m-points under pseudo-similarity transformations are found. The pseudo-similarity conditions of the two systems consisting of m points for these groups are given in terms of m-point invariants. Moreover, for the given two systems consisting of m-point satisfying the pseudo-similarity conditions, the evident forms of pseudo-similarity transformations are obtained in the terms of common invariants of these systems.

Acknowledgements. This work is supported by The Scientific and Technological Research Council of Turkey (TÜBİTAK) under Grant Number 119N643 and The Ministry of Innovative Development of the Republic of Uzbekistan (MID Uzbekistan) under Grant Number UT-OT-2020-2.

Keywords: Invariant; pseudo-similarity transformations; hyperbolic numbers.

Mathematics Subject Classification. Primary: 14L24; Secondary:22E43, 51F20

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Geometry of Coupled Dispersionless Equations with Mannheim Curves

Kemal Eren ¹, Soley Ersoy ²

Abstract. In this paper, we consider a special kind of curve pair associated with each other by the linear dependency between the principal normal vector of the first curve (called Mannheim curve) and the binormal vector of the second curve (called Mannheim partner curve). We establish a connection with the coupled dispersionless equation and Mannheim curve pair. Also, we give the Lax pair of the obtained coupled dispersionless equation from the motions of any Mannheim curve pair. This gives us a significant condition based on the curvature and torsion of any Mannheim curve for its integrability since it is well known that the Lax pair provides the integrability of differential equations.

Keywords: Mannheim curves; coupled dispersionless equations; Lax pair.

Mathematics Subject Classification. Primary: 53A04; Secondary: 35Q70

References


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FRAMED GENERAL HELICES AND FRAMED $\eta_3$-SLANT HELICES IN FOUR DIMENSIONAL EUCLIDEAN SPACE

Mahmut Akyigit $^1$, Mine Ates $^2$

ABSTRACT. In this paper, we introduce the framed general helix and $\eta_3$-slant helix with adapted frame in four-dimensional Euclidean space. Moreover, the paper contains basic definitions of the general helix, slant helix, $B_2$-slant helix with the Frenet frame in four-dimensional Euclidean space, and also the paper contains definitions of the framed curve and adapted frame in four-dimensional Euclidean space. The main point of this paper is that we obtain some characterizations of framed general helix and $\eta_3$-slant helix in four-dimensional Euclidean space in terms of their framed curvature functions.

Keywords: Framed curve; framed general helix; framed $\eta_3$-slant helix.

Mathematics Subject Classification. Primary: 53A04; Secondary: 58K05

References


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Warped Product Lagrangian Submanifolds of $C^n$

Miroslava Antić 1

Abstract. Calabi construction is the procedure of constructing a Lagrangian immersion in the complex projective space, starting with two other Lagrangian immersions into a complex projective spaces of lesser dimension. The motivation for the name comes from the affine differential geometry where similar procedure is used for constructing hyperbolic affine hyperspheres.

In particular, in a Calabi product of Lagrangian immersions, one may consider a point instead of the one of the immersions, and in both cases the submanifold has a warped product structure. Moreover, the resulting submanifold then admits a splitting of the tangent bundle into orthogonal subbundles defined in terms of the corresponding second fundamental form. In case of a Calabi product of a point and an immersion decomposition consists of two components and in case of a proper Calabi product, decomposition has three components.

This notion and its generalizations were investigated for Lagrangian immersions in complex space forms $M^n(4c)$, firstly for $c = 1$ in [2, 4]. Further, Calabi products of Lagrangian immersions were classified for $c \neq 0$ in [3].

Here we study the case $c = 0$. We investigate the properties of the Lagrangian immersions in $C^n$ with tangent bundle admitting the decomposition in question and further, we give explicit expressions for such immersions.

Keywords: Lagrangian submanifolds; warped product; Calabi product.

Mathematics Subject Classification. Primary: 53B25; Secondary: 53B20

References


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A GEOMETRIC VIEW TO FIXED POINT THEORY ON A METRIC SPACE: FIXED APOLLONIUS CIRCLE

Ozcan Gelisgen 1, Temel Ermis 2, Gaye Zaim Ercinar 3

ABSTRACT. Classical fixed-point studies usually focus on determining the necessary and sufficient conditions for a self-mapping to have a unique fixed point. But the set of fixed points of a self-mapping may have more than one point. Thus, a meaningful question arises: “What are the geometric properties of the set of fixed points of such self mappings?” (See for more detail [3, 2]).

In this work, we give some theorems which explain existence and uniqueness conditions for fixed Apollonius circle of self-mappings on a metric space together geometric interpretation. So, we will provide a geometrical perspective to the classical metric fixed point theory. Also we support our theoretical results with some illustrative extraordinary examples (See for more detail [1]).

Keywords: Fixed circle theory; Fixed Apollonius circle theory.

Mathematics Subject Classification. Primary: 47H10; Secondary: 37E10, 54H25, 55M20

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Fractal Geometry in the Architecture of North Macedonia Cities

Rushadije Ramani Halili ¹, Merita Azemi ², Getoar Abduramani ³

Abstract. This paper deals with some important applications of fractal geometry in architecture, application in the designing of facades and building forms. Fractal geometry was used in producing classical architecture in many places in North Macedonia. We also identify some examples.

Keywords: Fractals; architecture; urban organization.

References


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ON THE SPHERICAL INDICATRIX CURVES OF THE SPACELIKE SALKOWSKI CURVE WITH TIMELIKE PRINCIPAL NORMAL IN LORENTZIAN 3-SPACE

Sumeyye Gur Mazlum \(^1\), Birkan Aksan \(^2\)

ABSTRACT. In this study, we compute the Frenet frames, the curvatures, the Frenet derivative formulas, the arc lengths, the geodesic curvatures according to \(R^3_1\), \(S^2_1\) (Lorentzian sphere) and \(H^2_0\) (hyperbolic sphere) of the spherical indicatrix curves of the spacelike Salkowski curve with the timelike principal normal in Lorentzian 3-space \(R^3_1\) and show the graphs of these indicatrix curves on the spheres.

Keywords: Salkowski curve; spherical indicatrix curves; geodesic curvatures.

Mathematics Subject Classification. Primary: 53A04; Secondary: 53A55

REFERENCES


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ON THE POLE INDICATRIX CURVE OF THE SPACELIKE SALKOWSKI CURVE WITH TIMELIKE PRINCIPAL NORMAL IN LORENTZIAN 3-SPACE

Sumeyye Gur Mazlum 1, Birkan Aksan 2

ABSTRACT. In this study, we compute the Frenet frames, the curvatures, the Frenet derivative formulas, the arc lengths, the geodesic curvatures according to $R^3_1$, $S^2_1$ (Lorentzian sphere) and $H^2_0$ (hyperbolic sphere) of the pole indicatrix curve of the spacelike Salkowski curve with the timelike principal normal in Lorentzian 3-space $R^3_1$ and show the graphs of these indicatrix curves on the spheres.

Keywords: Salkowski curve; pole indicatrix curves; geodesic curvatures.
Mathematics Subject Classification. Primary: 53A04; Secondary: 53A55

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Approximation of helices has been studied by using in many ways. In this study we have examined, how a circular helix can be written as Bézier curve. We have written the 3rd degree, 5th degree and the 7th degree Maclaurin series expansions of helices for the polynomial forms. Hence, they can be written cubic, 5th order, and 7th order Bézier curves, based on the control points with matrix form we have already given in $\mathbb{E}^3$. Further we have given the control points of the Bézier curve based on the coefficients of the Maclaurin series expansion of the circular helix.

Keywords: Helix; 7th order Bézier curve; Maclaurin series.

Mathematics Subject Classification. Primary: 53A04; Secondary: 53A05

References

ON POLYNOMIAL CURVES AS BÉZIER CURVES AND RIGID MOTIONS $\mathbb{E}^2$

Seyda Kilicoglu ¹, Suleyman Senyurt ²

ABSTRACT. Polynomial curves are very familiar curves in mathematics. Each Bézier curve can not be written in any degree polynomial curve in $\mathbb{E}^2$. In this study we have examined the conditions of being any degree polynomial curve based on the control points. Since polynomial function has the arc segments on themself which are can be written as any order Bézier curves with the control points. First we have examined the control points based on coefficient of the polynomial functions, and the coefficients of the polynomial functions based on the control points of 4th degree, 5th degree polynomial function which has a arc segments as any Bézier curve with given the control points. Further we give a generalization as a method to find, nth degree, degree polynomial function which has a arc segments as any Bézier curve with given the control points or vice versa. Rigid motions, Rotation and translation of them have been examined too in $\mathbb{E}^2$.

Keywords: Helix; 7th order Bézier curve; Maclaurin series.

Mathematics Subject Classification. Primary: 53A04; Secondary: 53A05

References


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Abstract. In this study, we handled biharmonic, $f$-harmonic and $f$-biharmonic magnetic Legendre curves in trans-Sasakian manifolds. We obtained necessary and sufficient conditions for a magnetic Legendre curve to be biharmonic, $f$-harmonic and $f$-biharmonic. Besides, we investigated the states of these conditions in the $\alpha-$Sasakian, $\beta-$Kenmotsu and cosymplectic manifolds.

Keywords: Magnetic Curves; trans-Sasakian manifolds; $f$-biharmonic curves.

Mathematics Subject Classification. Primary: 53C25, 53C15; Secondary: 58E20

References


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A Study on the Geometry of Dual Quaternions

Tulay Erisir ¹, Gokhan Mumcu ², Sezai Kiziltug ³, Yusuf Yayli ⁴

Abstract. This study presents the propositions regarding dual sphere geometry when the motion is represented by unit dual quaternions. These propositions are based on a two-way interaction between the geometric objects in the space of dual unit quaternions representing dual motion and the geometric objects in the D-module exposed to this dual motion. Therefore, it is thought that this study on the geometry of dual quaternions will bring innovations to the representation of motion with dual quaternions.

Keywords: Dual quaternion; screw motion.
Mathematics Subject Classification. Primary: 11R52; Secondary: 47L50

References


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Darboux Vectors and Constant Curvature Ratios in Minkowski 4-Space

Yonca Gul Gunay 1, Esen Iyigun 2

Abstract. In this paper; we study Darboux vectors, harmonic curvatures and constant curvature ratios of a non-null curve in Minkowski 4-Space.

Keywords: Minkowski 4-space; Darboux vector; harmonic curvature; constant curvature ratio.

Mathematics Subject Classification. Primary: 53C50; Secondary: 53A04

References


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HELICES VIA Q-FRAME IN LORENTZ 3-SPACE

Yasin Unluturk 1, Cumali Ekici 2, Dogan Unal 3

Abstract. In this research, q-helices by which we mean curves whose q-frame fields’ inner product with a non-zero fixed axis gives a constant value. We give the necessary and sufficient conditions for curves due to the q-frame to be q-helices. Then we obtain some results of the relations between q-helices and Darboux q-helices. Then we classify Darboux q-helices as special ones whose Darboux vector’s product with a non-zero fixed axis has a constant value by choosing the curve as one of the types of q-helices, and also the general case.

Keywords: q-frame; q-helices; Darboux q-helices.

Mathematics Subject Classification. Primary: 53A99; Secondary: 53B99

References

A NEW APPROACH TO THE WAVE EQUATIONS OF MASSIVE FIELDS

Zulal Derin Yaqub 1, Mehmet Ali Gungor 2

ABSTRACT. In this study, we consider the first-order and second-order wave equations for massive and massless fields by the alternative approach based on elliptic biquaternions. In particular, we give the elliptic biquaternionic plane wave solutions for these wave equations. Furthermore, we discuss these methods for describing the electromagnetic fields with massive quantum. We express the system of Maxwell-like equations similar to the system of Maxwell equations in electromagnetics for the massive field strengths by elliptic biquaternions. Then, we discuss field interpretation of the elliptic biquaternionic Klein-Gordon equation.

Keywords: Elliptic biquaternions, Klein–Gordon equation, Maxwell equations.

Mathematics Subject Classification. 11R52; 35Q41; 35Q61

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ABSTRACT. In this study, generalized rectifying ruled surfaces of Frenet-type framed base curves in the three-dimensional Euclidean space are introduced. These surfaces are a generalization of not only the tangent surfaces and binormal surfaces of Frenet-type framed base curves, but also the tangent surfaces and binormal surfaces of regular curves. Additionally, we present some geometric characterizations and properties of these surfaces. Moreover, generalized rectifying ruled surfaces are examined as framed surfaces by using the framed surface theory, and we investigate the basic invariants and curvatures of them. Then, several illustrative examples with figures are given to support the theorems and results.

Keywords: Framed surfaces; Frenet-type framed base curves; generalized rectifying ruled surfaces.
Mathematics Subject Classification. Primary: 53A05; Secondary: 57R45, 58K05

References


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Spinor Representations of Positional Adapted Frame in the Euclidean 3-Space

Zehra Isbilir ¹, Kahraman Esen Ozen ², Mehmet Guner ³

Abstract. The main goal of this study is to bring together the spinors, which have a major place in several disciplines from mathematics to physics, and Positional Adapted Frame (PAF) which is a new type frame that attracts the attention of many researchers. In accordance with this purpose, we introduce the spinor representations for the trajectories endowed with PAF in the Euclidean 3-space $E^3$, and construct the spinor equations of PAF vectors. Then, we find the relations between spinor representations of PAF and Serret-Frenet frame. Also we give some results and present some geometric interpretations with respect to this relationship. Moreover, we present an illustrative numerical example in order to support the given theorems and results.

Keywords: Kinematics of a particle; Positional Adapted Frame; spinors.
Mathematics Subject Classification. Primary: 70B05; Secondary: 57R25, 15A66

References


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OTHER AREAS
Threshold of the Aneurysmal Diameter of the Abdominal Aorta in the Population of the Setif Region of in Algeria

Bouharati Saddek 1, Bouharati Imene 2, Bouharati Khaoula 3

ABSTRACT. By definition, when the abdominal aorta undergoes dilation, this is called an aneurysm. However, this definition depends on the threshold diameter of the aorta reached after dilation. According to angiographic studies, aneurysm is considered when the diameter of the aorta exceeds 30 mm. According to the International Society for Cardiovascular Surgery/Society for Vascular Surgery Ad Hoc Committee, we speak of an aneurysm when the diameter of the infrarenal aorta exceeds one and a half times the normal diameter. It then becomes necessary to define the normal value of this diameter, which varies from 16 to 23 mm depending on the population concerned. Ultrasound is often used in screening for abdominal aortic aneurysms (AAA) for its simplicity and low cost. This study evaluates the prevalence of abdominal aortic aneurysms in the population at risk in the region of Sétif in Algeria. The study concerns a population of 850 patients over the age of 50 who consented to AAA screening. For each patient, a medical history is taken. Physical and ultrasound examinations are performed. The parameters sex, history of diabetes, hyperlipidemia, blood pressure, body mass index and smoking are listed. In order to establish an average diameter of the aorta in this population at risk, an intelligent analysis relating these factors to the diameter of the abdominal aorta is applied. As the system is very complex to analyze by classical mathematical techniques, the principles of fuzzy logic come in handy. The rule base that maps the input variables to the diameter of the aorta is created from the database of the performed analyzes. At the end of this program, it becomes possible to determine the average diameter of this population from which the clinician signifies an aneurysm.

Keywords: Abdominal aorta; Aneurysm; Intelligent system; Fuzzy logic

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ON THE ELEMENTARY MATHEMATICS TEACHING UNDERGRADUATE PROGRAM IN TURKEY, WHICH WAS RENEWED IN 2018

Celil Nebiyev 1

ABSTRACT. In this study, some problems in the Elementary Mathematics Teaching Undergraduate Program in Turkey, which was renewed in 2018, were discussed. As it is known, within the scope of the Teacher Training Program, the programs in the Faculties of Education have been updated by the Council of Higher Education and put into practice as of the 2018-2019 Academic Year. As a mathematician, I can say that with this updated new program, the weekly course hours have been reduced and Educational Sciences courses have been added, provided that the content of many field courses in Elementary Mathematics and Mathematics Teaching Undergraduate Programs remains almost the same. With this, while there are difficulties in raising the subject in the current situation in the field courses, this has been made much more difficult with the newly updated program. In this program, field courses such as Geometry, Elementary Number Theory and Differential Equations, which are very necessary for Secondary School Mathematics Teachers, are not included in the newly updated program. Similar updates are also available in the Mathematics Teaching Program. Reducing the hours of Mathematics lessons in fields such as Science Education, Classroom Teaching, and Computer Education and Instructional Technologies Education creates another problem. While the Abstract Mathematics course, which should normally be two semesters and at least three hours per week in the Primary Education Mathematics Teaching Program, was one semester and three hours per week before 2018, it has been reduced to a single semester and two hours per week in this new program. Proof methods, which are very necessary in mathematics, are also explained in the Abstract Mathematics course. In addition, the Abstract Mathematics course has a very important role in students’ abstract thinking. In this new program, this situation was interrupted by reducing the number of weekly lessons of this course to two.

Keywords: Education-Training; Elementary Mathematics Teaching; Teacher Training; Faculty of Education; Higher Education Council.

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References


Abstract. In this work at first we study a right-invariant control system as well a right-invariant optimal control problem on an arbitrary Lie groupoid and show that external curves of any optimal control problem on trivial Lie groupoid as well some others for example action groupoid evolve on the co-adjoint Lie groupoid. Our hypothesis is open for arbitrary Lie groupoid.

- Control systems on the some Lie groupoids,
- Ghorbanali Haghighatdoost, Azarbaijan Shahid Madani University, Tabriz, Iran, gorbanali@azaruniv.ac.ir
- Optimal control problem, Invariant control system, Hamiltonian system, Co-adjoint Lie groupoid.
- Mathematics Subject Classification 2020: 93A10; Secondary: 49k20
- References

Please submit your abstract(s) via http://www.iecmsa.org/login/.

Keywords: Optimal control problem, Invariant control system, Hamiltonian system, Co-adjoint Lie groupoid.

Mathematics Subject Classification. Primary: 93A10; Secondary: 49k20

References


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Dual-Generalized Complex Matrices
Nurten Gurses¹, Gulsum Yeliz Senturk²

Abstract. Some of four-component number systems can be constructed by utilizing complex, hyperbolic and dual numbers. By using the Cayley-Dickson doubling procedure with generalized complex and dual numbers, the dual-generalized complex (DGC) numbers can be defined [15]. The key point in carrying out this construction is that DGC numbers are commutative. In this paper, we explain how well-known classical matrix theory for real, complex and hypercomplex numbers can extend to DGC matrices. DGC matrices contains dual-complex matrices and dual-hyperbolic matrices as special cases and allows general contributions to the literature. This approach is examined by proving several characteristic theorems and fundamental concepts over DGC matrix theory.
Keywords: Dual-generalized complex number, Matrices over special rings.
Mathematics Subject Classification. Primary: 15B33.

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References

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A Surplus Calculation of Quadratic Demand and Supply Functions with Trapezoidal Fuzzification Method and Graded Mean Defuzzification Method

Salih Aytar

Abstract. Let the quadratic demand function be \( p(x) = a_0 - b_0x - c_0x^2 \) and the quadratic supply function be \( p(x) = d_0 + e_0x + g_0x^2 \) where \( x \) is a quantity and \( a_0, b_0, c_0, d_0, e_0 \) and \( g_0 \) are coefficients. In this talk, we fuzzify these coefficients using trapezoidal fuzzy numbers. Then we estimate consumer surplus and producer surplus. We use the graded mean defuzzification method to obtain the crisp values. Finally we compare our results with not only ordinary case but also triangular fuzzy case.

Keywords: Consumer Surplus; Producer Surplus; Quadratic Demand Function; Quadratic Supply Function; Trapezoidal Fuzzy Number.

Mathematics Subject Classification. Primary: 03E72; Secondary: 91B42.

References


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A New Lower Bound for the Randić Energy of Graphs

S. Burcu Bozkurt Altindag 1

Abstract. Let $G$ be a simple connected graph of order $n$ with Randić eigenvalues $\rho_1 \geq \rho_2 \geq \cdots \geq \rho_n$. The Randić energy of $G$ is defined as $RE(G) = \sum_{i=1}^{n} |\rho_i|$. In this study, we are interested in establishing a new lower bound for $RE(G)$.

Keywords: Graph; Randić eigenvalues; Randić energy.
Mathematics Subject Classification. Primary: 05C50; Secondary: 05C90

References


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On Relations Between the Normalized Laplacian Resolvent Energy and Kemeny’s Constant of Graphs

S. Burcu Bozkurt Altindag ¹

Abstract. For a simple connected graph $G$ of order $n$ with normalized Laplacian eigenvalues $\gamma_1 \geq \gamma_2 \geq \cdots \geq \gamma_{n-1} > \gamma_n = 0$, the normalized Laplacian resolvent energy and Kemeny’s constant of $G$ are defined as

$$ERN(G) = \sum_{i=1}^{n} \frac{1}{3 - \gamma_i}$$

$$K(G) = \sum_{i=1}^{n-1} \frac{1}{\gamma_i},$$

respectively. In this talk, some relations between $ERN(G)$ and $K(G)$ will be presented.

Keywords: Graph; Normalized Laplacian eigenvalues; Normalized Laplacian resolvent energy; Kemeny’s constant

Mathematics Subject Classification. Primary: 05C50; Secondary: 15A18

References


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\( q \)-P A R A M E T E R

Ugur Duran

Abstract. In this study, we introduce the Gould-Hopper based fully degenerate type2 poly-Euler polynomials with a \( q \) parameter and provide some of their properties. Moreover, we derive multifarious correlations and identities for these polynomials, including recurrence relations, symmetric property and implicit summation formulas.

Keywords: Gould-Hopper polynomials; Bernoulli polynomials; poly-Bernoulli polynomials; Stirling numbers of first kind; polyexponential functions.

Mathematics Subject Classification. Primary: 33C45; Secondary: 11B68, 11B73.

References


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ON GOULD-HOPPER BASED TRUNCATED DEGENERATE FROBENIUS-EULER POLYNOMIALS

Ugur Duran 1

ABSTRACT. In this study, we consider the Gould-Hopper based truncated degenerate Frobenius-Euler polynomials. Then we examine diverse properties and formulas covering addition formulas, correlations and derivation property. Also, we derive some interesting implicit summation formulas.

Keywords: Gould-Hopper polynomials; Frobenius-Euler polynomials; truncated degenerate Frobenius-Euler polynomials;
Mathematics Subject Classification. Primary: 11B68; Secondary: 33C45, 11B73.

REFERENCES


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STATISTICS
Discretization of Continuous Probability Distributions with Application to the Evaluation of Aggregate Risk

Alessandro Barbiero \(^1\), Asmerilda Hitaj \(^2\)

**Abstract.** In this work, we propose a novel family of procedures for deriving a discrete counterpart (supported on a lattice) to a continuous probability distribution, based on the minimization of an appropriate distance between cumulative distribution functions \([1]\). Explicit formulas for the probabilities of the discretized distribution are derived in general and examples are provided with reference to some well-known parametric families, comprising the exponential and Lomax distributions.

An application of the discretization procedures is presented in the insurance field, within the framework of the collective risk model, namely, for the (approximate) determination of the distribution of the total claims’ amount in a fixed period in a portfolio of insurance contracts, where discretization is used along with Panjer’s recursive formula, which can be applied when the claim size is discrete and the claim frequency distribution belongs to the so-called \((a, b, 0)\) class \([2]\). For some artificial settings, the accuracy of the approximation derived by combining Panjer’s formula along with discretization (for different span values) is assessed and compared to the ones obtained by approximating the total claims’ amount with the Gaussian or the translated Gamma distribution \([3]\).

Keywords: convolution; loss distribution; Panjer’s formula.
Mathematics Subject Classification: 62E17, 91B30

**References**


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A Note on Constrained General Linear Mixed Model
Melek Eris Buyukkaya, Nesrin Guler

Abstract. In this study, the authors are concerned with comparing dispersion matrices of the best linear unbiased predictors (BLUPs) under a constrained general linear mixed model (CGLMM) and its unconstrained forms. The authors aim to establish equalities and inequalities for comparing dispersion matrices using various rank formulas of block matrices and elementary matrix operations. The authors also give some comparison results for special cases of BLUPs. For the subjects related to the results obtained in this study, please see the following references [1]-[5].

Keywords: BLUP; comparison; constrained general linear mixed model; inertia; rank.
Mathematics Subject Classification. 62J05; 62H12; 15A03

References

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Neutrosophic Analysis of Experimental Data from the Completely Randomized Block Designs

Pranesh Kumar

Abstract. While dealing with the observed or measured data in surveys or experiments, it is not uncommon to deal with vague, incomplete, and imprecise information for whatever reasons. In this regard, researchers have proposed various emerging approaches such as fuzzy, intuitionistic fuzzy and neutrosophic logic and analysis, which provide better understanding, analysis and interpretations of the data. Neutrosophic logic is an extension of fuzzy logic where a variable $x$ is described by triplet values, i.e., $x = (t, i, f)$, where $t$ is the degree of truth, $f$ is the degree of false and $i$ is the level of indeterminacy. A neutrosophic data $x$ can be expressed as $x = d + i$, where $d$ is the determinate (sure) part of $x$, and $i$ is the indeterminate (unsure) part of $x$. Experimental design and analysis is a systematic, rigorous approach to problem-solving that applies principles and techniques at the data collection stage so as to ensure the generation of valid, defensible, and supportable conclusions. In generating data through experimentation, the experimenter has one factor of primary interest, which affects the response. However, there are other nuisance factors that may affect the response, but these are not of primary interest. A completely randomized block design uses blocking to remove the effects of a few of the most important nuisance factors and then, uses randomization to reduce the contaminating effects of the remaining nuisance factors. In this paper, we present the neutrosophic analysis of the experimental data to answer the question, “Does the type of cooking pot affect iron content?” Data was obtained from a randomized trial conducted to study the effect of consumption of food cooked in iron pots on iron status and growth of young children.

Keywords: Block designs; imprecise data; neutrosophic analysis.
Mathematics Subject Classification. Primary: 62K10; Secondary: 62K86

References


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Nonparametric Regression Using Spline and Kernel Mixed Estimator in the Case of Dengue Fever Models

Sifriyani Sifriyani 1, I. N. Budiantara 2, Syatirah Jalaluddin 3, Andrea T R Dani 4, R Ruslan 5

Abstract. This article describes innovations in the field of Statistics implemented in the Health Sector. Development of a nonparametric regression model using a mixed of spline truncated estimator and kernel estimator, to estimate the regression curve. This method is able to handle differences in data patterns between predictors in multiple nonparametric regression. The research is implemented on the handling and mitigation of Dengue Hemorrhagic Fever (DHF) with a special issue of factors that affect the increase in DHF. Truncated splines are polynomial pieces that have segmented and continuous properties. Truncated splines have knot points that are able to find their own estimated data wherever the data pattern moves. While the kernel estimator depends on bandwidth, which serves to control the smoothness of the regression curve. Empirical analysis of DHF data obtained that the Spline and Kernel mixture estimator was able to model DHF with GCV = 0.0011818 and R2 = 88.58%.

Keywords: Nonparametric regression; spline truncated estimator; kernel estimator; mixed estimator; Dengue Hemorrhagic Fever modeling.

Mathematics Subject Classification. Primary: Statistics

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REFERENCES


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Abstract. In this study, we aim to obtain some fixed point theorems using various auxiliary functions in the setting of metric and modular metric space. Besides, the given consequences indicates the applicability and validity of the outcomes of this study.

References

Abstract. We introduce the notion of $g - I$-closed set by using $I$-open sets as a new $g$-closed sets type in ideal topological spaces. We also investigate of these sets.

Keywords: $g$-closed sets; $I$-open sets; $g - I$-closed sets; $\Lambda_I$-operation.

Mathematics Subject Classification. Primary: 54A05; Secondary: 54C08

References

POSTER
ABSTRACT. Sanitary standards for drinking milk are often affected by unsuitable storage and transport conditions. The composition of milk is sensitive to external factors. The ambient temperature between 25 and 40°C is particularly favorable to the development of micro-organisms and a low temperature of 4°C, the recommended temperature for the conservation of milk and dairy products. Also, a strong acidity is unfavorable to their multiplication. Add to this, the hygiene of the container and the personnel as well as the shelf life play a big role. In order to maintain the milk in optimal conditions, it is necessary to control the storage and transport chain. This study supports the parameters that influence the process. An artificial neural network system is proposed in this analysis. The system input variables represent the factors characterizing these conditions. The output variable is expressed by maintaining the milk within the required standards. As artificial neural networks deal with complex phenomena, their application in this field makes it possible to optimize the conditions of storage and transport of drinking milk.

Keywords: Milk; sanitary standards; transport conditions; storage conditions; artificial neural networks.
ABSTRACT. From the physico-chemical point of view, milk is an emulsion of fat in a colloidal solution of proteins. Sanitary standards are established in order to preserve its sanitary quality. This relates to the pH and density, depending on its chemical and biological composition. However, the established limits are characterized by their rigidity while the system is very complex. Several factors are in combined interactions (the breed and age of the cow, as well as the season and the diet). This study aims to analyze the physico-chemical parameters of milk according to the extrinsic influences. As the system is very complex to analyze using classical mathematical techniques, an intelligent system is applied. A fuzzy inference system is established. The factors that alter its properties are considered as input variables to the system. The output variable expresses the quality of the milk. A database is established. The rule base connects the inputs to the output of the [If . . . Then] form. When the system is completed, this will allow random variables to be assigned to the input to automatically read the corresponding milk quality and therefore make the appropriate decision. As fuzzy logic deals with the uncertain and imprecise, its application in this analysis is adequate.

Keywords: Milk; physico-chemical; sanitary standards; extrinsic influences; fuzzy logic.
Abstract. Digital Elevation Models (DEMs for short) have a wide application in Hydrology, Geology, Environment and Civil Engineering, among other disciplines. Sometimes there exists more than one DEM from the same area. The difference among them may be due to the fact that they come from different producers, different methodologies to capture them or different cell sizes used in their production. Many applications require that all DEMs used have the same cell size to be interoperable [1, 2, 3], which implies a resampling of the original DEM. This resampling can influence the quality of the final product, so the resampling method used very important aspect to take into account.

In this work we propose the construction of a triangular spline quasi-interpolant over the type-1 triangulation of the partition into squares associated with the dataset to be approximated. The triangulation is endowed with a Powell-Sabin 6-split. Instead of expressing the quasi-interpolant in terms of a basis of B-spline-like functions, it is constructed by directly setting the coefficients of the Bernstein-Bézier representation of its restriction to each of the micro-triangles into which each macro-triangle is decomposed. Each coefficient will be determined from the values to be approximated at the points of a neighbourhood of the micro-triangle under consideration, making use of rules that will guarantee the required regularity and order of approximation.

This quasi-interpolating spline will provide a new resampling method that will allow to study its quality when going from a higher resolution to a lower resolution.

Keywords: Bivariate spline; quasi-interpolation; Digital Elevation Model.
Mathematics Subject Classification. Primary: 41A15; Secondary: 65D07

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References


ABSTRACT. In this work we present a new kind of probabilistic models, Semi-Hidden Gaussian Markov Models (SHGMM), intended for run analysis of continuous numeric time-discrete sequences with statistical inertia and memory. They are an extension of a former development for symbolic sequences [1], the Semi-Hidden Markov Models (SHMM), to continuous probability Gaussian distributions.

The proposed models are related to the hidden Markov models (HMM) [2], and they are called semi-hidden because generated sequences need less information than HMM sequences to infer the succession of states run by the source.

The main feature of SHGMM is that they work with statistical memory, i.e. the output’s emission probability distribution on the current state of the emitting source depends on a number of values already emitted in the previous state. The proposed model is useful for the generation and analysis of processes and numeric sequences containing runs.

The following classical [2] open problems arise for SHGMM too:

• Evaluation problem. Given an observation sequence \(O\) and a model \(\lambda\), efficiently compute the probability \(P[O|\lambda]\) of the sequence, given the model. For discrete SHMM, this problem has been solved by means of the so-called forward algorithm [3].

• Decoding problem. Given an observation sequence \(O\) and a model \(\lambda\), obtain the ‘optimal’ sequence of states that best explains the sequence.

• Training problem. Given an observation sequence \(O\), adjust the model \(\lambda\) parameters to maximize \(P[O|\lambda]\).

In addition, other open problems can be the extension to non-Gaussian probability distributions, and the extension to time-continuous sequences.

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λ-Deformed Quantum Mechanics: Generalized Statistical Functions

J. J. Peña 1, J. Morales 2

ABSTRACT. In this work, an algebraic approach applied to the position-dependent mass Hamiltonian to obtain a λ-deformed quantum mechanics is used. Likewise, their corresponding generalized λ-deformed operators for the position $x_\lambda$ and linear momentum operator $p_\lambda$ are derived with the commutation relationships keeping unchanged, namely $[x_\lambda, p_\lambda] = i\hbar$. Such generalized operators are straightforwardly generated by means of a canonical transformation of the position dependent mass Schrödinger equation where the von-Ross kinetic energy operator is expressed as the square of the λ-deformed quantum linear momentum operator plus a potential energy function. As an example, of the usefulness of the proposal, we consider the mass distribution $m(x) = m_0(1 + \lambda^2 x^2)^{-1}$ from where we get the canonical transformation that will be used to obtain its corresponding λ-deformed exponential function $\exp_\lambda(x) = (\lambda x + \sqrt{1 + \lambda^2 x^2})^{1/\lambda}$ as well as the λ-deformed logarithm function $\ln_\lambda(x) = \frac{x - \sqrt{1 - x^2}}{2\lambda}$ from where a statistical mechanics can be constructed. In fact the λ-deformed logarithm function can be rewritten as $\ln_\lambda(x) = x^{-2} \ln \frac{1 - x}{1 - x^2} = \ln \frac{1 - x}{1 - x^2}$, being $\ln \frac{1 - x}{1 - x^2}$ the celebrate expression for the generalized entropy $S_q$ introduced by Tsallis [2] for a microcanonical ensemble $S_q = \frac{W^{1 - q}}{1 - q} = \ln_{1 - q}(W)$ from which many thermodynamic functions can be generalized [3].

Keywords: Eigenvalue problems for linear operators; position dependent mass; deformed exponential function.

Mathematics Subject Classification. Primary: 47A75

REFERENCES


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A Spline-Based Approach to Model Resistive Switching Memristors

M. J. Ibáñez 1, D. Barrera 2, P. González 3, D. Maldonado 4, F. Jiménez 5, J. B. Roldán 6

Abstract. Resistive switching memristors present an exciting set of features that make them suitable for a wide range of applications, such as non-volatile memories and neuromorphic circuits.

Nevertheless, prior to the development of circuits making use of this emerging technology is necessary to get ready the infrastructure for device and circuit design software tools, essential industrial simulation programs in the electronic industry. For this purpose we need compact models for these new devices. These models represent analytically (through algebraic equations) important operation magnitudes: current, capacitances, internal temperature, etc., as a function of external applied voltages, signal frequency and so on. In this contribution we work on the modeling issue to advance in the field of circuit simulation. To do so, we make use of smoothing splines. In particular, we model current-voltage curves of devices fabricated and measured at the Institute of Microelectronics of Barcelona (CNM-CSIC) [1]. For the characterization of these devices, hundreds of curves are measured in a successive manner to analyze the operation of the devices, their endurance, their variability and their capacity to mimic biological synapses.

Here, we study reset current curves and perform an in-depth modeling process based on smoothing splines. In this respect, we change previously employed methodologies [2] based on the charge-flux domain to work directly on the current-voltage measured curves. We develop a model that allows reproducing analytically the strongly non-linear behavior of the devices.

Keywords: Memristors; spline approximation; smoothing spline.
Mathematics Subject Classification. Primary: 45A15; Secondary: 65D07

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REFERENCES


Abstract. The main objective of this paper is a study of some new local fractional Hilbert-type inequalities. We apply our general results to homogeneous kernels. Also, we obtain the best possible constants in term of local fractional hypergeometric function.

Keyword: Hilbert inequality; conjugate parameters; local fractional integral.
Mathematics Subject Classification. 26D15

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List of Participants of IECMSA-2022

**Invited Speakers**

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<td>Technical University of Cluj-Napoca, Romania</td>
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<td>Prof. Dr. Velichka Milousheva</td>
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<td>University of Phayao, Thailand</td>
</tr>
<tr>
<td>Yonca Gul Gunay</td>
<td>Bursa Uludag University, Turkey</td>
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<tr>
<td>Zulal Derin Yaqub</td>
<td>Sakarya University, Turkey</td>
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