4th International Eurasian Conference on Mathematical Sciences and Applications

Books of Abstracts

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FOREWORD

The “4th International Eurasian Conference on Mathematical Sciences and Applications (IECMSA-2015)” jointly organized by Sakarya University, Kocaeli University, Bilecik Seyh Edebali University, Turkic World Mathematical Society, University of Hassan II, University of Mohammed V and International Balkan University, will be hold on 1 August--3 September 2015 in Athens, Greece.

The series of the International Eurasian Conference on Mathematical Sciences and Applications provide communication between the members of the mathematics community, interdisciplinary researchers, educators, statisticians and engineers. These conferences are held every year in different countries with distinguished participants from all over the world and they build agelong Cultural Bridges.

After the following three very successful international conferences the IECMSA-2012, Prishtine, Kosovo, IECMSA-2013, Sarajevo, Bosnia and Herzegovina, IECMSA-2014, Vienna, Austria, now IECMSA-2015, Athens, Greece, hosts 300 esteemed participants from 28 different countries.

IECMSA-2015 has taken a lot of applications all over the world. These big numbers of applications have given us opportunity to choose the best ones to reach the higher scientific level. After having been reviewed by the distinguished members of International Scientific Committee; 187 oral and 43 poster presentations have been accepted and the abstracts of them have been presented in this book. Moreover, five worldwide distinguished speakers have been invited to the conference and the abstracts of the plenary talks have been substituted in this book, too. The electronic version of the abstracts of all presentations can be found in the Conference Abstracts Book at www.iecmsa.org
I wish to thank all members of scientific committee and sponsors for their continued support to the IECMSA-2015. And finally, I would like to sincerely thank all the participants of IECMSA-2015 for contributing to this great meeting in many different ways. I believe and hope that each of them will get the maximum benefit from the conference. Welcome to Athens!

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Authenticated Encryption Based on Prime Moduli

Debasis Giri¹

Abstract. In an authenticated encryption scheme, a signer signs a message for a particular verifier using signer’s own private key and the public key of the verifier. The verifier recovers the original message from the signencrypted message using the signer’s public key and the verifier’s own private key. Significant work is done in this direction by the authors Zheng and others. We first describe an authenticated encryption scheme for signing fixed block length message, which is based upon a variant of the ElGamal encryption scheme and a variant of the ElGamal signature scheme over large prime moduli. We then also present an another authenticated encryption scheme that can be adapted for signature generation of arbitrary length of message.

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An Algebraic Description of Gradient Descent Decoding

Edgar Martínez-Moro ¹

Abstract. Several constructions in (binary) linear block codes are also related to matroid theory topics or integer programming. These constructions rely on a given order in the ground set of the matroid/code. In this talk we will show how basic coding theory and gradient descent coding methods can be seen as instances of some problems associated to reductions and ideal membership to some binomial ideals. We will give a short introduction to the Gröbner representation of a binary matroid/code and we show how it can be used for studying different sets bases, cycles, minimal code words, etc..

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Elliptic Diophantine Equations and the Elliptic Logarithm Method
Nikos Tzanakis¹

Abstract. By an Elliptic Diophantine equation we mean one of the form \( f(x, y) = 0 \), where:

- \( f \) is a polynomial with integer coefficients.
- The plane curve defined by the equation \( f = 0 \) is of genus one and has a (projective) point with rational coordinates.
- The sought for solutions \((x, y)\) are rational integers or \(S\)-integers.

The standard elliptic Diophantine equation example comes from \( f(x, y) = x^3 + ax + b - y^2 \), where \( a, b \) are integers and \( 4a^3 + 27b^2 \neq 0 \); this is the Weierstrass equation.

Around 1994, with R.J. Stroeker, we elaborated the ideas of S. Lang [3], [4] concerning these equations, and published in [6] a practical method—the Elliptic Logarithm Method; Ellog for short—for solving explicitly such equations over the integers. A little later, a more or less analogous method was independently developed in [2].

In the years to follow, many interesting applications of the Ellog to Diophantine equations over the integers (for example, to \( f(x, y) = 0 \) where \( f(x, y) = ax^4 + bx^3 + cx^2 + dx + e - y^2 \), and to the resolution of simultaneous Pell equations) have been published. Moreover, the method was implemented by the MAGMA group [1] into a routine of the package.

In the turning of the century, with R.J. Stroeker, we developed a general method for solving over the integers an elliptic equation of any shape, like, for example, \( f(x, y) = 0 \) with \( f(x, y) = x^5 + x^4 - 2y^3, x^6 + x^3 - 2y^2, x^7 + x^4 - 2y^2 \) or with much more “complicated” \( f(x, y) \); see [7]. Generalizing the method in an other direction, Pethö, Zimmer, Gebel and Herrmann, in [5], extended the method for solving the Weierstrass elliptic equation from the integers to the \(S\)-integers for an explicitly given (finite) set \( S \) of primes. The combination of

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these two generalizations which would make possible a practical method for solving the
general elliptic Diophantine equation over the \( S \)-integers, has not been accomplished yet.

In my lecture I will try to give an overview of the Ellog and the elegant mathematical
tools and techniques behind it. I do not intend to address to specialists of Diophantine
equations, but to a general mathematical audience.

**AMS 2010.** 11G05; 11D25; 11J86; 11Y50.

**References**


Möbius Transformations and the Circle-Preserving Property

Nihal Yılmaz Özgür¹

Abstract. Let $\mathbb{R}^n$ be the real $n$ dimensional space and let $\hat{\mathbb{R}}^n = \mathbb{R}^n \cup \{\infty\}$. A map $f : \hat{\mathbb{R}}^n \to \hat{\mathbb{R}}^n$ is said to be $r$-sphere preserving if $f$ maps every $r$-dimensional sphere onto an $r$-dimensional sphere. When $r = 1$ it is called the corresponding map $f$ as a circle-preserving map in $\hat{\mathbb{R}}^n$. In this talk we give a survey on the circle-preserving property of Möbius transformations acting on $\hat{\mathbb{R}}^n = \mathbb{R}^n \cup \{\infty\}$.

Keywords. Möbius Transformation, Circle-Preserving Property.


References


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Advances in Frames, Riesz Bases and Frames on Hilbert C* Modules
Ram N. Mohapatra

Abstract. Frames have been of interest for past several years after the success of wavelets for image processing and the introduction of wavelet frames. There has been considerable work on Frames in Hilbert spaces, Banach spaces and Hilbert C* module. There is also a lot of work on optimal Frames for Erasers, gframes, semi-frames and frames in semi-inner product spaces. In this talk we shall consider some of the developments in these areas and some open problems relating to unbiased frames.

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ALGEBRA

www.iecmsa.org
Representations of a Leavitt Path Algebra with Coefficients in an Abelian Category
Ayten Koç and Murad Özaydin

Abstract. We define and study the module category of a Leavitt path algebra of finitely separated digraph with coefficients in an abelian category. When the abelian category is that of $F$-vector spaces then we recover the module category of $L_F(\Gamma)$, the Leavitt path algebra with coefficients in $F$. In the case of an arbitrary abelian category the module category is defined without specifying the algebra (which may not even exist and when it exits is unique only up to Morita equivalence).

Keywords. Noncommutative Rings, Representations, Morita Theory, Abelian Categories.

AMS 2010. 16G20, 18E35.

References


Some Relations via \(k\)-Balancing Numbers

Arzu Özkoç\(^1\) and Ahmet Tekcan\(^2\)

Abstract. In this work, we derive some relations between the \(k\)-balancing numbers and the sums of \(k\)-balancing numbers. Also we consider some formulas for the greatest common divisor of \(k\)-balancing numbers. Further we deduce the simple continued fraction expansion of \(k\)-balancing numbers.

Keywords. Balancing Number, Pell Number, Binary Linear Recurrences.

AMS 2010. 11B37, 11B39.

References


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Vertex-Decomposability and Depth Bounds of Independence Complexes
Alper Ülker¹ and Tahsin Öner²

Abstract. Let $G$ be a simple undirected graph. Let $\text{Ind}(G)$ be the independence complex of $G$ whose faces correspond to the independent sets of $G$. We call the graph $G$ Cohen-Macaulay if and only if $\dim(\text{Ind}(G)) = \text{depth}(\text{Ind}(G))$ [1]. A simplicial complex $\Delta$ is said to be vertex-decomposable if it is either a simplex or else has some vertex $v$ so that both $\Delta$ and $\text{link}_\Delta(v)$ are vertex-decomposable and no face of $\text{link}_\Delta(v)$ is a facet of $\Delta \setminus v$ [3]. We call a simplicial complex pure if all its facets have the same dimension. If $\Delta$ is pure and vertex-decomposable complex then $\Delta$ is Cohen-Macaulay complex. Let $\text{skel}_d \Delta$ be the $d$–skeleton of complex $\Delta$ whose all faces have dimension $\leq d$ [4]. $\text{depth}(\Delta) \geq d$ if and only if $\text{skel}_d \Delta$ is Cohen-Macaulay [2]. In this talk, we give some results about vertex-decomposability of some particular dimensional skeletons of $\text{Ind}(G)$.

Keywords. Cohen-Macaulay Graphs, Vertex-Decomposability.

AMS 2010. 13F55, 05E45, 05E40.

References


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On Generalized FI-Extending Modules
Canan Celep Yücel

Abstract. A module $M$ is called $FI$-$extending$ if every fully invariant submodule of $M$ is essential in a direct summand of $M$. In this work, we define $generalized$ $FI$-$extending$ ($GFI$-$extending$) module as for any fully invariant submodule $N$ of $M$ there exists a direct summand $D$ of $M$ such that $N \leq D$ and that $D/N$ is singular. We give some characterizations of this class of modules. To this end we focus on direct sums and summands of the former class.

Keywords. Extending Module, Fully Invariant Submodule, FI-Extending, GFI-Extending.

AMS 2010. 16D50; 16D70.

References


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An Explicit Homomorphism from the Complex Clifford Algebra $\mathbb{C}l_{2n}$ to the Cuntz Algebra $\mathcal{O}_{2^n}$

Derya Çelik

Abstract. It is well known that there exists an isomorphism $g$ from the complex Clifford algebra $\mathbb{C}l_{2n}$ to the matrix algebra $\mathbb{C}(2^n)$. Moreover, the matrix algebra $\mathbb{C}(2^n)$ is homomorphic (with homomorphism $h$) to the Cuntz algebra $\mathcal{O}_{2^n}$ (see [1]). Thus, the composition $h \circ g$ gives naturally a homomorphism from $\mathbb{C}l_{2n}$ to $\mathcal{O}_{2^n}$. Since we do not have an explicit expression of this composition yet, it would be desirable to give a direct homomorphism from $\mathbb{C}l_{2n}$ to $\mathcal{O}_{2^n}$ explicitly. In this work, we construct such an explicit homomorphism from the complex Clifford algebra $\mathbb{C}l_{2n}$ to the Cuntz algebra $\mathcal{O}_{2^n}$.

Keywords. Clifford Algebra, Cuntz Algebra, Homomorphism.

AMS 2010. 15A66.

References

Circulant Matrices in Terms of Tetranacci Numbers
Elif Ardiyok1 and Arzu Özköç2

Abstract. In this work, the eigenvalues and determinants of the circulant matrices involving tetranacci sequence $M_n$ and companion-tetranacci sequence $K_n$ are denoted by tetranacci and companion-tetranacci numbers. Also Euclidean norms, spectral norms of circulant and negacyclic matrices are obtained.

Keywords. Circulant Matrix, Negacyclic Matrix, Tetranacci Numbers, Determinant.

AMS 2010. 11B83, 15A60, 05A15, 11C20.

References


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A Symmetric Key Fully Homomorphic Encryption Scheme using General Chinese Remainder Theorem
Emin Aygün¹ and Erkam Lüy²

Abstract. The Fully Homomorphic Encryption was an open problem up to 2009. In 2009, Gentry solved the problem. After Gentry's solution, a lot of work have made on Fully Homomorphic Encryption. However these works have stil too high time complexities for practical use. In [7], authors suggested a symmetric key homomorphic encryption scheme. Authors proved that scheme is faster and the security of scheme is equivalent to the large integer factorization problem. Scheme is based on matrix operations which are computationally fully homomorphic. After that, in [8] and [9] authors extended the ideas and suggested a new scheme. In [7] authors used 2m prime numbers in keygen algorithm and in [8] and [9] authors extended this to 2m mutually prime numbers. In [7], [8] and [9] authors used Chinese Remainder Theorem in Encryption algorithm for security of their encryption scheme is equivalent to the large integer factorization problem.

We extend the approach used in [7], [8] and [9]. We use General Chinese Remainder Theorem in Encryption algorithm and obtained a new fully homomorphic encryption scheme by using General Chinese Remainder Theorem.

Keywords. Fully Homomorphic Encryption, Large Integer Factorization, General Chinese Remainder Theorem.


References


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Soft Radicals
Emin Aygün¹, Akın Osman Atagün² and Betül Erdal¹

Abstract. Soft set theory, proposed by Molodtsov, has been regarded as an effective mathematical tool to deal with uncertain objects. In this paper, we define a radical of an ideal in soft set theory by using two different soft ideal concepts: a soft ideal of a ring and a soft ideal of a soft ring. We give some results and illustrate with several examples.

Keywords. Soft sets, Radicals, soft radicals, Ideals.

AMS 2010. 16Y30, 03G25.

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Fixed Points on NG-Groups
Faraj A. Abdunabi

Abstract. We consider the NG-group which consisting of transformations on a non-empty set A and the group has no bijection as its element. Recall a permutation group on A is a group consisting of bijections from A to A with respect to compositions of mappings. It is well known that any permutation group on a set A with cardinality n has order not greater than n!. There are some authors, [10], [9], Problem 1.4 in [1], considering groups which consists of non-bijective transformations on A where the binary operation is the composition of mappings. Our result is on the orders of such groups are mapping on a non-empty set A with respect to function compositions which are not subsets of symmetric groups by using the fixed points.

Keywords. Symmetric Groups, Fixed Points.


References


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Invariant Ring of $\text{Aut}(V, H)$
Fawad Hussain

Abstract. Let $V$ be a finite dimensional vector space over the finite field $F_q$ with basis $e_1, \ldots, e_n$. Suppose $x_1, \ldots, x_n$ is the dual basis of the dual vector space $V^*$. Let $G \leq \text{GL}(V)$ and consider the polynomial ring in the $n$ indeterminates $F_q[x_1, \ldots, x_n]$. Invariant theory over finite fields is a branch of abstract algebra. The theory deals with those elements of $F_q[x_1, \ldots, x_n]$ which do not change under the action of the group $G$. These elements form a ring structure which is called the ring of invariants of the group $G$.

For a long time there has been interest in finding the ring of invariants of the group $G \leq \text{GL}(V)$. The rings of invariants of the general linear and the special linear groups were computed early in the 20th century by Dickson in [2]. These were found to be a graded polynomial algebras in both cases. In 1992, Carlisle and Kropholler calculated the ring of invariants of the symplectic group in [4] and their result showed that this ring of invariants is a graded complete intersection. In 2005 Kropholler, Mohseni Rajaei and Segal [4] found explicit generators and relations for the rings of invariants of orthogonal groups over $F_2$ but the general case is still open. In 2006, Chu and Jow [3] computed rings of invariants of unitary groups. In the last two cases it was found that the rings of invariants are graded complete intersections. In this talk I will discuss the ring of invariants of the following group:

$$\text{Aut}(V, H) = \{ g \in \text{GL}(V) : H(gv, gu) = H(v, u) \text{ for all } v, u \in V \}$$

where $V$ is a vector space over the finite field $F_q$ and $H$ is a singular hermitian form on $V$.

Keywords. Aut$(V, H)$, Polynomial Invariants, Graded Complete Intersection.

References


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Solution of a Matrix Completion Problem and Nil-Clean Companion Matrices
George Ciprian Modoi

Abstract. We solve a matrix completion problem, more precisely we write any companion matrix as a sum between an idempotent matrix and a matrix with prescribed characteristic polynomial. The number of applications of the matrix completion problem to information theory, electrical engineering etc. is huge (see for example [2], [3] or [4]). Our application is a more theoretical one: We describe nil-clean companion matrices over fields. Recall that an element of a ring is called clean or nil-clean if it decomposes as a sum between an idempotent and a unit, respectively a nilpotent. It turns out that decompositions like these are important in the study of some properties of rings, see [5]. This presentation is based on a joint work with Simion Breaz, [1].

Keywords. Matrix Completion, Companion Matrix, Nil-Clean Matrix


References


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A Presentation of Free Lie Algebra $F/\gamma_3(F)'$

Gülistan Kaya Gök and Naime Ekici

Abstract. Let $F$ be free Lie algebra generated by the free generators $x$ and $y$. By using the technique of Gröbner-Shirshov bases we show that the Lie algebra $F/\gamma_3(F)'$, has the presentation $\langle x, y | \Delta \rangle$, where $\Delta$ is the minimal Gröbner basis of the algebra $\gamma_3(F)'$.

Keywords. Free Lie Algebra, Presentation, Gröbner Basis.

AMS 2010. 17B01.

References


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Centering nonlinear Fuchsian Codes
M. Alsina

Abstract. Algebraic structures as Fuchsian groups have been applied to information theory to construct nonlinear codes. A new transmission scheme for additive white Gaussian noisy (AWGN) channels based on Fuchsian groups was presented at [1], and their generalization to higher rate was developed at [2]. In this talk we review the general construction and focus on the study of the center of those codes. In order to do that we use the geometry of the hyperbolic uniformizations of Shimura curves attached to the Fuchsian groups developed at [3]. This work is also related with a series of papers by Palazzo et al. among others (see for example [4]).

Keywords. Nonlinear Codes, Fuchsian Groups, Hyperbolic Geometry.

AMS 2010. 94B60, 94B35, 11F06, 20H10, 51M10.

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On the Codes over the Ring $IF_2 + vIF_2 + uIF_2 + u^2IF_2$

Mustafa Özkan$^1$ and Figen Öke$^2$

Abstract. In this paper the ring $IF_2 + vIF_2 + uIF_2 + u^2IF_2$ where $u^3 = 0 , v^2 = 0 , uv = vu = 0$ is defined. Thus it is shown that the Gray image of $(1+v)$–constacyclic codes with odd order over the ring $IF_2 + vIF_2 + uIF_2 + u^2IF_2$ is a cyclic code over the ring $IF_2 + uIF_2 + u^2IF_2$. Also it is shown that there exist a quasicyclic codes of index 2 over the ring $IF_2 + vIF_2 + uIF_2 + u^2IF_2$.

Keywords. Cylic Codes, Gray Map, Codes Over Rings.

AMS 2010. 94B05 , 94B15 , 94B60.

References


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Some Special Codes Over $\mathbb{F}_3 + v\mathbb{F}_3 + u\mathbb{F}_3 + u^2\mathbb{F}_3$

Mustafa Özkan¹ and Figen Öke²

Abstract. In this paper the structure of the ring $\mathbb{F}_3[u, v]/\langle u^3, v^2, uv \rangle$ where $u^3 = 0$, $v^2 = 0$ and $uv = vu = 0$ is described. The distance function on this ring which is isomorphic to the ring $R = \mathbb{F}_3 + v\mathbb{F}_3 + u\mathbb{F}_3 + u^2\mathbb{F}_3$ is defined. This means that linear codes over the ring $R$ can be written. Then it’s shown that the Gray images of cyclic codes over the ring $R$ are quasi-cyclic codes of index 2 over the ring $\mathbb{F}_3 + v\mathbb{F}_3$. Then another Gray map from the ring $\mathbb{F}_3 + v\mathbb{F}_3$ to $\mathbb{F}_3$ is described. Also the relation between the cyclic codes over the ring $R = \mathbb{F}_3 + v\mathbb{F}_3 + u\mathbb{F}_3 + u^2\mathbb{F}_3$ and quasi-cyclic codes over the field $\mathbb{F}_3$ is established.

Keywords. Linear Codes, Quasi-Cyclic Codes, Gray Map.

AMS 2010. 94B05, 94B15, 94B60.

References


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Minimaxness and Cofiniteness Properties of Local Cohomology Modules

Monireh Sedghi

Abstract. Let $R$ be a commutative Noetherian ring, $I$ an ideal of $R$ and $M$ a non-zero $R$-module. The purpose of this paper is to introduce the notation of the $n$-th finiteness dimension $f^n_i(M) := \inf \{ f_{R_p}(M_p) : p \in \text{Supp}(M/I M) \text{ and } \dim R/p \geq n \}$, for all $n \in \mathbb{N}_0$, and to prove the following results:

(i) $f^1_i(M) := \inf \{ i \in \mathbb{N}_0 : H^i_I(M) \text{ is not minimax} \}$.

(ii) The $R$-modules $H^i_I(M)$ are $I$-cofinite for all $i < f^2_i(M)$ and for all minimax submodules $N$ of $H^i_I(M)$, the $R$-modules

$$\text{Hom}_R(R/I, H^i_I(M)/N) \text{ and } \text{Ext}_R^i(R/I, H^i_I(M)/N)$$

are finitely generated, whenever $f^2_i(M)$ is finite. This implies that if $I$ has dimension one, then $H^i_I(M)$ is $I$-cofinite for every $i \geq 0$, which is generalization of the main results of Defino-Marley, Yoshide and Bahmanpour-Naghipour.

(iii) $f^2_i(M) = \inf \{ i \in \mathbb{N}_0 : H^i_I(M) \text{ is not weakly Laskerian} \}$, whenever $R$ is semilocal.

(iv) The $R$-modules $\text{Ext}_R^j(R/I, H^i_I(M))$ are weakly laskerian for all $j \geq 0$ and all $i < f^3_i(M)$, whenever $(R,m)$ is complete Noetherian local ring.

Keywords. Cofinite Module, Minimax Module, Eakly Laskerian Module.

AMS 2010. 13D45, 14B15, 13E05.

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Abstract. In this work we give a survey of the generalized Shmel’kin embedding. Let $F$ be a free product of finitely generated free abelian Lie algebras, $R$ be an ideal of $F$ and $V$ be a variety of Lie algebras. Shmel’kin has found an embedding for a Lie algebra $\frac{F}{V(R)}$, where $V(R)$ is the verbal ideal of $R$ corresponding to variety $V$. In the case of $\frac{F}{V(R)}$ is a solvable product, we apply Shmel’kin embedding for the algebra $\frac{F}{V(R)}$. Using this embedding we describe generalized Fox derivatives in a solvable product of finitely generated free abelian Lie algebras.

Keywords. Free Lie Algebras, Solvable Product, Embedding.

AMS 2010. 17B01, 17B40.

References


Rank Properties of the Direct Product of Finite Cyclic Groups
Osman Kelekci\textsuperscript{1}

Abstract. There are five different ranks defined as small rank, lower rank, intermediate rank, upper rank and large rank, respectively ([1], [2]). In previous studies, these ranks are calculated for certain semigroups and groups ([3], [4]). All the ranks of the direct product of finite cyclic groups are given in this work.

Keywords. Cyclic Group, Direct Product, Ranks.

AMS 2010. 20F05, 20K25.

References


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A Note on a Category of Cofinite Modules which is Abelian

Reza Naghipour

Abstract. Let $R$ denote a commutative Noetherian (not necessarily local) ring, and $I$ an ideal of $R$ of dimension one. The main purpose of this paper is to generalize, and to provide a short proof of, K. I. Kawasaki's Theorem that the category $\mathcal{M}(R,I)_{\text{cof}}$ of $I$-cofinite modules over a commutative Noetherian local ring $R$ forms an Abelian subcategory of the category of all $R$-modules. Consequently, this assertion answers affirmatively the question raised by R. Hartshorne in [it Affine duality and cofiniteness], Invent. Math. (1970), 145-164, for an ideal of dimension one in a commutative Noetherian ring $R$.

Keywords. Abelian Category, Arithmetic Rank, Cofinite Module, Noetherian Rings.

AMS 2010. 13D45, 14B15, 13E05.
The Values of a Class of Dirichlet Series at the Non Positive Integers
Sadaoui Boualem

Abstract. We relate the special value at a non positive integer \( s = (s_1, \ldots, s_r) = (-N_1, \ldots, -N_r) = -N \), obtained by meromorphic continuation of the multiple Dirichlet series

\[
Z(P, s) = \sum_{m = (m_1, \ldots, m_n) \in \mathbb{N}^n} \frac{1}{\prod_{i=1}^{r} P_i^{s_i}(m)}
\]

to special values of the function

\[
Y(P, s) = \int_{[1, +\infty]^n} \frac{1}{\prod_{i=1}^{r} P_i^{s_i}(x)} \, dx
\]

Where \( x = (x_1, \ldots, x_n) \) and \( P = (P_1, \ldots, P_r) \) are polynomials of several variables which verified a certain conditions.

We prove a simple relation between \( Z(P_a, -N) \) and \( Y(P_a, -N) \), such that for all \( a = (a_1, \ldots, a_n) \in \mathbb{R}^n \), with the notation \( P_a = (P_{1,a}, \ldots, P_{r,a}) \), where

\[
P_{i,a}(x) = P_{i,a}(x + a) = P_{i,a}(x_1 + a_1, \ldots, x_n + a_n)
\]
is the shifted polynomial.

Keywords. Meromorphic Continuation; Integral Representation; Special Values.

AMS 2010. 11M32; 11M41.

References


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On Congruences with the Terms of Second order Sequence and Harmonic Numbers

Sibel Koparal\textsuperscript{1} and Neşe Ömür\textsuperscript{2}

Abstract. In this study, we give the congruences involving the terms of second order sequence \( \{u_n(A, B)\} \) and harmonic numbers. For example, for any prime \( p > 2b + 1 \),
\[
\sum_{k=0}^{p-1} \frac{u_{k-(1-(\frac{p}{d}))/2}}{b^k} \equiv 0 \pmod{p},
\]
and for a prime \( p > 3 \),
\[
\sum_{k=1}^{p-1} \frac{H_k P_{k-1}}{2^k} \equiv 0 \pmod{p}, \quad \sum_{k=1}^{p-1} \frac{H_k Q_{k-1}}{2^k} \equiv \frac{2}{p} \sum_{k=1}^{p-1} \frac{Q_{k-1}}{2^k} \pmod{p},
\]
where \( \Delta = 4B - A^2 \), \( P_n \) and \( Q_n \) are \( n \)-th Pell and Pell-Lucas numbers.

Keywords. Congruences, Fibonacci Numbers, Pell Numbers.

AMS 2010. 11B39, 05A19.

References


On Commuting Automorphisms of Some Finite P-Groups
Sandeep Singh

Abstract: Let G be a finite p-group. In this article, under some certain conditions, we prove that if G is nilpotent group of either maximal or co-class 2 or co-class 3, then Set of all commuting automorphisms of G form the subgroup. Also some positive answers of questions raised in the article of Deaconescu, Silberg and Walls [2] are given.

Keywords. Nilpotent Groups, Commuting Automorphism.

References


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Permuting n-f-Derivations on Lattices
Şahin Ceran¹ and Utku Pehlivan²

Abstract. In this paper as a generalization of permuting tri-f-derivation on a lattice we introduced the notion of permuting n-f- derivation of a lattice. We defined the isotone permuting n-f-derivation and got some interesting results about isotoneness. We characterized the distributive and isotone lattices by permuting n-f-derivation.

Keywords. Lattice, Derivation, Permuting n-f-Derivation.

AMS 2010. 06B35, 06B99, 16B70.

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Automorphisms of the Lie Algebras Related with 2x2 Generic Matrices
Şehmus Fındık¹

Abstract. Let $F_m$ be the relatively free algebra of rank $m$ in the variety of Lie algebras generated by the algebra $sl_2(K)$ over a field $K$ of characteristic 0. We describe the inner and outer automorphisms of the completion of $F_m$ with respect to the formal power series topology ([1], [2]). As a consequence we obtain the description of the inner and outer automorphisms of the factor algebra of $F_m$ modulo the members of its lower central series.

Some of the results were obtained with Vesselin Drensky².

Keywords. Free Lie Algebras, Generic Matrices, Inner and Outer Automorphisms.

References


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On the Ambarzumyan's Theorem for the Quasi-Periodic Boundary Conditions
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Abstract. We obtain the classical Ambarzumyan’s theorem for the Sturm-Liouville operators with a summable potential and quasi-periodic boundary conditions, when there is not any additional condition on the potential q.

Keywords. Ambarzumyan Theorem, Inverse Spectral Theory, Hill Operator, Quasi-periodic

AMS 2010. 34A55, 34B30, 34L05, 47E05, 34B09

References


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Quasi-Partial b-Metric Spaces and Some Related Fixed Point Theorems

Anuradha Gupta\textsuperscript{1} and Pragati Gautam\textsuperscript{2}

\textbf{Abstract:} In 1989, Bakhtin [1] introduced the concept of a b-metric space as a generalization of metric spaces which was further extended by Czerwik [2]. In 1994, Matthews [3] introduced the notion of partial metric spaces and extended the Banach Contraction Principle from metric spaces to partial metric spaces. Later, Shukla [4] generalized both the concept of b-metric and partial metric spaces by introducing the partial b-metric spaces. Karapinar [5] introduced the concept of quasi-partial metric space and studied some fixed point theorems on these spaces. In this paper, the concept of quasi-partial b-metric space is introduced which is a generalization of quasi-partial metric space and general fixed point theorems are proved in setting of such spaces. Some examples are also given to verify the effectiveness of the main results.

\textbf{Keywords.} Quasi-partial Metric, T-orbitally Lower Semi-continuous, Quasi-partial b-metric Space, Fixed Point Theorem.

\textbf{AMS 2010.} 47H10, 54H25.

\textbf{References:}


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On Transformation Types of the $\Gamma_0(N)$ and the Suborbital Graph $F_{u,N}$

Ali Hikmet Değer

Abstract. In [1] authors studied the action of $\Gamma$ Modular group on the extended rational set $\mathbb{Q} := \mathbb{Q} \cup \{\infty\}$ by using suborbital graphs introduced in 1967 by Sims [2] for finite permutation groups. The simplest example of the suborbital graph is the well-known Farey graph $\mathcal{F} := G_{1,1}$ which is related to the Farey sequence $F_m$. In [1] authors generalized the properties of $\mathcal{F}$ to suborbital graphs $F_{u,N}$ which are isomorphic to a subgraph of $\mathcal{F}$.

In this paper we give the $F_{u,N}$-distance by using the Farey distance from [1]. We derive the result how a shortest path in $F_{u,N}$ from vertices $\infty$ to $w$ can be found by expressing $w$ as a continued fraction. Also we examine the transformation types of the congruence subgroup $\Gamma_0(N)$ of $\Gamma$ which gives paths of minimal length of the suborbital graph $F_{u,N}$.

Keywords. Suborbital Graphs, Modular Group, Paths of Minimal Length.

AMS 2010. 20H10, 20H05, 05C05, 05C20.

References


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Boundedness of Fractional Maximal Operator Associated with Hankel Transform on Weighted Lorentz Spaces
Canay Aykol Yüce

Abstract. In this paper we characterize the boundedness of fractional maximal operator associated with Hankel (Fourier-Bessel) transform on weighted Lorentz spaces.

Keywords. Fractional Maximal Operator; Hankel Transform; Weighted Lorentz Spaces; Weighted Norm Inequalities


References


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Abstract. Let $X$ be a Banach space and let $B(X)$ be the algebra of all bounded linear operators on $X$. $G$ will be denoted a locally compact abelian group with the dual group $\Gamma$. Let $L^1(G)$ and $M(G)$, respectively be the group algebra and the measure algebra of $G$. By $C(K)$ we denote the space of all continuous functions on a compact $K$. Let $U : G \to B(X)$ be a strongly continuous bounded representation of $G$ on $X$. For arbitrary $\mu \in M(G)$, we can define $U_\mu \in B(X)$, by $U_\mu x = \int_G U^{-1} g x d\mu(g)$, $x \in X$. Then, the mapping $h : M(G) \to B(X)$ defined by $\mu \to U_\mu$ is a bounded unital algebra homomorphism. The Arveson spectrum $sp(U)$ [1] of $U$ is defined as the hull of the closed ideal $I_U := \{ f \in L^1(G) : U f = 0 \}$. Said that $\mu \in M(G)$ has the spectral mapping property if $\sigma(U_\mu) = \hat{\mu}(sp(U))$, where $\hat{\mu}$ is the Fourier-Stieltjes transform of $\mu$.

Recall that a compact set $K$ in $\Gamma$ is a Helson set for $L^1(G)$ if for every $g \in C(K)$ there is a function $f \in L^1(G)$ such that $\hat{f} = g$ on $K$ [4, Section 5.6.1]. If $K \subset \Gamma$ is a Helson set, then there is a constant $C > 0$ with the following property: If $g \in C(K)$, there exists $f \in L^1(G)$ such that $\hat{f} = g$ on $K$ and $\|f\| \leq C \sup_{\chi \in K} |g(\chi)|$. If $K$ is a Helson set and is a set of synthesis for $L^1(G)$, then $K$ is said to be WTP (without true pseudomeasures) set for $L^1(G)$. For example, compact countable independent set in $\Gamma$ is a WTP set for $L^1(G)$ [4, Theorem 5.6.7]. By $M_0(G)$ we will denote the set of all $\mu \in M(G)$ such that $\hat{\mu}$ vanishes at infinity.

We have the following

**Theorem.** If $sp(U)$ is a WTP set for $L^1(G)$, then every $\mu \in M_0(G)$ has the spectral mapping property.

**Keywords.** Banach Algebra, Multiplier, (Local) Spectrum, Spectral Mapping Property.

**AMS-2010.** 47B07, 30H05.

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References


\textbf{Abstract.} In this paper, we introduce and study $I_\lambda$-statistical convergence for double sequences in topological groups and we shall also present some inclusion theorems.

\textbf{Keywords.} Ideal Convergence, Ideal Statistical Convergence, Double Statistical Convergence, Topological Groups.

\textbf{AMS 2010.} 42B15; 40C05.

\textbf{References}


Absolute Tauberian Constants
Fatma Aydin Akgün and Billy Rhoades

Abstract. Sherif [2] obtained estimates of the form \( \sum |\tau_n - a_n| \leq K \sum |\Delta(na_n)| \) and \( \sum |\tau_n - a_n| \leq K' \sum n|\Delta \tau_{n-1}| \) under the assumption that \( \sum n|\Delta \tau_{n-1}| \) is finite where \( \Delta \) is the forward difference operator and \( \tau_n = C^k_n - C^k_{n-1} \). The constants \( K \) and \( K' \) are called Tauberian constants. Sherif [3] also obtained analogous results for regular Hausdorff matrices. In a recent paper [1] the authors obtained absolute Tauberian constants for the H-J generalized Hausdorff transformations, which generalized the corresponding results, obtained earlier by Sherif, for ordinary Hausdorff matrices. In this paper we obtain absolute Tauberian constants for regular lower triangular matrices with row sums one. As corollaries we obtain the corresponding results for factorable and weighted mean matrices.

Keywords. Factorable Matrices, Hausdorff Matrices, Tauberian Constants, Weighted Mean Matrices.

AMS 2010. 47H10.

References


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On Convex Meromorphic Functions
Faruk Uçar and Yusuf Avci

Abstract. Let us denote by $S(p)$ the set of univalent functions in the unit disc $D = \{ z \in \mathbb{C} : |z| < 1 \}$ such that $f(0) = 0, f'(0) = 1$ and $f(p) = \infty$. We denote by $K$ the subset of functions in $S(p)$ which omits a convex set in the extended plane $\hat{\mathbb{C}} = \mathbb{C} \cup \{ \infty \}$, that is, $f \in K$ if and only if the set $\hat{\mathbb{C}} \setminus f(D) = \{ w \in \mathbb{C} : f(z) \neq w \}$ is convex. Functions in $K$ are called as convex meromorphic functions. In this paper, we define a function $p : D \times D \times D \to \mathbb{C}$ in terms of $f$ and show that $\Re p > \frac{1}{2}$ for all $\zeta, z, w \in D$ if and only if $f$ belongs to $K$.

Keywords. Univalent Function, Convex Meromorphic Function, Starlike Function.

AMS 2010. 30C45, 30D30.

References


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Abstract. Convexity has generalized different types ([4]). $B^{-1}$-convexity is of these abstract convexity classes ([1]). $B^{-1}$-convex sets and functions are studied in [2,3,5].

In this work, some examples of convex and $B^{-1}$-convex functions are discussed and the relationship between convex and $B^{-1}$-convex functions is examined. Finally, taking into account given examples, it is shown that $B^{-1}$-convex functions and convex functions do not include each other.

Keywords. Abstract Convexity, $B^{-1}$-Convexity, $B^{-1}$-Convex Functions.

AMS 2010. 26B25, 52A41.

References


On Some Inequalities and Their Refinements
Gültekin Tınaztepe\textsuperscript{1}, Ramazan Tınaztepe\textsuperscript{2} and Serap Kemali\textsuperscript{3}

Abstract. In this work, the results derived in [1] is summarized, that is, generalized mean inequalities and some important inequalities is sharpened by using a theorem related to minimization of a function in the framework of abstract convexity. Apart from that, by using same ideas, sharpened inequality for Hölder inequality is given.

Keywords. Abstract Convexity, Functional Inequalities, Harmonic-Geometric-Arithmetic Means, Hölder Inequality.

AMS 2010. 26D07

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A Generalized Mountain Pass Theorem
Hans-Jörg Ruppen¹

Abstract. We present a new variational characterization of multiple critical points for even energy functionals corresponding to nonlinear Schrödinger equations of the following type:
\[
\begin{cases}
-\Delta u + V(x)u - q(x)|u|^\sigma u = \lambda u, & (x \in \mathbb{R}^N) \\
u \in H^1(\mathbb{R}^N) \setminus \{0\}.
\end{cases}
\]
We assume \(N \geq 3, \ q(x) \in L^\infty(\mathbb{R}^N), \ q(x) > 0\) a.e. with \(\lim_{|x| \to \infty} q(x) = 0\) and \(0 < \sigma < \frac{1}{N-2}\). Our results cover the following 3 cases in a uniform way:
1. \(V(x) \equiv 0\);
2. \(V(x)\) is a Coulomb potential and
3. \(V(x) \in L^\infty(\mathbb{R}^N)\) with \(V(x + k) = V(x)\) for all \(k \in \mathbb{Z}^N\).

The eigenvalue \(\lambda\) thereby may or may not lie inside a spectral gap.

Our variational characterization is “simple” and well suited for discussing multiple bifurcation of solutions.

Keywords. Variational Principles, Critical Points

AMS 2010. 58E05, 58E30

References

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A New Result on the Almost Increasing Sequences
Hikmet S. Özarslan\textsuperscript{1} and Ahmet Karakaş\textsuperscript{2}

Abstract. In this paper, we have generalized a known theorem on $\left[ N, p_n \right]_k$ summability factors of infinite series to the $\varphi - \left[ A, p_n \right]_k$ summability by using an almost increasing sequence. This new theorem also includes several new results.

Keywords. Summability Factors, Absolute Matrix Summability, Almost Increasing Sequences, Infinite Series.

AMS 2010. 40D15, 40D25, 40F05, 40G99.

References


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Bi-Parametric Potentials and Their Inverses with The Aid of Wavelet-Type Transforms
İlham A. Aliev

Abstract. Given $\alpha > 0$ and $\beta > 0$, we introduce the following integral transform (bi-parametric potential) of a function $\varphi \in L^p(R^n)$:

$$
(J^\alpha_\beta \varphi)(x) = \frac{1}{\Gamma\left(\frac{\alpha}{\beta}\right)} \int_0^\infty e^{-\frac{t}{\beta}} e^{-i(W^\alpha_\beta \varphi)(x)} dt, \quad (x \in R^n)
$$

Here,

$$
(W_1^\alpha \varphi)(x) = \int_{R^n} \varphi(x-y) \omega^{\alpha}(y; t) dy, \quad (0 < t < \infty),
$$

$$
\omega^{\alpha}(y; t) = t^{-\frac{n}{\beta}} G^{(\alpha)}(t \frac{y}{|y|^\beta})
$$

and

$$
G^{(\alpha)}(y) = (2\pi)^{-n} \int_{R^n} e^{i \langle y, \xi \rangle - |\xi|^\alpha} d\xi, \quad \left\langle y, \xi \right\rangle = \sum_{k=1}^n y_k \xi_k
$$

The integral $W^\alpha_\beta \varphi$ coincides with the classical Gauss-Weierstrass integral when $\beta = 2$ and Poisson integral when $\beta = 1$. The bi-parametric potentials $J^\alpha_\beta \varphi$ reduce to classical Bessel potentials for $\beta = 2$ and to Flett potentials for $\beta = 1$.

We introduce relevant wavelet-type transforms and by making use of these transforms we obtain explicit inversion formulas for bi-parametric potentials $J^\alpha_\beta \varphi$, $(\varphi \in L^p(R^n))$.

Keywords. Bessel Potentials, Wavelet Transform, Gauss-Weierstrass Integral.

References


Abstract. We investigate the existence and uniqueness of solutions for multi-point nonlocal boundary value problems of higher-order nonlinear fractional differential equations by using some well-known fixed point theorems.

Keywords. Boundary Value Problems, Fixed Point Theorems, Fractional Derivative.


References


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Impulsive Boundary Value Problem for Nonlinear Differential Equations of Fractional Order $\alpha \in (2, 3]$

İlkay Yaslan Karaca¹ and Fatma Tokmak Fen²

Abstract. In this paper, we investigate the existence of solutions for the boundary value problem of nonlinear impulsive differential equations of fractional order $\alpha \in (2, 3]$. By using some well-known fixed point theorems, sufficient conditions for the existence of solutions are established. Some examples are presented to illustrate the main results.

Keywords. Impulsive Boundary Value Problem, Fractional Order, Fixed-Point Theorem.


References


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Some Coupled Fixed Point Theorems for Generalized Contractions
İsa Yıldırım

Abstract. In this work, we prove new coupled fixed point theorems for mapping having the mixed monotone property in partially ordered metric space. Here the mappings are assumed to satisfy certain contractive type inequalities. These new results generalize and improve several related results in coupled fixed point theory.

Keywords. Coupled Fixed Point, Partially Ordered Set, Mixed Monotone Mappings.

AMS 2010. 47H10, 34B15.

References


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Characterizing $\omega$-Limit Sets for Analytic Vector Fields in Open Subsets of the Sphere
José Ginés Espín Buendía and Víctor Jiménez López

Abstract. In [1] Jiménez López and Llibre gave a topological characterization, up to homeomorphisms, of $\omega$-limit sets of (real) analytic vector fields on the plane, the sphere and the projective plane. Here, recall that if $f$ is a smooth vector field on a surface $S$, and $x(t)$ is a solution of the differential equation $x'=f(x)$, then the $\omega$-limit set of (the orbit associated to the solution) $x(t)$ is the set of limit points of $x(t)$ as $t$ goes to $+\infty$.

In the last section of the paper an argument is outlined to extend these results to analytic vector fields just defined on arbitrary subsets of these surfaces, but this argument has a gap and, as a consequence, the proposed characterizations are incomplete. In this work, still in progress, we partially fill this gap by proving the following result:

Theorem. If $K$ is a totally disconnected compact subset of the sphere $S^2$ and $\mathcal{B}$ is an $\omega$-limit set for some analytic vector field defined on $S^2 \setminus K$, then $\mathcal{B}$ is the boundary of a shrub. Conversely, if $\mathcal{B}$ is the boundary of a shrub, then there are a homeomorphism $h: S^2 \rightarrow S^2$ and a $C^\omega$ vector field $f$ on the sphere, which is analytic except for a totally disconnected compact set of points, such that $h(\mathcal{B})$ is an $\omega$-limit set of some orbit of the equation $x'=f(x)$.

In the second statement of the theorem, the set of points of non-analyticity can be “minimized”: in particular, if a point $x$ of $\mathcal{B}$ is locally the vertex of a $2n$-star in $\mathcal{B}$, then $f$ is analytic at $h(x).$ By a shrub we mean a compact, connected, locally connected subset $T$ of $S^2$ containing a (possibly empty) family $\{D_n\}_n$ of closed topological disks with the following property: if $C$ is a topological circle in $T$, then there is exactly one disk $D_n$ containing $C$.

Keywords. Analytic Vector Field, $\omega$-Limit Set, Sphere.

AMS 2010. 37E35, 37B99, 37C10

References


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Weighted Composition Followed by Differentiation between Weighted Fréchet Spaces of Holomorphic Functions
Jasbir S. Manhas¹

Abstract. Let $U$ and $V$ be two countable families of weights on the unit disc $D$ and let $HU(D)$ and $HV(D)$ be the weighted Fréchet spaces of holomorphic functions. In this paper, we investigate the holomorphic mappings $\varphi: D \to D$ and $\psi: D \to \mathbb{C}$ which characterize boundedness and compactness of products of weighted composition operators and differentiation operators $D\psi \varphi$ and $W_{\psi,\varphi}D$ between weighted Fréchet spaces of holomorphic functions $HU(D)$ and $HV(D)$.

Keywords. Weighted Composition Operators, Differentiation Operators, Weighted Fréchet Spaces.

AMS 2010. 47B38, 47B33.

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The Effects of Privatisation and Competition on Malaysia Airlines Performance
Kok Fong See ¹ and Azwan Abdul Rashid ²

Abstract. A commercially sustainable flag carrier airline is central to the broader geopolitical and macroeconomic national objectives of global connectivity and trade linkages for Malaysia. However, Malaysia Airlines is in crisis. The survival of Malaysia Airlines is at stake given the internal and external factors combining to create the perfect storm. Malaysia Airlines reported a loss of RM1.17 billion in the full year 2013 and has had a negative operating cash flow for the past three years, which means that it is not generating enough cash to meet its day-to-day operating costs. As the national flagship air carrier, Malaysia Airlines has to strike a balance between its commercial, political and social obligations and will always be under close scrutiny. The study examines the total factor productivity (TFP) growth of Malaysia Airlines over a 33 year period from 1981 to 2013 using the Törnqvist index method. The privatisation of Malaysia Airlines is observed to coincide with lower TFP growth rates. Furthermore, our results could suggest that the introduction of competition was insufficient to produce improved TFP performance.

Keywords. Productivity Growth, Malaysia Airlines, Törnqvist Index.

AMS 2010. 91B82, 91B38.

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**New Integral Inequalities Via Ga-Convex Functions**

Merve Avci Ardiç¹, Ahmet Ocak Akdemir² and Erhan Set³

**Abstract.** In this paper, we prove a new integral identity and based on this equality, we established some integral inequalities for functions whose derivatives of absolute values are GA-convex functions.

**Keywords.** GA-Convex Functions, Logarithmic Mean, Hölder Inequality.

**AMS 2010.** 26D15, 26A51, 26E60, 41A55

**References**


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On Multistep Iteration Method for Contractive Condition of Integral Type in Banach Spaces

M. Abdussamed Maldar¹ and Vatan Karakaya²

Abstract. In this work, we show that the new multistep iteration process converges to unique fixed point of contractive condition of integral type. Also, we prove some stability results for new multistep iteration process by using this mapping in normed linear space. Furthermore, this iteration method is equivalent to Mann iterative scheme.

Keywords. Contractive Condition of Integral Type, Multistep Iteration, Normed Linear Space.

AMS 2010. 47H10, 54H25

References


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An Inequality and Its Applications
Mehmet Ali Sarıgöl

Abstract. In this paper, we prove a simple inequality which plays important role in the summability theory, matrix operators theory, approximation theory, and also provides great convenience in computations. As a corollary, we give the well-known results of [1], [2], [5] under some simpler conditions, and a very short and different proofs of results in [6], [7].

Keywords. Inequality, Matrix Transformations, Sequence Spaces

AMS 2010. 26D15, 40C05, 46A045

References


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Connectedness of Suborbital Graphs of Some Modular Groups
Murat Beşenk

Abstract. The matrix group $SL(2,\mathbb{Z})$ is generated by two elements \[
\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix} \] and \[
\begin{pmatrix} 1 & 1 \\ -1 & 0 \end{pmatrix}. \]
Identifying elements in $SL(2,\mathbb{Z})$ which differ by a sign, one obtains the modular group $PSL(2,\mathbb{Z})$. We use $\Gamma$ to denote the image of $\Gamma/\pm I$ in $PSL(2,\mathbb{Z})$ if there is no confusion. A complete classification of the normal congruence subgroups of the modular group $\Gamma$ is given by Newman [4]. Congruence subgroups are a class of arithmetic subgroups which are easy to describe. For example, given positive integers $m$ and $n$ the following are some well-known congruence subgroups: $\Gamma(n), \Gamma_0(n), \Gamma_1(n), \Gamma(m,n), \Gamma_\theta$.

In this paper, we investigate connectedness of a suborbital graph for some congruence subgroups. In order to make graph connected, we examine necessary and sufficient conditions for the $F_{u,v}$, whose vertices form the block $[\infty]$. Furthermore the structure of Farey graph in Poincare disk $\mathbb{D} = \{z \in \mathbb{C} : |z| < 1\}$ is analyzed.

Keywords. Congruence Subgroups, Suborbital Graph, Connectedness.

AMS 2010. 05C20, 11F06, 20H10.

References


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A New Perspective on Paranormed Riesz Sequence Space of Non-Absolute Type  
Murat Candan¹

Abstract. The current article mainly dwells on introducing Riesz sequence space $r^q(\widetilde{B}_u^\rho)$ that consists of all sequences whose $R^q_u\widetilde{B}$-transforms are in the space $\ell(p)$, where $\widetilde{B} = B(r_n, s_n)$ stands for double sequential band matrix and $(r_n)_{n=0}^\infty$ and $(s_n)_{n=0}^\infty$ are given convergent sequences of positive real numbers. Some topological properties of the new brand sequence space have been investigated as well as $\alpha-$, $\beta-$ and $\gamma-$ duals. Additionally, we have also constructed the basis of $r^q(\widetilde{B}_u^\rho)$. Eventually, we characterize a matrix class on the sequence space.

Keywords. Sequence Spaces, Double Sequential Band Matrix, Alpha-, Beta-, Gamma-Duals, Matrix Transformations.

AMS 2010. 44A45, 40C05, 46J05.

References

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Almost \( I \)-Convergent Sequence Spaces Defined by Orlicz Function
Mahmut Daştan\(^1\), Merve İlkhan\(^2\) and Emrah Evren Kara\(^3\)

**Abstract.** The purpose of this presentation is to introduce and study some sequence spaces which are defined by combining the concepts of Orlicz function, an infinite matrix and ideal convergence. We establish some inclusion relations between the resulting spaces and examine some properties of these spaces.

**Keywords.** Sequence Spaces, Orlicz Function, \( I \)-Convergence.

**AMS 2010.** 46A45, 40A35

**References**


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On Exton's q-Exponential Function
Mahmoud Jafari Shah Belaghi\textsuperscript{1} and Nuri Kuruoğlu\textsuperscript{2}

Abstract. In this paper, we study about the q-exponential function which was introduced by Exton and addition theorem for Exton’s q-exponential function was proposed.

Keywords. Exton's q-Exponential Function, Symmetric q-Binomial.

AMS 2010. 11B65, 33D05.

References


Some Properties of q-Exponential and q-Trigonometric Functions
Mahmoud Jafari Shah Belaghi\textsuperscript{1} and Nuri Kuruoğlu\textsuperscript{2}

Abstract. In this paper, we study about the q-exponential functions and some useful properties of these q-exponential functions are proposed.

Keywords. q-Exponential Functions, q-Trigonometric Function, q-Hypergeometric Functions.

AMS 2010. 11B65, 33D05.

References


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On a Volterra Equation of the Second Kind with Spectral Parameter
Amangaliyeva M.M.,1 Jenaliyev M.T.,2 Kosmakova M.T,3 and Ramazanov M.I.4

Abstract. Solving the boundary value problems of the heat equation in noncylindrical domains degenerating at the initial moment leads to the necessity of research of the singular Volterra integral equations of the second kind, when the norm of the integral operator is equal to 1. The paper deals with the singular Volterra integral equation of the second kind, to which by virtue of 'the incompressibility' of the kernel the classical method of successive approximations is not applicable. It is shown that the corresponding homogeneous equation when $|\lambda| > 1$ has a continuous spectrum, and the multiplicity of the characteristic numbers increases depending on the growth of the modulus of the spectral parameter $|\lambda|$. By the Carleman-Vekua regularization method [1] the initial equation is reduced to the Abel equation. The eigenfunctions of the equation are found explicitly. Similar integral equations also arise in the study of spectral-loaded heat equations [2], [3].

Keywords. Volterra Integral Equation, Abel Equation, Spectrum.

AMS 2010. 45D05, 45C05, 45E10.

References


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On Some Fixed Point Results for Rational $A_\phi$-Contractive Mappings in 2-Metric Spaces
Endowed with Partial Order
Mahpeyker Öztürk

Abstract. In this paper some new fixed point results have been established in the context of 2-metric spaces endowed with partial order for rational $A_\phi$-contractive mappings. The results given in this study generalize, extend and unify the fixed point theorems existing in the literature.

Keywords. Fixed Point, Rational $A_\phi$-Contraction, Ordered 2-Metric Space.

AMS 2010. 47H10, 54H25.

References


An Approach to the Stability of Nonlinear Volterra Integral Equations
Nasrin Eghbali

Abstract. Fractional differential and integral equations can serve as an excellent tool for the description of mathematical modelling of systems and processes in the fields of economics, physics, chemistry, aerodynamics, and polymer rheology. It also serves as an excellent tool for the description of hereditary properties of various materials and processes.

The purpose of this talk is to investigate the Hyers-Ulam stability for a class of nonlinear Volterra integral equations under some natural conditions which corresponds to numerous related outcomes in [1,2,3,4,5,6]. In fact, we presented and studied two types of stability of this equation.


AMS 2010. Primary 46S40; Secondary 39B52, 39B82, 26E50, 46S50.

References:


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Abel Convergence of Convolution Operators
Özlem Girgin Atlihan¹ and Mehmet Ünver²

Abstract. The classical Korovkin approximation theory deals with the convergence of a given sequence \((L_n)\) of positive linear operators on \(C[a,b]\). When the sequence of positive linear operators does not converge to the identity operator then it may be useful to use some summability methods. In this paper, we study some Korovkin type approximation theorems for the sequences of convolution operators via Abel method which is a sequence-to-function transformation. We also deal with the rate of Abel convergence.

Keywords. Abel Convergence, Convolution Operator, Korovkin Approximation Theorem.

AMS 2010. 41A25, 41A36, 40A05

References


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On Weighted Approximation by Singular Integral Operators Depending on Two Parameters
Özge Güller¹, Gümrah Uysal² and Ertan İbikli³

Abstract. In this talk, we give some theorems about pointwise approximation to the functions which belong to weighted Lebesgue space $L_{p,w}(D)$, where $D=\langle a,b \rangle$ is closed semi-closed or open interval in $\mathbb{R}$, at their characteristic points, by family of singular integral operators depending on two parameters.

Keywords. Singular Integral, Pointwise Approximations.

MSC 2010. 41A35, 41A25.

References


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Lyapunov Functions and Strict Stability of Caputo Fractional Differential Equations
R. Agarwal¹, S. Hristova² and D. O'Regan³

Abstract. One of the main properties studied in the qualitative theory of differential equations is the stability of solutions. Many authors defined and studied various types of stability for different classes of differential equations but the investigation of the stability of fractional order systems is quite recent. There are several approaches in the literature to study stability, one of which is the Lyapunov approach. Note application of Lyapunov techniques to fractional differential equations causes many difficulties. We will present the approach using Lyapunov functions for studying some stability properties of nonlinear Caputo fractional differential equations. A new definition for the derivative of Lyapunov functions among the studied equation is introduced. It is based on the Caputo fractional Dini derivative of a function. Comparison results using this new definition and scalar fractional differential equations are presented and sufficient conditions for some types of stability are given. Several examples will illustrate the advantages and the usefulness of the introduced definition comparatively to the known ones in the literature.

Keywords. Lyapunov Functions, Caputo Fractional Derivative, Stability, Fractional Differential Equations.

AMS 2010. 34A34, 34A08, 34D20.

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References


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On a Caputo type fractional operator
Ricardo Almeida\textsuperscript{1} Agnieszka Malinowska\textsuperscript{2} and Tatiana Odzijewicz\textsuperscript{3}

Abstract. We study a Caputo-Katugampola fractional derivative, which is a generalization of the Caputo and the Caputo–Hadamard fractional derivatives \cite{katugampola2011,a new approach to generalized}. After presenting some important results about the fractional operator, we study variational problems with dependence on this operator. We present sufficient and necessary conditions of first and second order to determine the extremizers of a functional. The cases of integral and holonomic constraints are also considered. An existence and uniqueness theorem for a fractional Caputo type problem, with dependence on the Caputo-Katugampola derivative, is proven. A decomposition formula for the Caputo-Katugampola derivative is obtained. This formula allows us to provide a simple numerical procedure to solve the fractional differential equation.

Keywords. Fractional Calculus, Fractional Differential Equations, Caputo-Katugampola Derivative, Numerical Methods

AMS 2010. 26A33, 34A08, 34K28

References


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Chaotic Behavior of Logistic Maps in Mann Orbit
Renu Chugh \textsuperscript{1} and Ashish \textsuperscript{2}

\textbf{Abstract.} The idea of logistic map $rx(1-x)$ was given by the Belgian mathematician Pierre Francois Verhulst around 1845 and worked as basic model to study the discrete dynamical system. It is a model of population growth that exhibits different types of behavior depending on the value of a few parameters. Above a certain parameter value, the logistic map shows the chaotic behavior. For choosing $x$ between $0$ and $1$ and $0 < r \leq 4$, the logistic map has found a celebrated place in chaos, fractal and discrete dynamics. In 1994, Holmgren Richard A., [5] has studied that the logistic map in Picard orbit becomes chaotic in nature for $r > 4$ (see also [1], [2], [4]). In recent decades, Rani et. al. [3, 6, 7] has shown that in Mann, Ishikawa and Noor iterative methods the logistic map is stable for the larger values of $r$ than that of Picard orbit. Our goal in this paper is to study the chaotic behavior of logistic map in Mann iterative method using bifurcation representation. We see that the range of chaotic behavior of logistic map increases drastically. Also, the chaotic behavior disappears in some cases.

\textbf{Keywords.} Logistic Map, Mann Iterative Procedure, Periodicity, Chaos, Bifurcation.

\textbf{AMS 2010.} 28A80, 34H10.

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Interpolation of Function Spaces Associated to a Vector Measure
R. del Campo\textsuperscript{1}, A. Fernández\textsuperscript{2}, F. Mayoral\textsuperscript{3} and F. Naranjo\textsuperscript{4}

Abstract. A basic problem in interpolation theory is to describe the spaces obtained by applying an interpolation method to concrete compatible couples of spaces. In this talk we analyze the results obtained in \cite{1}, \cite{2}, \cite{3} and \cite{4} by applying different interpolation methods (real and complex) to different couples of Banach and quasi-Banach spaces associated to a vector measure.

Let $\nu$ be a countably additive vector measure with values in a Banach space defined on a $\delta$-ring (or on a $\sigma$-algebra) of subsets of a set $\Omega$. Associated with $\nu$, for $1 \leq p < \infty$, are the real function Banach spaces $L^p(\nu)$, and $L^p_\omega(\nu)$, of equivalence classes of scalar measurable functions $p$-integrable, weak $p$-integrable, with respect to $\nu$. These two spaces are equipped with the topology of convergence in $p$-mean given by the norm

$$
\|f\|_{L^p(\nu)} := \left\{\sup \left\{ \int_\Omega |f(x)|^p \, d\langle \nu, x' \rangle \mid \|x\|_\Omega \leq 1 \right\} \right\}^{\frac{1}{p}}, \quad f \in L^p_\omega(\nu).
$$

We are going to point out that the interpolation results for vector measures defined on $\delta$-rings can be very different from those on the context of $\sigma$-algebras.

Keywords. Complex Interpolation Methods, Real Interpolation Methods, Lions-Peetre K-Functional, Integrable Function, Vector Measure, Locally Strongly Additive Measure.

AMS 2010. 46B70, 46G10, 46E30

References

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Complex Interpolation Operators and Optimal Domains
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Abstract. Let \( X \) be an order continuous Banach function space on a finite measure space \((\Omega, \Sigma, \mu)\) and let \( E \) a Banach space. Given a continuous linear operator \( T: X \to E \) we consider the vector measure \( m_r(A) = T(\chi_A) \). Then the space \( L^r(m_r) \) of scalar integrable functions with respect to the vector measure \( m_r \) is the optimal domain of the operator \( T \). In this talk we consider two order continuous Banach function spaces \( X_0, X_1 \) a Banach space interpolation pair \((X_0, X_1)\) and admissible operator between the pairs \((X_0, X_1)\) and \((E_0, E_1)\). If \( T_\theta: [X_0, X_1]_{\theta} \to [E_0, E_1]_{\theta} \) is the interpolated operator by the first complex method Calderon and \( m_0, m_1 \) and \( m_\theta \) are the vector measure coming from the operators \( T_{X_0}, T_{X_1} \) and \( T_\theta \) respectively, we study the relationship between the optimal domain \( L^r(m_\theta) \) of \( T_\theta \) and the interpolated space \([L^r(m_0), L^r(m_1)]_{\theta}\) of the optimal domains \( L^r(m_0) \) and \( L^r(m_1) \). Next we apply the obtained result to study interpolation of \( p \)-th power factorable operators.

Keywords. Complex Interpolation, Vector Measure, Factorable Operator.

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Abstract. Let $f(x)$ be a function defined on $[0,\infty)$ satisfying
\[ \int_0^\infty |f(t)| d_q t < \infty \]
for all $x \in \mathbb{R}_{q,+}$, and let $s(x) = \int_0^x f(t) d_q t$. The $q$-Cesàro means of $s(x)$ are defined by
\[ \sigma(s(x)) = \frac{1}{x} \int_0^x s(t) d_q t. \]
The function $s(x)$ is said to be $q$-Cesàro integrable to $A$ if
\[ \lim_{x \to \infty} \sigma(s(x)) = A. \]
In this talk we introduce the concept of $q$-Cesàro integrability and develop $q$-analogues of some results in summability theory. We also present sufficient Tauberian conditions under which the convergence of $s(x)$ follows from its $q$-Cesàro integrability.

Keywords. Cesàro Integrability, Tauberian Theorems, Quantum Calculus.

AMS 2010. 40E05, 05A30, 26A03.

References


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APPLIED MATHEMATICS

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Numerical Results of Extended Lane–Emden Type Equations
Ali Akgül¹, Adem Kılıçman² and Mustafa Inc³

Abstract. We use the reproducing kernel Hilbert space method [1], [2], [3] for solving extended Lane–Emden type equations [4]. A powerful method is shown in the reproducing kernel Hilbert spaces. We define many useful reproducing kernel functions and we find the best kernel function for approximate solutions.

Keywords. Lane–Emden Type Equations, Reproducing Kernel Functions and White-Dwarf Equation.

AMS 2010. 47B32, 46E22 and 74S30.

References


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Inventory Model of Type (s,S) with Regularly Varying Demands Having Infinite Variance
Aslı Bektaş Kamışlık¹, Tülay Kesemen² and Tahir Khaniyev³

Abstract. In this study an inventory model of type (s,S) with regularly varying demand having infinite variance is considered. Pareto distribution with infinite variance when \( F(x) = \left(\frac{x}{b}\right)^{\alpha}, x \geq b, b > 0, 1 < \alpha < 2 \) is used as a representative of regularly varying distributions. This work is motivated by a study of Geluk (1997). The results from Geluk’s paper are implemented to the stochastic process \( X(t) \) which represents the model that we consider. Based on the main result of the study Geluk (1997) two term asymptotic expansion for the ergodic distribution of the process \( X(t) \) is obtained as follows:

\[
Q_T(v) = F(v) + \frac{1}{2\mu_1\beta^{\alpha-1}} G(v) + O\left(\frac{1}{\beta^{1-(2-\alpha)^2}}\right)
\]

where;

\[
F(v) = \frac{4v - v^2}{4}
\]

\[
G(v) = \frac{(2^{1-\alpha}(2-v)^2 - (2-v)^{3-\alpha})b^{\alpha}}{(\alpha-1)(2-\alpha)(3-\alpha)}
\]

\[ v \in [0,2), \quad x \geq b, \quad b > 0, \quad 1 < \alpha < 2, \quad \beta = \frac{S - s}{2} \to \infty.\]

Moreover weak convergence theorem is proved for the ergodic distribution.

Keywords. Inventory Model of Type (s,S), Heavy Tailed Distributions with Infinite Variance, Regular Variation, Renewal Reward Process, Asymptotic Expansion.

AMS 2010. 60K05, 41A60.

References


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Inverse Spectral Problem for Sturm Liouville Operator with Spectral Parameter Dependent Boundary Condition

Aynur Çöl

Abstract. Consider the boundary value problem generated by the equation

\[-y'' + q(x)y = \lambda^2 y, \quad 0 < x < \infty\]

with the boundary condition

\[(\alpha_0 + i\alpha_1 \lambda - \alpha_2 \lambda^2 - i\alpha_3 \lambda^3)y'(0) - (\beta_0 + i\beta_1 \lambda - \beta_2 \lambda^2 - i\beta_3 \lambda^3)y(0) = 0\]

where \(\lambda\) is a spectral parameter, \(q(x)\) is real valued function with the condition

\[\int_0^\infty (1 + x)|q(x)|dx < \infty.\]

Here the polynomials in boundary condition satisfy the relations for \(\alpha_i, \beta_i \in \mathbb{R} (i = 1, 2, 3)\)

\[\alpha_{i+1}\beta_i - \alpha_i\beta_{i+1} > 0, \quad \alpha_{i+2}\beta_i - \alpha_i\beta_{i+2} < 0, \quad \alpha_{i+3}\beta_i - \alpha_i\beta_{i+3} = 0.\]

In this work, it is considered the Sturm Liouville operator with eigenvalue parameter dependent boundary condition, and the corresponding inverse scattering problem is analyzed. Scattering data are defined, some properties of the scattering data are examined, the main equation is obtained and it is shown that the potential is uniquely recovered by the scattering data. When the boundary condition doesn’t contain spectral parameter, inverse problem for equation on the half line was solved in [1]. The similar problem for Sturm Liouville operators with discontinuous coefficient was examined in [2].

Keywords. Sturm-Liouville Operator, Inverse Problem, Scattering Data, Spectral Parameter.


References


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Incorporating Views on Market Dynamics in Options Hedging
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Abstract. We examine the possibility of incorporating information or views of market movements during the holding period of a portfolio, in the hedging of European options with respect to the underlying. Given a fixed holding period interval, we explore whether it is possible to adjust the number of shares needed to effectively hedge our position to account for views on market dynamics from present until the end of our interval, to account for the time-dependence of the options' sensitivity to the underlying. We derive an analytical expression for the number of shares needed by adjusting the standard Black-Scholes-Merton $\Delta$ quantity, in the case of an arbitrary process for implied volatility, and we present numerical results.

Keywords. Derivatives, $\Delta$-hedging, Black-Scholes-Merton.

AMS 2010. 91G20.

References


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Numerical Identification of the Filtration Capacitive Parameters in Two-Phase Petroleum Reservoirs
A. Sakabekov¹, D. Ahmed Zaki² and Y. Auzhani³

Abstract. Modeling method is used to control a reservoir [1]. Modeling allows us to understand the geology of a reservoir and predict its behavior under different scenarios of development. It is necessary to predict the behavior of reservoir and technological development indicators at all stages of the development of field. Reliable geological and technological models are necessary to make decisions about the further study and optimization of the development of hydrocarbon deposits. It is necessary to note that a permanent operating geological and technological model is a central object for fields under development [2]-[3]. Adaptation of the model to the exploration history is an important and current problem of the field development. The identification of filtration capacitive parameters of a reservoir, that are inherent in the model, is done by solving the inverse problem. This is the process of history matching. Usually parameters with the highest uncertainty, that strongly influence the solution, are corrected. And usually production and injection of each component are known when exploration history is reproduced.

In this paper was considered non-linear three-dimensional two-phase filtration problem in a bounded three-dimensional region under the corresponding initial and boundary conditions. The algorithm for solving the inverse problem of parameter identification of inhomogeneous oil reservoir is made. It was build full implicit scheme for numerical solution for an imitation problem. Was introduced the target function [4]-[5], which is the measure of disparity between observed values and system response. The elements of Jacobian matrix for three-dimensional two-phase filtration problem in case of three-dimensional rectangular grid are calculated. The iterative process for determining coefficients of model sensitivity and coefficients of filtration parameters of inhomogeneous oil reservoir was built. It was build algorithm for numerical solution of the parameter identification problem.

Keywords. Two-phase Petroleum Reservoirs, Filtration Capacitive Parameters, Geological and Technological Model.

AMS 2010. 49M37.

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References


Multiple Scales Analysis and Exact Solutions for KdV Type Nonlinear Differential Equations

Burcu Ayhan¹, M. Naci Özer² and Ahmet Bekir³

Abstract. In this paper we apply multiple scale analysis for Korteweg-de Vries (KdV) type equations and we derive Nonlinear Schrödinger (NLS) equation. So we get a relation between KdV Type equations and NLS equations. Also exact solutions are found for KdV type equations. The (G'/G)-expansion methods and the (G'/G,1/G)-expansion methods are proposed to establish new exact solutions for KdV type differential equations. We obtain periodic and hyperbolic function solutions for these equations. These methods are very effective for getting travelling wave solutions of nonlinear differential equations.


AMS 2010. 35Q53, 83C15, 35C07.

References


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Numerical Solution of the Rosenau KdV-RLW Equation by Using Collocation Method
Bahar Korkmaz¹ and Yılmaz Dereli²

Abstract. In this study, Rosenau KdV-RLW equation is solved numerically by a meshless method based on RBF collocation method. Linear stability analysis is applied to analyze the stability of the proposed method for Rosenau-KdV-RLW equation. Accuracy of the method is discussed by computing the numerical conserved laws, error norms $L_2$ and $L_\infty$. Moreover, convergence rate of the solution is investigated. Comparisons are made between the results of this method and some other earlier works.

Keywords. RBF Collocation Method, Rosenau-KdV Equation, Rosenau-RLW Equation, Rosenau-KdV-RLW Equation.

AMS 2010. 34A37, 34A60, 34K45.

References


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Finite Difference Method for Film Equation in a Class of Discontinuous Functions
Bahaddin Sinsoysal\textsuperscript{1}, Mahir Rasulov\textsuperscript{2} and Ethem Ilhan Sahin\textsuperscript{3}

Abstract. In this study, an original method has been suggested to find a numerical solution of initial-boundary value problem for a fourth order degenerate diffusion equation which describes the thin film flow. For this goal, a special auxiliary problem which has some advantages over the main problem has been introduced and using the solution of it, a new method has been suggested for finding the weak solution of the main problem. Thus, the numerical solution of the main problem can be calculated by using the solution of the auxiliary problem obtained before, which expresses all of the physical properties accurately. In the study also some computer experiments are carried out.

Keywords. Thin Film Equation, Weak Solution, Numerical Solution in a Class of Discontinuous Functions.

AMS 2010. 35K35, 65M06.

References


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Analysis of Sound Diffraction from a Duct with Exterior Surface Impedance
Burhan Tiryakioğlu¹ and Ahmet Demir²

Abstract. In the present work, a rigorous solution is presented for the problem of diffraction of sound waves emanating from a ring source by a semi-infinite circular cylindrical pipe whose exterior surface is lined by an acoustically absorbent material. This boundary-value problem is investigated using Wiener-Hopf technique. The solution is obtained analytically by using fourier transform and saddle point technique. At the end of the analysis, numerical results illustrating the effects of the acoustic absorbent lining on the exterior surface of the cylinder on the sound spread are presented.


AMS 2010. 78A45, 47A68, 34B30.

References


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The Comparision of the Eigenvalues of Sturm-Liouville Operators
Bülent Yılmaz

Abstract. In this paper the eigenvalues obtained by the asymptotic method and the eigenvalues obtained by the finite difference method followed by a numerical correction, are compared. These eigenvalues are relevant to Sturm-Liouville problems having singular potential function, with Dirichlet boundary conditions.

Keywords. Eigenvalues, Sturm-Liouville Problems, Asymptotic Method, Numerical Method

AMS 2010. 34L16, 34L20

References


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Intuitionistic Fuzzy Optimization Technique in Multi-Commodity Solid Transportation Models

Deepika Rani¹ and T. R. Gulati¹

Abstract. While traditional as well as solid transportation problems have received enough attention in the literature, same is not the case with multi-commodity solid transportation problems. But, the occurrence of such problems is not unusual in industrial problems. This paper studies a solid transportation problem with heterogeneous products to be transported from supply points to demand points taking into consideration the safety factors while transporting. There always exist some risk in transporting the products from supply points to the demand points due to bad road conditions, insurgency etc. in some routes specially in the developing countries. In view of this, desired total safety factor is being introduced as well as an additional constraint on the budget at each destination is also considered. To reflect the uncertainty in real life situations, transportation parameters are taken as fuzzy numbers. The proposed algorithm proceeds by transforming the problem to deterministic model using the interval approximation of the fuzzy numbers and applying the intuitionistic fuzzy programming technique with different type of membership and non-membership functions. LINGO 15.0 software is then used to solve the final model and get the optimal solution. The performance of the proposed approach is shown with a numerical example. The obtained results are discussed and conclusions are drawn on the use of kind of membership and non-membership functions.

Keywords. Solid Transportation Problem, Fuzzy Optimal Solution, LR Flat Fuzzy Number.

AMS 2010. 90B05, 90C05, 90C70.

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On a Disjoint Idempotent Decomposition for Linear Combinations Produced from 
Commutative Tripotent Matrices
Emre Kişi¹ and Halim Özdemir²

Abstract. It has been established a 3ⁿ-term disjoint idempotent decomposition (DID) for the linear combinations produced from n (≥ 2) commutative tripotent matrices, their products and their products of power 2 at most. The results obtained in this way generalize those in [1]. Moreover, an algorithm to get a DID has been provided. Finally, a numerical example has been given to exemplify the results.

Keywords. Idempotent Matrix, Tripotent Matrix, Involutory Matrix, Linear Combination, Disjoint Idempotent Decomposition.


References


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Respect to Two Spectra Stability of the Inverse Problem for Diffusion Equation
Etibar S. Panakhov, Ahu Ercan and Tuba Gulsen

Abstract. Let consider the diffusion equation

$$-y''(x) + \left(2\lambda p(x) + q_1(x)\right)y(x) = \lambda^2 y(x), \quad 0 \leq x \leq \pi$$

with the following boundary conditions

$$y'(0) - h_1 y(0) = 0, \quad y'(\pi) + H y(\pi) = 0$$

$$y'(0) - h_2 y(0) = 0, \quad y'(\pi) + H y(\pi) = 0$$

where \( \lambda \) is the spectral parameter, \( p(x) \in W_2^2(0, \pi), \quad q_1(x) \in W_2^1(0, \pi), \quad h_1, h_2 \) (\( h_1 \neq h_2 \)) and \( H \) are some real constants. Let indicate the spectra of the boundary value problems (1)-(2) and (1)-(3) by \( \{\lambda_{1,n}\}_{-\infty}^\infty \) and \( \{\mu_{1,n}\}_{-\infty}^\infty \) respectively.

Now consider the equation

$$-y''(x) + \left(2\lambda p(x) + q_2(x)\right)y(x) = \lambda^2 y(x), \quad 0 \leq x \leq \pi$$

with the boundary conditions (2) and (3). Here \( q_2(x) \in W_2^1(0, \pi) \) and corresponding spectra to these conditions, respectively, are \( \{\lambda_{2,n}\} \) and \( \{\mu_{2,n}\}, \quad n \in \mathbb{Z} \).

**Theorem 1.** If the spectra \( \{\lambda_{j,n}\}, (j = 1, 2) \) of the problems (1)-(2) and (1)-(3) coincide the numbers of \( 2N + 2 \) on the interval \( (-N-1, N+1) \) for \( k > N+1, \quad n < \frac{N}{2} \) and \( k < -N-1 \), \( n > -\frac{N}{2} \) then the difference of the spectral functions is
\[\Var_{\frac{-N}{2} < \lambda < 0} \left\{ \rho_1(\lambda) - \rho_2(\lambda) \right\} \leq \begin{cases} \frac{4A \left( 1 + \frac{3}{2N} \right) e^{\frac{-A(1+1/3A)}{N^2}}}{N^{1+1/3A}} \rho_1 \left( \frac{N}{2} \right), & \lambda > 0 \\ \frac{4A \left( 1 + \frac{5}{2N} \right) e^{\frac{-A(1+5/2A)}{N^2}}}{N^{1+5/2A}} \rho_2 \left( -\frac{N}{2} \right), & \lambda < 0 \end{cases}\]

where \( A = \frac{1}{2\pi k} \int_{0}^{\pi} (q_2(t) - q_1(t)) dt + \frac{c_{2,k} - c_{1,k}}{k} \).

**Keywords.** Stability, Spectral Function, Eigenvalues, Diffusion Equation

**AMS 2010.** 34B09, 34K20, 34L05.

**References**


Spectral Problems for Regular Canonical Dirac Systems with More General Separable Boundary Conditions

Etibar S. Panakhov and Mine Babaoğlu

Abstract. In this work, we examined Dirac system and succeeded in performing our approach for regular canonical Dirac systems. Thus, we obtained satisfactory spectral results by using the Paley-Wiener spaces [1]:

\[ PW_x = \left\{ f \text{ entire}, \left| f(\mu) \right| \leq Ce^{-|\mu|}, \int_{\mathbb{R}} \left| f(\mu) \right|^2 d\mu < \infty \right\}. \]

Let

\[ v_{11}(x, \mu) = y_1(x, \mu^2) - \alpha(x) \cos(\mu^2 x - \alpha) - \beta(x) \sin(\mu^2 x - \alpha) \quad (1) \]

and

\[ v_{21}(x, \mu) = y_2(x, \mu^2) - \alpha(x) \sin(\mu^2 x - \alpha) + \beta(x) \cos(\mu^2 x - \alpha) \quad (2) \]

we claim the subsequent results.

Theorem 1. \( v_{11}(x, \mu), v_{21}(x, \mu) \in PW_x \) are functions of \( \mu \) for each \( x \) and the following estimates hold:

\[ |v_{11}(x, \mu)| \leq (c_1 + c_0 c_2) e^{[\Im \mu^2]} \]

\[ |v_{21}(x, \mu)| \leq (c_3 + c_0 c_4) e^{[\Im \mu^2]} \]

(3)

Theorem 2. \( v_{12}(x, \mu), v_{22}(x, \mu) \in PW_x \) are functions of \( \mu \) for each \( x \) and the following estimates hold:

\[ |v_{12}(x, \mu)| \leq c_0 c_2 e^{[\Im \mu^2]} \]

\[ |v_{22}(x, \mu)| \leq c_0 c_4 e^{[\Im \mu^2]} \]

(4)

Hence, functions \( v_{11}(x, \mu), v_{21}(x, \mu), v_{12}(x, \mu), v_{22}(x, \mu) \) are entirely of type \( x \) order 1 and square integrable on the real line as a function of \( \mu \) for each \( x \).

The boundary function (characteristic equation) \( B(\mu) \) is not necessarily in \( PW_x \) as in the Dirichlet-Dirichlet case. However, we have the following theorem.

Theorem 3. \( \bar{B}(\pi, \mu) = a_{21}v_{11}(\pi, \mu) + a_{22}v_{21}(\pi, \mu) \in PW_x \) is a function of \( \mu \) and the following estimate holds:

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\[ |\hat{B}(\pi, \mu)| \leq e^{\frac{|\mu|}{2}} (c_5 + c_6) \]  

**Keywords.** Dirac System, Paley-Wiener Space, Sampling Theory.

**AMS 2010.** 34B09, 34L05, 34L10.

**References**


Abstract. In this study, we introduce the concept of the generalized second-order composed radial epiderivative for set-valued maps and investigated some of its properties. A unified necessary and sufficient condition is derived in terms of the generalized second-order composed radial epiderivative.

Keywords. Radial Cone, Generalized Radial Epiderivative, Generalized Second-Order Composed Radial Epiderivative.

AMS 2010. 90C26, 90C30, 49J52.

References


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Equations of Anisotropic Elastodynamics for 1 Dimensional Qcs as a Symmetric Hyperbolic System: Deriving the Time-Dependent Fundamental Solution

H. Çerdik Yaslan

Abstract. In this study dynamic elasticity equations for 1D quasicrystals (QCs) with arbitrary system of anisotropy are considered. For these equations the phonon-phason displacements, displacement speeds and stresses arising from pulse point source are computed. Firstly, definition of the fundamental solution (FS) for the time-dependent differential equations of anisotropic elasticity in 1D QCs is given. These equations are written in the form of a symmetric hyperbolic system of the first order. Using the Fourier transform with respect to the space variables and matrix transformations we obtain formulae of the FS columns. As a computational example FS components are computed for orthorhombic and triclinic structures in 1D QCs.

Keywords. Anisotropic Dynamic Elasticity(3D) ,One-Dimensional Quasicrystals, Symmetric Hyperbolic System, Triclinic QCs, Fundamental Solution.


References


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Equivalence Relations on Quaternion Matrices
Işıl Arda Kösal¹ and Hidayet Hüda Kösal²

Abstract. In this paper, semi-similarity relation, semi-consimilarity relation, pseudo-similarity relation and pseudo-consimilarity relation for quaternion matrices are defined. Also, Relationships between these equivalence relations are studied.

Keywords. Quaternion matrices, Involutory automorphism, Equivalence relation.

AMS 2010. 15B33, 15A18.

References


The Fracture of the Elastic Matrix Containing Two Neighboring Co-phase Periodically Curved Carbon Nanotubes
İ. Gülten¹ and R. Köşker²

Abstract. It is known that one of the major mechanisms of the fracture of the unidirectional composites under uniaxial compression along the reinforcing elements is the stability loss in the material structure (structural or internal instability). According to this mechanism, the theoretical investigations of the fracture of the unidirectional composites under uniaxial compression along the reinforcing elements are reduced to the investigations of the stability loss in the material structure, and the value of the external critical forces is accepted as the value of failure forces in compression. At present, numerous theoretical and experimental investigations have been carried out in this field. In [1,2,3] within the framework of the piecewise homogeneous body model with the use of the Three-Dimensional Geometrically Nonlinear Exact Equations of the Theory of Viscoelasticity the approach for the investigation of the internal stability loss (microbuckling) in the structure of the viscoelastic unidirected fibrous composites under compression along the fibers is developed. However, in [1,2,3] the composite material was modelled as an infinite viscoelastic body containing fibers. In the paper [4] the attempt is made for development of the internal stability loss problems in the structure of the unidirectional fibrous composites for the case where the reinforcing element in the composite is the double-walled carbon nanotube (DWCNT). In the paper [5], the case is considered where a single periodical curved carbon nanotube (CNT) with an infinite length is contained by an infinite body with low concentration of CNT and the stability loss problem in that is investigated. The investigation on how the critical values related to the internal stability loss of composites is affected by the CNTs reciprocally as the volume ratio of CNTs gets bigger in composites, is very important. In the present investigation the approaches [5] is developed for solution of these stability loss problems and investigates the influence of the interaction between two neighboring CNTs on the values of the critical values. It is assumed that in the initial state the CNTs have the same initial imperfection in the periodical curving form. Within the framework of the piecewise homogeneous body model with the use of the Three-Dimensional Geometrically Nonlinear Exact Equations of the Theory of Elasticity the growing of the initial imperfection is investigated. The corresponding non-linear boundary-value problem is solved by employing

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boundary-shape perturbation method. In this case a small parameter characterizing the degree of the initial imperfection is introduced and the solution of the mentioned problem is presented in power series form in this small parameter. It is proven that the zeroth and first approximations are enough for investigation of the development of the initial imperfection. The case where the mentioned imperfection starts to increase and becomes indefinitely is taken as a fracture (stability loss) criterion.

**Acknowledgement.** This research has been supported by Yıldız Technical University Scientific Research Projects Coordination Department. Project Number: 2014-07-03-DOP01.

**Keywords.** Fracture in compression, Nanocomposite, Nanotube, Internal stability loss

**References**


On Homoclinic Structure for 2D Coupled Nonlinear Schrödinger System
Irma Hacinliyan\textsuperscript{1} and Ceni Babaoğlu\textsuperscript{2}

Abstract. It has been demonstrated that an analytic description of the homoclinic structure for 1D nonlinear Schrödinger equation is obtained via soliton type solutions [1]. In a further work, these analytic expressions of homoclinic orbits are used for 1D coupled nonlinear Schrödinger system and long-short wave equations [2]. In this study, the homoclinic structure for 2D coupled nonlinear Schrödinger (CNLS) system is investigated by following a similar approach. It is observed that the fixed point in the CNLS system is hyperbolic. Then, the soliton type solutions which form homoclinic orbits are found by using Hirota's method. Some consequences are also supported by numerical computations.

Keywords. Homoclinic Orbits, Nonlinear Schrödinger-Like Equations.

AMS 2010. 35Q55, 37C29.

References


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Abstract. In this paper, we consider the following singularly perturbed quasilinear nonlocal problem:

\[ Lu = \varepsilon u''(x) + \varepsilon u'(x) - f(x, u(x)) = 0, \quad 0 < x < \ell \]  
\[ u(0) = A \]  
\[ L_0 u = u(\ell) - \int_0^\ell g(x)u(x)dx = B, \quad 0 \leq \ell_0 < \ell_1 \leq \ell \]  

where \( 0 < \varepsilon << 1 \) is the perturbation parameter, \( A \) and \( B \) are given constants, the functions \( a(x) \geq 0 \) and \( f(x, u) \) are sufficiently smooth on \([0, \ell]\) and \([0, \ell] \times \mathbb{R}\), respectively, and \( g(x) \) is a continuous function on \([\ell_0, \ell_1]\), moreover \( 0 < \beta \leq \frac{\partial f}{\partial u} \leq \beta^* < \ell \).

First we discuss the nature of the continuous solution of singularly perturbed differential problem before presenting method for its numerical solution. The numerical method is constructed on piecewise uniform Shishkin type mesh. We show that the method is first-order convergent in the discrete maximum norm, independently of singular perturbation parameter except for a logarithmic factor. We give effective iterative algorithm for solving the nonlinear difference problem. Numerical results which support the given estimates are presented.

Keywords. Singular Perturbation, Fitted Difference Scheme, Uniformly Convergence
AMS 2010. 65L12, 65L70, 34B10, 34D15.

References


Inverse Spectral Problems for Energy-Dependent Sturm-Liouville Equations with Finitely Many Point $\delta$ – Interactions

Manaf Dzh. Manafov

Abstract. We study inverse spectral problems for energy-dependent Sturm-Liouville equations with finitely many point $\delta$ – interactions a finite interval. Spectral problems of differential operators are studied in two main branches, namely, direct and inverse problems. Direct problems of spectral analysis consist in investigating the spectral properties of an operator. On the other hand, inverse problems aim at recovering operators from their spectral characteristics. One takes for the main spectral data, for instance, one, two, or more spectra, the spectral function, the spectrum, and the normalized constants, the Weyl function. Direct and inverse problems for the classical Sturm-Liouville operators have been extensively studied (refer to [1-4]). In this study, various uniqueness results are proved, and a constructive procedure for the solution is provided.

Keywords. Energy-Dependent Sturm-Liouville Equations, Inverse Spectral Problems, Point $\delta$ –Interactions.

AMS 2010. 34A55, 34B24, 34L05

References


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Effect of a Surface Asperity at the Nanoscale
M. Grekov\textsuperscript{1} and S. Kostyrko\textsuperscript{2}

Abstract. Unlike bulk material elements, the nanostructures have elastic properties which are highly depend on their size. This size dependency of properties at the nanoscale can be understood by incorporating the effect of surface stress. The intent of this work is to examine the effect of surface and bulk elastic parameters, surface stress and nanosized asperity shape on stress concentration and local stress distribution at a solid surface. We consider the 2-D model of semi-infinite elastic solid having a nanosized surface roughness and subjected to remote tensile loading. It is assumed that, according to Young-Laplace law \cite{1}, the traction at the boundary is expressed in terms of surface stress which is intrinsic to nanometer size structures. In order to find the surface stress we take into consideration the condition of surface and bulk inseparability. To solve the boundary value problem, we use Gurtin-Murdoch surface elasticity model \cite{1} containing constitutive equations for the surface linear elasticity with two elastic parameters and residual surface stress \cite{2}. The way of deriving an analytical solution is based on Goursat-Kolosov complex potentials, Muskhelishvili representations and the boundary perturbation technique. This technique leads to the singular integro-differential equation in expansion coefficients of surface stress in each-order approximation. The solution of this equation and numerical results are presented in the first-order approximation.

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Keywords. Boundary Perturbation Method, Singular Integral Equations, Surface Nanodefects, Surface Stress, Stress Concentration, Size Effect.

AMS 2010. 74G10, 74M25, 74S70.

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Conservation Laws and Exact Solutions of Nonlinear Differential Equation
Melike Kaplan¹, Arzu Akbulut² and Filiz Tascan³

Abstract. The concept of conservation laws has a long and profound history in physics. Whatever the physical laws considered: classical mechanics, fluid mechanics, solid state physics, as well as quantum mechanics, quantum field theory or general relativity, whatever constituents of the theory and the intricate dynamic processes involved, quantities left dynamically invariant have always been essential ingredients to describe nature. At the mathematical level conservation laws are deeply connected with the existence of a variational principle which admits symmetry transformations [1], [2].

In this study we have used conservation theorem approach to construct conservation laws of an equation [3]. Also by using the $(G'/G,1/G)$-expansion method exact solutions have been verified [4].

Keywords. Conservation Law, Exact Solution, $(G'/G,1/G)$-Expansion Method.

AMS 2010. 70S10, 83C15.

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Stability of One Nonlinear System with Delay

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Abstract. In the book [1] Lotka-Volterra mathematical model is widely used in economic dynamics. The model for two economic agents and in the multidimensional case has a second order polynomial nonlinearity in the right-hand side. Furthermore, the delay is entered in its reproduction mechanism. Thereby, the analysis of the qualitative behavior of solutions requires apparatus of nonlinear systems with concentrated delay. Many papers are focused on these problems. In particular, the recognized authoritative textbooks and monographs by N. N. Krasovsky [2], R. Bellman and K. Cooke [3], J. Hale [4], etc.

In the paper [1] (see also [5]) basic model is analyzed in point of asymptotic stability of the equilibrium states and the presence of oscillations about stationary points when asymptotic stability is absent. Analysis algorithm is generally accepted: calculating stationary points, building the linear part of the system in deviations and the problem of asymptotic stability of the equilibrium solutions of the nonlinear system is solved by the location of the roots of the characteristic equation. Herewith nonlinear part must satisfy the conditions of the theorem about stability in first approximation by N. N. Krasovsky, which we'll give for the sake of completeness by [2] in the case of the same constant delay in all system's equations.

The novelty of this study is selection of the class of mathematical models with a special introduced delay. Let us recall that the characteristic equation of a linear system with concentrated delay is not polynomial as in systems without delay but quasipolynomial, and this brings difficulties as a countable number of roots [3]. Selected class reduces the problem to the analysis of a finite number of roots, for each of which are known conditions of asymptotic stability. In this article were obtained three theorems which allow us to find the critical value of delay for a sufficiently broad class of systems arbitrary dimension by a simple algorithm. Lotka-Volterra systems are widely used in the simulation of economic processes, and examples confirm the applicability of these theorems.

Keywords. Lotka-Volterra Model, Delay, Stability.

AMS 2010. 34A34, 34D05.

References


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Control Problems of Nonlinear Phase Systems
M. N. Kalimoldayev\(^1\) and M. T. Jenaliyev\(^2\)

Abstract. Let us consider the problem of functional minimization:
\[
J(v_1,\ldots,v_l) = \frac{1}{2} \sum_{i=1}^{\ell} \int_0^T \left( w_{v_i} S_i^2 + w_{v_i} v_i^2 \right) \exp\{\gamma_i t\} dt + \Lambda(\delta(T), S(T)) ,
\]
(1)
\[
\frac{d\delta_i}{dt} = S_i , \quad H_i \frac{dS_i}{dt} = -D_i S_i - f_i(\delta_i) - N_i(\delta_i) + v_i , \quad \delta = (\delta_1,\ldots,\delta_l) , \quad S = (S_1,\ldots,S_l) ,
\]
(2)
where \(w_{v_i}\), \(w_{v_i}\) are weight coefficients, correspondingly positive functions and constants; \(H_i\) is an inertial constants; \(f_i(\delta_i)\) are \(2\pi\)-periodical continuously differentiated functions; \(N_i(\delta)\) are \(2\pi\)-periodical continuous differentiated functions relative to \(\delta_1,\ldots,\delta_l\); for

Theorem 1. For optimality of controls \(v_i^0(S_i,t) = -[w_{v_i}]^{-1} \exp\{-\gamma_i t\} S_i ; i = 1,\ldots,l\),
and their corresponding solution \(\{S^0(t),S^0(t)\}\) of system (2)–(3), it is necessary and sufficient, that
\[
\Lambda(\delta,S)_{\ell=0} = K(\delta,S)_{\ell=0} \quad w_{v_i}(t) = 2D_i \exp\{-\gamma_i t\} + [w_{v_i}]^{-1} \exp\{-2\gamma_i t\} > 0 , \quad i = 1,\ldots,l ,
\]
where
\[
K(\delta,S) = \frac{1}{2} \sum_{i=1}^{\ell} \left[ H_i S_i^2 + \int_0^{\delta_i} f_i(\delta_i) d\delta_i \right] + \sum_{i=1}^{\ell} \int_0^{\delta_i} N_i(\delta_1,\ldots,\delta_{i-1},\delta_{i+1},\ldots,\delta_l) d\xi_i .
\]
Bellman-Krotov function [1] and besides, \(J(v^0) = \min_{v} J(v) = K(\delta^0, S^0) .
\]

In this work while solving the control synthesis problem for the considered electric power system, the constructions of the method of Bellman-Krotov function in the form of necessary and sufficient optimality conditions were used.

Keywords. Optimal Control, Phase System, Bellman-Krotov Function.


References


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Interchange of Mass after a Close Encounter between Galaxies
M. Ollé 1, E. Barrabés and J.M. Cors

Abstract. The talk's context is Celestial Mechanics and the application of dynamical systems tools to study the motion of the parabolic restricted three body problem (PRTBP). The goal of this problem is to study the motion of a massless body attracted, under the Newton's law of gravitation, by two equal masses moving in parabolic orbits all over in the same plane. The PRTBP may be regarded as a simplified model for the motion of two galaxies, taken as the primaries, and an infinitesimal mass. In order to discuss possible motions for the particle, first we consider a rotating and pulsating frame where the equal masses (primaries) remain at rest. The obtained system of ODE is gradient-like and has exactly ten hyperbolic equilibrium points lying on the boundary invariant manifolds corresponding to escape of the primaries in past and future time. The invariant manifolds of the equilibrium points play a key role in the dynamics and we study some trajectories described by the particle before and after a close encounter between the primaries. Finally some numerical simulations are done, paying special attention to capture and escape orbits.

Keywords. Parabolic Restricted Three-Body Problem, Equilibrium Points, Invariant Manifolds, Numerical Simulations, Global Dynamics

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One a Numerical Method of Riemann Type Problem for 2D Conservation Laws in a Class of Discontinuous Functions

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Abstract. In this study, a new method for obtaining a numerical solution of first order nonlinear equation describing conservation laws is suggested. In order to realize it, a special auxiliary problem is introduced. This problem permits us to find the solution of the investigated problem with higher accuracy, such that the obtained solution expresses all of the physical properties of the considered problem.

Keywords. Riemann-Type Problem, 2D-Burgers Equation, Numerical Solution in a Class of Discontinuous Functions, Numerical Weak Solution

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On Two-Dimensional Nonsteady Free Convection near Vertical Plate subject to Stepped-up Surface Temperature

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Abstract. Theoretical studies involving buoyancy-driven flows of viscous incompressible fluids near stationary or moving vertical flat plates have been a subject of intense investigations in the literature, apparently due to numerous applications in a number of areas of engineering and technology. In such convection problems, the role of momentum as well as thermal boundary conditions is known to have a significant bearing on the developing as well as fully developed flows. For instance, in certain applications, the nature of the initial thermal profile of the bounding surface could play an important role in the design processes. We have thus investigated a specific unsteady free convective flow near a semi-infinite vertical plate assuming that bounding plate has been subjected to stepped-up time dependent temperature distribution. This leads to the development of boundary layer near the surface. We have solved the governing momentum and thermal boundary layer equations numerically using an appropriate implicit finite difference technique, and exhibited the profiles of the developing and steady state velocity and temperature at various cross-sections. Furthermore, we have also included the plots of isotherms to analyze the thermal changes in the boundary layer. The comparison of some results with infinite vertical wall case as well as variations of two quantities of engineering interest, namely, wall skin friction and Nusselt number, will also be reported during the presentation.

Keywords. Free Convection, Unsteady Flow, Stepped-Up Temperature, Boundary Layer.

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An Alternative Technique for Solving Ordinary Differential Equations
Neşe Dernek¹, Fatih Aylıkcı² and Sevil Kıvrak³

Abstract. In the present paper, a new method for solving ordinary differential equations is given by using the generalized Laplace transform $L_n$:

$$F(y) = L_n\{f(x); y\} = \int_0^\infty x^{n-1} f(x) \exp(-x^n y^n) \, dx, \quad n \in \mathbb{N}.$$  

The $L_n$-transform and the complex inverse generalized Laplace transform $L_n^{-1}$ were introduced by Dernek and Aylıkcı in [4]. The $L_n^{-1}$-transform is defined by

$$L_n^{-1}\{F(y)\} = \frac{1}{2\pi i} \int_{c-i\infty}^{c+i\infty} n L_n\{f(x); y^{1/n}\} \exp(x^n y) \, dy,$$

where $L_n\{f(x), y^{1/n}\}$ has a finite number of singularities in the left-half plane $\text{Re}(y) \leq c$.

The object of this paper is first to introduce a differentiation operator $\delta$ for the $L_n$-transform that we call the $\delta$-derivative and define as ([4],[11])

$$\overline{\delta_x} = \frac{1}{x} \frac{d}{dx}.$$  

We note

$$\overline{\delta_x^2} = \overline{\delta_x \delta_x} = \frac{1}{x^2} \frac{d^2}{dx^2} - \frac{1}{x^3} \frac{d}{dx}.$$  

The $\delta$-derivative operator can be successively applied in a similar fashion for any positive integer power. A relation between the $L_n$-transform of the $\delta$-derivative of a function and the $L_n$-transform of the function itself is derived by the following theorem.

**Theorem 1.** If $f$ is piecewise continuous function on the interval $[0, \infty)$ and is exponential order $\exp(x^n y^n)$ as $x \to \infty$, for some constant $a$, then the following relation holds true for $k \geq 1$, $k$ is a positive integer.

$$L_n\{x^{kn} f(x); y\} = \frac{(-1)^k}{n^k} \delta_y^k L_n\{f(x); y\},$$

holds true for $k \geq 1$, $k$ is a positive integer.

The theorem for the inverse transform $L_n^{-1}$ is given as follows.
Theorem 2. Let \( L_n\{f(x), y^{1/n}\} \) be an analytic function of \( y \) except at singular points, each of which lies to the left of the vertical line \( \text{Re}(y) = c \) and they are finite numbers. Suppose that \( y=0 \) is not a branch point and \( \lim_{y \to \infty} L_n\{f(x), y^{1/n}\} = 0 \) in the left-plane \( \text{Re}(y) \leq c \), then the following identity

\[
L_n^{-1}\{L_n\{f(x); y\}\} = \frac{1}{2\pi i} \int_{c-i\infty}^{c+i\infty} \frac{L_n\{f(x), y^{1/n}\} \exp(yx^n)}{y} dy
\]

\[
= \sum_{k=1}^{m} \text{Res}\{L_n\{f(x); y^{1/n}\} \exp(x^n y); y = y_k\}
\]

holds true for \( m \) singular points.

Definition: The convolution of two integrable functions \( f(x) \) and \( g(x) \) is defined by

\[
f(x) * g(x) = \int_{0}^{x} \tau^{n-1} g(\tau)f((x^n - \tau^n)^{1/n}) d\tau.
\]

Theorem 3. If \( L_n\{f(x), y\}=F(y) \) and \( L_n\{g(x), y\}=G(y) \), then the relation for the convolution \( f(x) * g(x) \)

\[
L_n\{f(x) * g(x); y\} = F(y)G(y),
\]

holds true.

In the last part of this paper using above theorems, some initial-value problems are solved as examples.

Keywords. The Laplace Transform, The \( L_n \)-Transform, The \( L_n^{-1} \)-Transform, Linear Ordinary Differential Equations.

AMS 2010.44A10, 44A15, 44A20, 34A30.

References


New Identities for the Generalized Glasser Transform, the Generalized Laplace Transform and the $E_{2n,1}$-Transform

Neşe Dernek$^1$, Fatih Aylıkçı$^2$ and Gülesin Balaban$^3$

Abstract. In the present paper the authors defined the generalized Glasser transform $G_{2n}$ and gave the following iteration identity for the generalized Laplace transform $L_{2n}[5]$ and the generalized Glasser transform $G_{2n}$:

$$2nL_{2n}\{u^{-n}L_{2n}\{f(x); u\}; y\} = \sqrt{\pi}G_{2n}\{x^{2n-1}f(x); y\}.$$  

Using this identity, a Parseval-Goldstein type theorem for the $L_{2n}$-transform and the $G_{2n}$-transform is given as follows:

$$2n \int_0^\infty y^{n-1}L_{2n}\{f(x); y\}L_{2n}\{g(u); y\}dy = \sqrt{\pi} \int_0^\infty x^{2n-1}f(x)G_{2n}\{u^{2n-1}g(u); x\},$$

$$2n \int_0^\infty y^{n-1}L_{2n}\{f(x); y\}L_{2n}\{g(u); y\}dy = \sqrt{\pi} \int_0^\infty u^{2n-1}g(u)G_{2n}\{x^{2n-1}f(x); u\}du$$

and

$$\int_0^\infty x^{2n-1}f(x)G_{2n}\{u^{2n-1}g(u); x\}dx = \int_0^\infty u^{2n-1}g(u)G_{2n}\{x^{2n-1}f(x); u\}du.$$  

By making use of these results, new Parseval-Goldstein type identities are obtained for $G_{2n}$-transform and many other well-known integral transforms. Some of them are:

$$2n \int_0^\infty y^{-\mu(\mu-1)}L_{2n}\{f(x); y\}dy = \Gamma\left(\frac{1}{2} - \frac{\mu}{2}\right) \int_0^\infty x^{\mu(\mu+1)-1}f(x)dx,$$

$$\Gamma\left(\frac{\mu}{2}\right) \int_0^\infty y^{-\mu(\mu+1)-1}L_{2n}\{f(x); y\}dy = \sqrt{\pi} \int_0^\infty u^{\mu-1}G_{2n}\{x^{2n-1}f(x); u\}du,$$

$$nL_{2n}\{y^{n(2v-1)}L_{2n}\{f(x); \frac{1}{21/m}\}; z\} = 2^{v-\frac{1}{2}}z^{-\alpha(v+1)}K_{v+\frac{1}{2},m}\{x^{n+1}f(x); z\},$$

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where the integrals involved converge absolutely. $K_{v,n}$ and $H_{v,n}$ are generalized Bessel and Hankel transforms, respectively [6].

The identities that are proven in this paper are shown to give rise to useful corollaries for evaluating infinite integrals of special functions. Illustrative examples are also given. Some of them are:

\[
\begin{align*}
1) & \int_0^\infty \frac{x^{2n-1} \exp(a^2 x^{2n}) \Gamma(v, a^2 x^{2n})}{\sqrt{x^{2n} + y^{2n}}} dx = -\frac{i a^{2n}}{2n} \sqrt{\pi} \Gamma(v) \exp(-a^2 y^{2n}) \text{erfc}(ia^n y^n) \\
& + i (-1)^{n/2} \frac{\theta^{2n}(x)}{2n} B\left(v, \frac{1}{2} - v\right) \exp(-a^2 y^{2n}) \Gamma\left(v + \frac{1}{2}, -a^2 y^{2n}\right) \\
& \text{where } -1 < Re(v) < \frac{1}{2} \text{ and } |Arg(-a^2)| < \pi.
\end{align*}
\]

\[
2) \int_0^\infty x^{(v+\frac{1}{2})-1} \cos(a^2 x^{2n}) K_v(x^n z^n) dx = \frac{z^{v+\frac{1}{2}} \Gamma(v+\frac{1}{2})}{2^{v+\frac{1}{2}} a^{n(2v+3)}} \left[ \exp\left( i \frac{z^{2n}}{4a^{2n}} + i \frac{(v - \frac{1}{2}) \pi}{2}\right) \right. \\
& \times \Gamma\left(\frac{1}{2} - v, i \frac{z^{2n}}{4a^{2n}}\right) + \exp\left( -i \frac{z^{2n}}{4a^{2n}} - i \frac{(v - \frac{1}{2}) \pi}{2}\right) \Gamma\left(\frac{1}{2} - v, -i \frac{z^{2n}}{4a^{2n}}\right) \\
& \text{where } Re(a^{-2n}) > 0, Re(z^{2n}) > 0, Re(v) > -\frac{1}{2}.
\]

etc.

We conclude by remarking that, many other infinite integrals can be evaluated by applying theorems and corollaries that are given in our paper.

**Keywords.** Laplace Transforms, L$_{2n}$-Transforms, G$_{2n}$-Transforms, F$_{s,n}$-Transforms, F$_{c,n}$-Transforms, H$_{v,n}$-Transforms, K$_{v,n}$-Transforms, E$_{2n,1}$-Transforms, Parseval-Goldstein Type Theorems.

**AMS 2010.** Primary 44A10, 44A15, Secondary 33C10, 44A35.

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Estimating Elasticity Modulus of the Piezo Ceramic Disc Using Basic Mathematical Modelling

Nedret Elmas 1, Levent Paralı, Ali Sarı, Jiri Pechousek and Frantisek Latal

Abstract. The objective of this paper is to determine a mathematical modelling of piezoceramic disc vibration using a single degree freedom mechanical model, with estimation of its elasticity modulus. The experimental vibration displacement values of piezo ceramic disc have been achieved utilizing the swept-sine signal excitation following the peak values in the signal response measured by the laser Doppler vibrometer. Consistency between the mathematical modelling and experimental values have been observed from 97 to 80 % between excitation amplitudes of 0.5 and 3.5 V when the mathematical modeling of piezo ceramic disc is normally taken into consideration with a linear working range. The results obtained from experimental studies on resonance frequency are in a compliance with reference value declared by producer of the piezo ceramic disc.

Keywords. Elasticity Modulus, Piezo Ceramic, Resonance Frequency, Vibration, Displacement.

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Oscillation Results for a Class of Fourth-order Nonlinear Differential Equations with Positive and Negative Coefficients

Nagehan Kılınç Geçer¹ and Pakize Temtek²

Abstract. Over the past few years, there has been a strong interest in the study of the oscillatory behavior of solutions of delay differential equations with positive and negative coefficients of the first and second orders. However, very few results are available on the study of oscillatory and asymptotic behavior of solutions of the fourth-order equations, which is explained by significant technical difficulties arising in the analysis of these equations. Thus we are concerned with oscillation of the fourth-order differential equations with positive and negative coefficients and obtained oscillation results by using some techniques for these differential equations.

Keywords. Oscillation, Fourth Order Nonlinear Differential Equation.

AMS 2010. 34C10, 35C15.

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Different Methods for Nonlinear Fractional Differential Equation

Özkan Guner¹, Ahmet Bekir², Adem C. Cevikel³ and Esin Aksoy⁴

Abstract. In this study, the nonlinear fractional partial differential equation have been defined by the modified Riemann-Liouville fractional derivative [1,2]. By using this fractional derivative and the fractional complex transform [3-5], the nonlinear fractional partial differential equations have been converted into nonlinear ordinary differential equations. Then the reduced equations can be solved by symbolic computation.

The different methods [6-14] are implemented to get exact solutions of the nonlinear fractional equation. As a result, some exact solutions including hyperbolic solutions of this equation have been successfully obtained.

Keywords. Exact Solution, Modified Riemann-Liouville Derivative, Fractional Complex Transform.

AMS 2010. 34A08, 26A33, 83C15, 35R11.

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On Solutions of Some Second-Order Ordinary Differential Equations by Jacobi Last Multiplier Method
Özlem Orhan¹ and Teoman Özer²

Abstract. In this study, we present a new classification of a nonlinear equation and the approach is used to obtain the general solutions by first integral and an effective technique for analyzing first integral of nonlinear equation based on λ-jacobian approach is considered. The effectiveness of this approach is demonstrated to find the general solution for the differential equations defining geodesics on surfaces of revolution of constant curvature in a unified manner.

Keywords. First Integral, Jacobi Last Multiplier Method, Ordinary Differential Equations, Lagrangian.

References


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A Gravitational model with $Y(R)F^2$-type Coupling
Özcan Sert

Abstract. We investigate a gravitational model which involves a non-minimal coupling between a function of curvature scalar and electromagnetic fields in $Y(R)F^2$ form. The models with $RF^2$-type couplings [1–4] give more information about gravity and electromagnetism. The natural extensions of the models to the $Y(R)F^2$ gravity [5] were studied in order to explain the late-time acceleration and inflation of the universe. Moreover, the rotational curves of test particles around galaxies may be realized by considering a non-minimal $Y(R)F^2$ gravity [6,7]. We give the gravitational field equations obtained from a first-order variation principle using the method of Lagrange multipliers and the algebra of exterior differential forms. We discuss various spherically symmetric, electromagnetic solutions consistent with observations.

Keywords. Gravitation, Einstein-Maxwell, Non-Minimal Coupling.

AMS 2010. 83C15, 83C22

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Some Aspects of Natural Convection in a Hydrodynamically and Thermally Anisotropic Porous Non-Rectangular Cavity

Pallath Chandran¹, Nirmal C. Sacheti², Ashok K. Sing³ and Beer S. Bhadauria⁴

Abstract. Natural convection in a porous non-rectangular vertical cavity with a sloping upper boundary with or without heat sources/sinks has been considered. It is assumed that the cavity is filled with porous material subject to hydrodynamical and thermal anisotropy. Assuming Darcy law to hold, together with Boussinesq approximation, the governing partial differential equations have been solved numerically. To facilitate the computation, the non-rectangular physical domain has been transformed to a square computational domain using an algebraic grid generation method. The effect of a range of parameters of interest such as internal heating parameter, slope of the upper boundary, Darcy-Rayleigh number and aspect ratio, has been illustrated through plots of streamlines and isotherms. Furthermore, the variation of the average Nusselt number has also been discussed in relation to the anisotropic as well as heat source/sink parameters.

Keywords. Porous Media, Natural Convection, Anisotropy, Heat Source/Sink.

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Classic Metaheuristics and Evolutionary Optimization Algorithms for Routing Problems: A Computational Study

Pantelis Z. Lappas¹, Manolis N. Kritikos² and George D. Ioannou³

Abstract. This paper focuses on the development of effective metaheuristic algorithms for hard combinatorial optimization problems, such as routing problems. Routing problem is the generic name given to a whole class of problems in which the transportation is necessary. The Travelling Salesman Problem (TSP), the Vehicle Routing Problem (VRP) and the Inventory Routing Problem (IRP) are representative examples of this category. Routing problems have received much attention throughout the literature, because they are easily described, widely applied to many transportation and distribution problems, and difficult to be solved. The TSP is the most basic routing problem, as well as, a typical model of the combinatorial optimization problems whose computation complexity is of non-polynomial time (NP-Hard problem). The statement of the TSP is rather simple: a vehicle is to visit a number of customers and the distance connecting two customers is known; the problem is to find the shortest route that starts from a depot, visits all customers exactly once, and returns to the depot. However, in transportation problems, customers have usually a demand, whereas the depot consists of a fleet of vehicles, with limited and known capacity. This situation reflects the VRP which generalizes the Multiple Travelling Salesman Problem (m-TSP), that is the TSP with m vehicles. The VRP is even more complicated, since for small fleet sizes and a moderate number of transportation requests, the planning task is highly complex. The Vehicle Routing Problem with Time Windows (VRPTW) is a generalization of the VRP involving the added complexity that every customer should be served within a given time window. Furthermore, the IRP is an extension of the VRP, which integrates routing decisions with inventory control. The problem arises in environments where Vendor Managed Inventory (VMI) resupply policies are employed. Whereas VRPs typically deal with a single day, IRPs have to deal with a longer horizon (a sequence of days). Actually, contrary to the VRP, the vendor (supplier), not the customers, decides how much to deliver to which customer each day. Moreover, the Inventory Routing Problem with Time Windows (IRPTW), which is not addressed in the literature so far, is a generalization of the standard IRP involving the added complexity that every customer should be served within a given time window. The IRP is obviously NP-Hard, being a generalization of the single vehicle IRP, which reduces to

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the TSP when time horizon is composed of one day, the inventory costs are zero, all the customers need to be served and the transportation capacity is infinite. Due to the NP-hard nature of the routing problems, it is very challenging to develop exact algorithms that can solve large scale problems in a reasonable computational time. The TSP has been a primary driving force for the development of novel optimization concepts and solution algorithms. Several of the most important classic metaheuristics and evolutionary optimization algorithms for the routing problems are summarized, implemented and compared, in the context of the TSP. Classic metaheuristics that have been developed are related to algorithms such as: (1) Iterated Local Search (ILS), (2) Guided Local Search (GLS), (3) Variable Neighborhood Search (VNS), (4) Greedy Randomized Adaptive Search Procedure (GRASP), (5) Tabu Search (TS) and (6) Simulated Annealing (SA). In addition, evolutionary optimization algorithms that have been developed and compared to classic metaheuristics encompass population-based approaches such as: (1) Genetic Algorithm (GA) and (2) Ant Colony Optimization Algorithm (ACO). Some testing instances with different properties are established to investigate the algorithmic performance, and the computational results are then reported. Experimental results show that the GAs produce an optimal solution and reflect superior performance compared to the classic algorithms. As a consequence, GAs have been chosen and implemented to solve several variants of TSP, namely the m-TSP and the VRPTW. Finally, an hybrid GA, combining Monte Carlo Simulation and GA, is used for solving the IRPTW.

**Keywords.** Routing Problems, Metaheuristics, Evolutionary Optimization Algorithms.
The $L^p$ Hardy Inequality with Two Weight Functions and Its Improved Versions
Semra Ahmetolan$^1$ and Ismail Kombe$^2$

Abstract. In this work, the $L^p$ Hardy Inequality with two weight functions is obtained for generalized Greiner vector fields:

$$\int_{\Omega} \rho^{\alpha}|z|^t|\nabla_k \varphi|^p \, dw \geq \left( \frac{Q+\alpha+t-p}{p} \right)^{2k} \int_{\Omega} \rho^{\alpha-p}|z|^t|\nabla_k \rho|^p|\varphi|^p \, dw.$$ 

A generic point in $\mathbb{R}^{2n+1}$, $n \geq 1$, is defined by $w = (z,l) = (x,y,l) \in \mathbb{R}^{2n+1}$ where $x, y \in \mathbb{R}^n$, $z = x + \sqrt{-1}y$ and $|z| = (|x|^2 + |y|^2)^{1/2}$. Here $dw = dzdl$ denotes the Lebesgue measure on $\mathbb{R}^{2n+1}$ and $\rho(w) = (|z|^{4k} + l^2)^{1/4k}$. The sub elliptic gradient is the $2n$ dimensional vector field given by $\nabla_k = (X_1, X_2, \ldots, X_n, Y, Y_2, \ldots, Y_n)$ where $X_j = \frac{\partial}{\partial x_j} + 2ky_j|z|^{2k-2} \frac{\partial}{\partial t}$, and $Y_j = \frac{\partial}{\partial y_j} - 2kx_j|z|^{2k-2} \frac{\partial}{\partial t}$, $j = 1, 2, \ldots, n$, $k \geq 1$. Furthermore, we also present its improved versions with remainder term by introducing a distance function. It is well known that the Hardy inequality and its improved versions play important role in partial differential equations with singular potentials [1-4]. Hence, there is a vast amount of work in the literature related to the Hardy inequality [5-6].

Keywords. Hardy Inequality, Greiner Vector Fields, Sharp Constants.

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Static Analysis of Euler-Bernoulli Beams Resting on Foundation of Pasternak and Winkler using Differential Transformation Method
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Abstract. In this study, differential equations of Euler – Bernouilli beams which play an important role in engineering problems of Winkler and Pasternak foundation have been examined [1,3.8]. Problems of beams, plates and shells rested on top of elastic foundation are usually extreme due to the wideness of the area of their application. Some examples of these applications are used in railway engineering, transportation pipes for fluids and gas, coastal and seaport structures, missilse launchers, airports, aerospace, petro-chemical industries, biomechanic and dentistry. Models like Winkler and Pasternak, Vlasov, Kerr and other types have been developed for the resting foundation of structural elements such as beams and plates[5,7]. Until today, problem of resting beam on elastic foundation, static, strain and vibration, has been solved by calculating finite variations, finite elements, boundary elements, Ritz, Galerkin using differential quadrature methods [2,7]. In this study, foundation models that belong to Winkler and Pasternak foundations have been defined by Euler – Bernouilli beam theory and equations of these problems calculated with the help of differential transformation method [6]. Applicability between two foundation models has been analysed. The differential transformation method used in analysis, is a technique of transformation which is based on expansion of Taylor Series and analytic solutions of differential equations [4]. In this method, specific transformation rules are applied to differential equations belonging to a certain problem and boundary conditions to transform them into simple analytic expressions. Characteristics of the described method have been defined and their outcome compared to analytic results with the help of Maple 13 program. Subsidence values have been presented in the table form to show the compliance of both outcome and analytic results.

Keywords. Differential Transform Method, Winkler’s Model, Pasternak’s Model, Euler – Bernouilli Beams

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Octonic Formulation of Dyons for Gravi-Electromagnetism
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Abstract. Mathematically, octons are the eight-deimensional values composed of scalars, vectors, pseudoscalars and pseudovectors. Mironov and Mironov [1] have proposed this spatial object generating a closed noncommutative associative algebra and having a clear well defined geometric interpretation. In relevant literature, octons have many physical applications specially in electromagnetic theory [1,2], relativistic quantum mechanics [3,4] and linear gravity [5]. In this work, a octonic model [6] is presented for the unification of linear gravity and electromagnetism. Similarly, the generalized field equations are expressed for the particles(dyons) carrying both electromagnetic and gravitational charges simultaneously.

Keywords. Octon, Electromagnetic Theory, Linear Gravity, Dyon

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Evaluation of Soybean Hydration Model with Volume Variation
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Abstract. Measurement of moisture during soybean hydration one of the most important analyses on food product. During soaking, moisture profiles behave as distributed parameter systems which predict moisture of grain over time by solution of partial differential equations. One of the distributed parameter model in literature is known as Hsu model. Hsu model has the advantage that it has effective diffusivity of water as its most important parameter which depends on moisture content. Model parameters ($D_0, k_1, \beta$) from Hsu’s (1983) which influence the behavior of the model and diffusivity are important.

In this study, Hsu model considered with volume variation during soybean hydration was solved numerically. Different model parameters were obtained from literature and optimal parameters were found at each temperature.

Keywords. Hsu Model, Finite Difference Method, Optimal Parameters.

AMS 2010. 65M06, 35K55.

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Stabilization of Solutions of Linear Volterra Implicit Integro-Differential Equation of the First Order

S Iskandarov

Abstract. All presented functions are continuous and relations is true \( t \geq t_0, \ t \geq \tau \geq t_0 \);
IDE - integro-differential equation; a stabilization of the solutions of linear first order Volterra type IDE refers to the pursuit of finite limits for \( t \to \infty \) all its solutions.

PROBLEM. To establish sufficient conditions for stabilization of solutions of the first order IDE:

\[
x'(t) + a(t)x(t) + \int_{t_0}^{t} [K(t, \tau) + Q(t, \tau)]x'(\tau)d\tau = f(t) + q(t), \quad t \geq t_0,
\]

This problem previously considered by the author (2002), author and D.N. Shabdanov (2004). In this paper, a more general conditions imposed on the kernel \( K(t, \tau) + Q(t, \tau) \) and the free term \( f(t) + q(t) \) than in the cited papers. Here presented one is of the results.

Let: \( 0 < \phi(t) \) - some weighting function,

\[
K(t, \tau) = \sum_{i=0}^{n} K_i(t, \tau), \quad Q(t, \tau) = \sum_{j=0}^{m} Q_j(t, \tau), \quad f(t) = \sum_{i=0}^{n} f_i(t), \quad q(t) = \sum_{j=0}^{m} q_j(t), \quad (K), (Q), (f), (q)
\]

\( \psi_i(t) (i = 1..n), \ \varphi_j(t) (j = 1..m) \) - some cutting functions,

\[
R_i(t, \tau) \equiv \phi(t)K_i(t, \tau)(\psi_i(t)\psi_i(\tau))^{-1}, \quad E_i(t) \equiv \phi(t)f_i(t)(\psi_i(t))^{-1},
\]

\[
R_i(t, t_0) = A_i(t) + B_i(t) \quad (i = 1..n), \quad (R)
\]

\[
P_j(t) \equiv \phi(t)Q_j(t, t)(\varphi_j(t))^{-2}, \quad T_j(t, \tau) \equiv Q_j(t, \tau)(\varphi_j(\tau))^{-1}, \quad F_j(t) \equiv \phi(t)q_j(t)(\varphi_j(t))^{-1},
\]

\[
P_j(t) = M_j(t) + N_j(t) \quad (j = 1..m), \quad (P)
\]

\( c_{i1}(t), \ c_{j2}(t) \quad (i = 1..n; \ j = 1..m) \) - some functions.

Note that the kernels \( R_i(t, \tau) (i = 1..n) \) called cut; kernels \( T_j(t, \tau) (j = 1..m) \) - partially cut.

THEOREM. Let 1) \( \phi(t) > 0 \), the conditions \( (K), (Q), (f), (q), (R), (P) \) are true;

2) \( a(t) \geq 0, \ (a(t)\phi(t))' \leq 0; \)

3) \( A_i(t) \geq 0, \ B_i(t) \geq 0, \ B_i'(t) \leq 0, \ R_i'(t, \tau) \geq 0 \), there are functions

\( A'_i(t) \in L^1(J, R_+) \), \( c_{i1}(t) \), \( R''_i(t) \in L^1(J, R_+) \) such that \( A'_i(t) \leq A''_i(t)A_i(t), \)

\( \left( E_i^{(k)}(t) \right)^2 \leq B_j^{(k)}(t)c_{i1}^{(k)}(t), \quad R''_i(t, \tau) \leq R''_i(t)R''_i(t, \tau) \quad (j = 1..m; \ k = 0,1); \)

4) \( M_j(t) > 0, \)

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\(N_j(t) \geq 0, \quad N'_j(t) \leq 0\), there are functions \(M'_j(t) \in L^1(J, R_+), \quad c_{j_2}(t)\) such that

\[
M'_j(t) \leq M'_j(t)M_j(t), \quad \left(F^{(k)}_j(t)\right)^2 \leq N^{(k)}_j(t)c^{(k)}_{j_2}(t); \quad 5 \quad \varphi(t)(f_0(t)) \leq \varphi(t)\left(K_0(t, \tau)\right)^2 \left(\varphi(\tau)\right)^{-1} d\tau + \varphi(t)\left(T_{j_2}'(t, \tau)\right)^2 (M_j(\tau))^{-1} d\tau \in L^1(J, R_+) \ (j = 1..m). \ 6 \quad (\varphi(t))^{-1} \in L^1(J, R_+ \ \{0\}).
\]

Then for any solution \(x(t)\) of IDE (1): \(x'(t) \in L^1(J, R)\), i.e. any solution \(x(t)\) of IDE (1) has a finite limit:

\(x(t) \to x(\infty)\) under \(t \to \infty\).

**Keywords.** Integro-ordinary Differential Equations, Stabilization, Sufficient Conditions.

**AMS 2010.** 53A40, 20M15.
Existence of a Solution for a General Class of Fredholm Integral Equations via F-Contractive Non-Self-Mappings

Soomeyeh Khaleghizadeh Shahkhali

Abstract. This research concerns introducing new concepts of F-contractive non-self-mapping and establishing the existence of PPF dependent fixed point theorems for such kinds of contractive non-self-mappings in the Razumikhin class. This study also comprises an example showing the validity of the researcher’s main result as well as an application in which an existence and uniqueness of a solution for a general class of Fredholm integral equations of the second kind has been proved.
Abstract. In this paper, we are concerned with the oscillatory behavior of a class of fractional differential equations with functional terms. The fractional derivative defined in the sense of the modified Riemann-Liouville derivative. By using a variable transformation, generalized Riccati transformation, Philos type kernels, and averagaging technique we establish new interval oscillation criteria. Illustrative examples also given.

Keywords. Differential Equations, Functional Term, Oscillation.

AMS 2010. 34C10, 34C15, 34K11.
Mathematical Aspects of Molecular Replacement: The Structure of Chiral Space Groups Preferred by Proteins
Sajdeh Sajjadi$^1$ and Gregory S. Chirikjian$^2$

Abstract. The main goal of molecular replacement in macromolecular crystallography is to find the appropriate rigid-body transformations that situate identical copies of model proteins in the crystallographic unit cell. The search for such transformations can be thought of as taking place in the coset space $\Gamma/G$ where $\Gamma$ is the chiral space group of the macromolecular crystal, and $G$ is the continuous group of rigid-body motions in Euclidean space. Though the symmorphic case was addressed earlier in [1], [2] and [3], this paper is concerned with decomposing nonsymmorphic $\Gamma$, which then gives freedom in how to choose fundamental domains $F_{\Gamma/G}$. Decompositions of $\Gamma$ involve the concepts of Bieberbach subgroups and maximal symmorphic subgroups. A number of new theorems are proven, and it is shown how these concepts are related to the preferences that proteins have for crystallizing in different space groups.

Keywords. Molecular Replacement, Bieberbach Group, Coset Space, Rigid-body Motion.


References


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A New Extended Method For Solving Some Fractional Order Evolution Equations

Şerife Müge Ege and Emine Mısırlı

Abstract. In this work, a new extended method is constructed to obtain the traveling wave solutions of fractional order nonlinear equations. This method is effective, powerful and can be used as an alternative to establish new solutions of different type of fractional differential equations.

In this study, traveling wave solutions of the space-time fractional foam drainage equation and the space-time fractional potential Kadomtsev-Petviashvili equation are derived and compared with the solutions which obtained by means of modified Kudryashov method.

Keywords. Space-Time Fractional Foam Drainage Equation, Space-Time Fractional Potential Kadomtsev-Petviashvili Equation, Modified Kudryashov Method.

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A Nonclassical and Nonautonomous Diffusion Equation with Infinite Delay
T. Caraballo and A.M. Márquez Durán

Abstract. In this paper we consider the following nonclassical and nonautonomous diffusion problem:

\[ \frac{\partial u}{\partial t} - \gamma(t)\Delta \left( \frac{\partial u}{\partial t} \right) - \Delta u = g(u) + f(t, u_t) \quad \text{in} \quad (\tau, +\infty) \times \Omega \]

\[ u = 0 \quad \text{on} \quad (\tau, +\infty) \times \partial \Omega \]

\[ u(t, x) = \phi(t - \tau, x), \quad t \in (-\infty, \tau], \quad x \in \Omega, \]

where \( \tau \in \mathbb{R} \) is the initial time, \( \Omega \subset \mathbb{R}^n \) is a smooth bounded domain, and the time-dependent delay term \( f(t, u_t) \) represents, for instance, the influence of an external force with some kind of delay, memory or hereditary characteristic. Here, \( u_t \) denotes a segment of solution, in other words, given a function \( u : \mathbb{R} \times \Omega \to \mathbb{R} \), for each \( t \in \mathbb{R} \) we can define the mapping \( u_t(s) = u(t+s), s \in (-\infty,0] \).

In this way, this abstract formulation allows to consider several types of delay terms in a unified way.

When \( \gamma(t) \) is constant, this type of nonclassical parabolic equations has been very much studied and is often used to model physical phenomena, such as non-Newtonian flows, soil mechanics, heat conduction, etc (see, e.g., [1], [4], [5]). However, any physical model might experiment some kind of natural or artificial changes, therefore it needs consistence under perturbations (see, e.g., [3]). Moreover, in this paper we are interested in the case in which some kind of delay is taken into account in the forcing term. This is an important variant of the nondelay case because there are many situations in which the evolution of the model is determined not only by the present state of the system but for its past history (see, e.g., [2]).

The existence and uniqueness of solution of our problem is first proved. We also analyze the stationary problem and, under suitable conditions, we obtain exponential decay of the solutions of the evolutionary problem to the stationary solution.

Keywords. Nonautonomous diffusion problem, infinite delay, stationary solution, exponential decay.

AMS 2010. 35B20, 35B50, 35K55, 37B55, 37C70.

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References


On a Spectral Expansion for Non-selfadjoint Boundary Value Problem
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Abstract. Let us consider the boundary value problem generated by the differential expression
\[-y'' + q(x)y = \lambda^2 y, \quad x \in [0, \infty)\] (1)
with the boundary condition
\[y'(0) - \lambda^2 y(0) = 0,\] (2)
where \(q(x)\) is a complex-valued function, \(\lambda\) is a complex parameter.

In this work, the classification of spectrum for (1)-(2) is studied and the resolvent operator is constructed. Eigenvalues and spectral singularities are investigated and under certain conditions it is shown that spectral singularities have finite multiplicity. The principal functions are defined and in terms of them the expansion formula is obtained.

Keywords. Sturm-Liouville Equation; Resolvent Operator; Spectral Singularities


References


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Matrices with Null Columns in First Order Chemical Kinetics Mechanisms
Victor Martinez-Luaces

Abstract. When modelling First Order Chemical Kinetics Mechanisms (F.O.C.K.M.), the corresponding O.D.E. system associated matrix has a particular structure [1], [2]. As a consequence of this fact, the Gershgorin Circles Theorem [3] can be applied to show that all the eigenvalues are negative or zero. In several examples, like the conversion of grape juice into wine and its final transformation into vinegar [1], the F.O.C.K.M. matrix has a null column. Using an inverse modelling approach [4], [5], it can be proposed F.O.C.K.M. with two or more final products and associated matrices with two or more null columns. As a consequence of this fact, the algebraic multiplicity of the null eigenvalue is greater than one and therefore, the stability of the solutions must be studied. In this paper, F.O.C.K.M. matrices with null columns are analyzed and the corresponding stability properties of the solutions are studied. As an application of these results, the propagation of concentration and/or surface concentration measurement errors are analyzed.


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Stability of ODE Systems Associated to First order Chemical Kinetics Mechanisms without Final Products
Victor Martinez-Luaces

Abstract. First Order Chemical Kinetics Mechanisms (FOCKM) and their corresponding O.D.E. system associated matrices were deeply studied in a book recently published in U.S.A. [1]. In that publication was proved that all the eigenvalues have non-positive real parts. This article can be considered as a further research on FOCKM matrices, by analysing possible chemical mechanisms without final products. In this case the behaviour of the solutions is absolutely different from other cases previously studied [2-3] since the curves show oscillations which are not common in other cases where one or more final products are present in the mechanism.

Some examples of this kind of mechanisms will be considered and the corresponding ODE systems will be analysed from a qualitative viewpoint.

Finally, the algebraic and geometric multiplicity of the null eigenvalue in general FOCKM matrices will be studied. As an application of algebraic theorems and chemical laws, the stability of the solutions for these systems will be stated in all cases.


References


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A Two-Level Method for Emulating Parameterized Dynamic Partial Differential Equation Models
Wei Xing¹, V. Triantafyllidis¹, Akeel Shah¹, P.B. Nair² and N. Zabaras¹

Abstract. Model order reduction (MOR) techniques (e.g., proper orthogonal decomposition (POD) and Krylov subspaces [1]) are often employed for numerical solutions to PDE models when the computational expense of standard schemes is prohibitive. POD uses a reduced-basis (RB) representation of the output space based on data from selected simulations. The numerical formulation is restricted to the truncated basis and the coefficients in the new basis become the targets for the numerical scheme. State-of-the-art methods are global basis POD [2] and greedy RB [3]. We extend POD approaches for applications to nonlinear, time-dependent PDEs with multiple parameters using a novel statistical emulator that leverages nonlinear dimensionality reduction to learn the snapshots for a new parameter value (standard methods are either unfeasible). The method is not restricted to POD and can be used with other methods such as balanced truncation. Examples include 2D heat conduction-convection (via finite volume) and a 1D burgers equation (using Galerkin FEM), demonstrating the power of the method.


References


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The Numerical Solution of the Symmetric RLW Equation by Using the Meshless Kernel Based Method of Lines

Yılmaz Dereli¹

Abstract. In this study, the Symmetric regularized long wave equation is solved numerically by using meshless kernel method based of lines. The accuracy and efficiency of the used method are tested by computing the invariants and error norms $L_2$ and $L_\infty$. The numerical results are compared with numerical solutions of some earlier papers in the literature.

Keywords. Meshless Method, Method of Lines, Symmetric RLW Equation

AMS 2010. 35C07, 35C08, 65M20

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DISCRETE MATHEMATICS
One-Parameter Apostol-Genocchi Polynomials
Burak Kurt

Abstract. In this work, we introduce and investigate a generalization of the one-parameter Apostol-type polynomials by means of suitable generating functions. We establish several interesting properties and relation between these polynomials. Furthermore, we give explicit series representations for these polynomials. We prove the series expansion for the product of the one-parameter Apostol-Genocchi polynomials $G_n(x,\alpha,\lambda)$ and one-parameter Apostol-Euler polynomials $E_n(x,\alpha,\lambda)$. Also, we give different form of the analogue of the Srivastava-Pintér addition theorem.


AMS 2010. 11B68, 11B73.

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The Computational Complexity of Some Domination Parameters
Nader Jafari Rad

Abstract. A subset \( S \subseteq V \) is a dominating set of \( G \) if every vertex not in \( S \) is adjacent to a vertex in \( S \). The domination number of \( G \), denoted by \( \gamma(G) \), is the minimum cardinality of a dominating set of \( G \). A dominating set \( S \) in a graph with no isolated vertex is a total dominating set if the induced subgraph \( G[S] \) has no isolated vertex. The total domination number of \( G \), denoted by \( \gamma_t(G) \), is the minimum cardinality of a total dominating set of \( G \). The bondage number of \( G \), denoted by \( b(G) \), is the minimum number of edges whose removal from \( G \) results in a graph with larger domination number. Let \( p \geq 2 \) be a positive integer. The \( p \)-bondage number of a graph \( G \), is the minimum number of edges whose removal from \( G \) results in a graph with larger \( p \)-domination number. The problem of NP-completeness has received a huge amount of attention. The question of whether or not NP-complete problems are intractable is one of the foremost problems, and determining whether or not a problem is NP-complete plays an important role. Several parameters in the theory of domination have been proved to be NP-complete, see for example [3, 4]. In this talk we study the complexity issue of several parameters related to domination number and show that the decision problems for these problems are NP-complete.

Keywords. Domination; \( p \)-domination; Bondage; Complexity.

AMS. 05C69

References


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Construction of 4-Connected Graphic Matroids with Essential Elements
P. P. Malavadkar, M. P. Gadiya, S. B. Dhotrey and M. M. Shikare

Abstract. An element $e$ of an $n$-connected matroid $M$ is called essential element if neither $M - e$ nor $M = e$ is $n$-connected. Tutte proved that in a 3-connected matroid $M$ every element is essential if and only if $M$ is wheel or whirl. We give construction of some families of 4-connected graphic matroids in which every element is essential.
Unified One-Parameter Apostol-Bernoulli, Euler and Genocchi Polynomials

Veli Kurt

Abstract. The aim of this paper is to introduce and investigate one-parameter Apostol-Bernoulli, Euler and Genocchi polynomials. We obtain some symmetry identities between these polynomials and the generalized power sums. We give explicit relations for these polynomials and recurrence relations related to power sums.

Keywords. Bernoulli Polynomials and Numbers, Euler Polynomials and Numbers, Apostol-Bernoulli Polynomials and Numbers, The Stirling Numbers of Second Kind, Unified Apostol-Bernoulli, Euler and Genocchi Polynomials, One-Parameter Unified Apostol-Type Polynomials, Modified Apostol-Type Polynomials.

AMS 2010. 05A10, 11B65, 11B68.

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GEOMETRY
Anti-Kahler-Codazzi Structures on Walker Manifolds
Arif Salimov\textsuperscript{1} and Sibel Turanli\textsuperscript{2}

Abstract. Theory of structures on manifolds is the one of the most interesting subjects of modern differential geometry. One of these subjects is the complex structures. The differential geometric aspects of manifolds which have such structures are very large and very efficient areas for pseudo-Riemannian geometry.

Walker manifold is the triple in the form of \((M,g,D)\), where \(M\) represents 4-dimensional manifold, \(g\) represents indefinite metric and \(D\) the 2-dimensional parallel null distribution. Canonical forms of such metrics were achieved by Walker (1950). It's well known that \(g\) has components

\[
g = \begin{pmatrix}
0 & 0 & 1 & 0 \\
0 & 0 & 0 & 1 \\
1 & 0 & a & c \\
0 & 1 & c & b
\end{pmatrix}
\]

with respect to the adapted Walker coordinates \((x_1,x_2,x_3,x_4)\), where \(a,b\) and \(c\) are functions of adapted coordinates.


In this study, the purpose is introducing anti-Kahler-Codazzi manifolds which are new class of the integrable almost anti-Hermitian manifolds and to investigate these structures on Walker 4-manifolds.

Keywords. Walker Manifold, Anti-Kahler-Codazzi and Anti-Kahler Manifolds.

References

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Classification of Geodesics on Sierpinski Gasket with the Intrinsic Metric
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Abstract. In this work, we explicitly define the intrinsic metric on Sierpinski Gasket (SG) by which we determine the geodesics on SG. Moreover we give a classification of geodesics on SG and we also show that there are at most five different geodesics between two points on SG.

Key words: Sierpinski Gasket, Intrinsic Metric, Geodesic.

AMS 2010. 28A80, 51K99

References


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On Ricci Solitons in Kenmotsu Manifolds with the Semi-Symmetric Non-Metric Connection

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Abstract. In this paper, we study 3-dimensional Kenmotsu manifolds with the semi-symmetric non-metric connection. We obtain some results on Ricci solitons in Kenmotsu manifolds with the semi-symmetric non-metric connection satisfying the conditions 
\[ \tilde{C}(\xi, X)\tilde{S} = 0, \quad \tilde{H}(\xi, X)\tilde{S} = 0 \quad \text{and} \quad \tilde{P}(\xi, X)\tilde{C} = 0 \] where \( \tilde{C} \) is quasi-conformal curvature tensor, \( \tilde{S} \) is Ricci tensor, \( \tilde{P} \) is projective curvature tensor and \( \tilde{H} \) is conharmonic curvature tensor. We also show that Ricci solitons are shrinking and expanding.

Keywords. Semi-Symmetric Non-Metrik Connection, Ricci Soliton, Kenmotsu Manifold.

AMS 2010. 53C07, 53C25, 53D15.

References


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Metallic Shaped Hypersurfaces in Lorentzian Space Forms
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Abstract. In [4], the present authors define the notion of a metallic shaped hypersurface and give the classification of these kinds of hypersurfaces in real space forms. In [5], Yang and Fu classified golden shaped hypersurfaces in Lorentzian space forms. In the present study as a generalization of the results given in [5], we classify metallic shaped hypersurfaces in Lorentzian space forms.

Keywords. Lorentzian Space Form, Metallic Shaped Hypersurface.

AMS 2010. 53C40, 53C42, 53A07.

References


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Homothetic Cayley Formula for Homothetic Motions around a Timelike Axis and its Applications in Lorentzian Space

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Abstract. In this study, homothetic Cayley mapping for a skew-symmetric matrix $S$ is defined. Some relations between skew-symmetric matrices and timelike vectors which are corresponding to these matrices in $\mathbb{E}^3_1$ are given. Then, for homothetic motions around a timelike axis in $\mathbb{E}^3_1$, Rodrigues and Euler Parameters are obtained. Moreover, homothetic rotation matrix which is obtained from a timelike vector is given and with the help of these, some results, definitions, theorems and applications are obtained.

Keywords. Homothetic Cayley mapping, Cayley formula, homothetic motions.

AMS 2010. 53A17, 15A30.

References


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Screen Scalar Curvature in Screen Locally Conformal Coisotropic Lightlike Submanifolds of a Semi-Euclidean Space
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Abstract. The ideal screen distribution for screen locally conformal coisotropic lightlike submanifolds is introduced in a semi-Euclidean space of index 2. Some inequalities involving the screen scalar curvature on screen locally conformal coisotropic lightlike submanifolds of a semi-Riemannian space form of index 2 are established.

Keywords. Ideal Screen Distribution, Lightlike Submanifold, Semi-Euclidean Space.
AMSC 2010. 46C20, 53C40, 53C42.

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References


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The Fermi-Walker Derivative on the Spherical Indicatrix

Fatma Karakuş¹ and Yusuf Yaylı²

Abstract. In this study Fermi-Walker derivative and Fermi-Walker parallelism and non-rotating frame concepts are given along the spherical indicatrix of a timelike curve in Minkowski 3-space. We consider a timelike curve in Minkowski space and investigate the Fermi-Walker derivative along the principal normal indicatrix. The concepts which Fermi-Walker derivative are analyzed along its principal normal indicatrix.

Keywords. Fermi-Walker Derivative, Fermi-Walker Parallelism, Non-Rotating Frame, Principal Normal Indicatrix, Helix, Slant Helix.


References


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On Hypersurfaces of Indefinite Quaternionic Kaehler Manifolds
Gülşah Aydin Şekerçii, Sibel Sevinçii and A. Ceylan Çökenii

Abstract. In this study, some properties of hypersurfaces of indefinite quaternionic Kaehler manifolds are analyzed. We research whether these hypersurfaces is indefinite quaternionic Kaehler manifolds and some conclusions are obtained. Also, the differential geometry of these manifolds is examined by using sectional curvature and Riemannian curvature.

Keywords. Kaehler Manifold, Indefinite Kaehler Manifold, Hermitian Manifold, Quaternionic Manifold.


References


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On Holomorphically Projective Curvature Tensor in a Kahler-Weyl Space
Gülçin Çivi

Abstract. In this work, the tensor $P$, which is an invariant under the holomorphically projective mapping between two Kahler-Weyl spaces is obtained and analogously to the definition in a Kahler space, the tensor $P$ is defined as the holomorphically projective curvature tensor of Kahler-Weyl spaces. Then, the some basic identities of the holomorphically projective curvature tensor by using the pure and hybrid tensors.

Keywords. Holomorphically Projective Mapping, Kahler-Weyl Space, Holomorphically Projective Curvature Tensor.

MSC 2010. 53B35, 53B15; 53B20

References


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Characterization of Null Scrolls in $\mathbb{R}^{m+n}_v$

Gül Güner$^1$ and F. Nejat Ekmekci$^2$

**Abstract.** In this work, we expand the theory of null scrolls to the semi Riemannian manifolds with higher index. We construct a null scroll by

$$Y_M(u, \theta, t) = X(u) + t(n^T + n^S)(u), \quad t \in \mathbb{R}.$$  

In our construction method, we assume the lightlike submanifold $X(U) = M$ in $\mathbb{R}^{m+n}_v$ as the base curve and a lightlike normal vector field in its transversal bundle as the directrix of the null scroll. Note that this definition is the most general form of null scrolls so far. We also give some examples.

**Keywords.** Null Scroll, Lightlike Submanifold, Sectional Curvature, Second Fundamental Form.

**AMS 2010.** 53A35, 53C50.

**References**


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On Affine Translation Surfaces
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Abstract. In this paper we study the polynomial affine translation surfaces in $E^3$ with constant curvature. We derive some non-existence results for such surfaces. Several examples are also given by figures.

Keywords. Affine Translation Surface, Polynomial Translation Surface, Gaussian Curvature, Mean Curvature.

AMS 2010. 53A05, 53B25.

References


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On Quasi-Einstein Weyl Manifolds
İlhan Gül\(^1\) and Elif Özkara Canfes\(^2\)

**Abstract.** In this work, first, we define the quasi-Einstein Weyl manifolds. Then, we prove the existence of quasi-Einstein Weyl manifolds. Moreover, we examine quasi-Einstein Weyl manifolds having semi-symmetric and Ricci-quarter symmetric connections and obtain some results about them.

**Keywords.** Quasi-Einstein Weyl Manifolds, Semi-Symmetric Connection, Ricci-Quarter Symmetric Connection.

**AMS 2010.** 53A30, 53A40, 53C25

**References**


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On Constant Ratio Curves According to Bishop Frame in Minkowski 3-Space $E^3_1$

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Abstract. In the present paper, we consider a curve in Minkowski 3-space $E^3_1$ as a curve whose position vector can be written as linear combination of its Bishop frame vectors. In particular, we study the non-null curves in $E^3_1$ and characterize such curves in terms of their Bishop curvatures. Further, we obtain some results of T-constant and N-constant type non-null curves in Minkowski 3-space $E^3_1$.

Keywords. Position Vector, Bishop Frame, Constant Ratio Curve.

AMS 2010. 53A04, 53A05.

References


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On Canal Surfaces According to Parallel Transport Frame in Euclidean Space $E^4$
İlim Kişi$^1$, Günay Öztürk$^2$ and Kadri Arslan$^3$

Abstract. In this study, we consider canal surfaces according to parallel transport frame in Euclidean space $E^4$. The curvature properties of these surfaces are investigated with respect to $k_1$, $k_2$ and $k_3$ which are principal curvature functions according to parallel transport frame. Finally, we point out that if spine curve $\gamma$ is a straight line, then $M$ is a Weingarten canal surface and also $M$ is linear Weingarten pipe surface.

Keywords. Parallel Transport Frame, Gaussian Curvature, Mean Curvature.

AMS 2010. 53C40, 53C42.

References


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Complete System of Polynomial Invariants of Vectors in the Pseudo-Euclidean Geometry of Index 1

İdris Ören

Abstract. Let $E_1^n$ be $(n+1)$-dimensional pseudo-Euclidean geometry of index 1, $G$ be the group $M(n,1)$ of all motions of $E_1^n$ or $G$ is the subgroup of $M(n,1)$ generated by rotations and translations of $E_1^n$.

Let $U$ be a subspace of $E_1^n$. For a subspace $U \subset E_1^n$, denote the number of linearly independent null vectors in $U$ by $\kappa(U)$.

This paper presents the system of generators of the set of all $G$-invariant polynomial functions of vectors $x_1, x_2, \ldots, x_m \in E_1^n$. Correlations between the Gram matrix of vectors in $U$ and $\kappa(U)$ are investigated.

Keywords. Pseudo-Euclidean Space, Invariant, Null Vector.

AMS 2010. 15A03, 15A63, 51M10, 83A05.

References


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On Classification of Canal Surfaces in Minkowski 3-space
Kazım İlarslan¹ and Ali Uçum²

Abstract. In this paper, we reconsider the canal surfaces for all Lorentz spheres which are pseudo sphere, pseudo-hyperbolic sphere and lightlike cone. We find the parametrizations of the surfaces. Moreover, we found the parametrization of the tubular surfaces with respect to all Lorentz spheres.

Keywords. Canal Surfaces, Minkowski 3-Space, Space Curves.

AMS 2010. 53B30, 53C50, 53A35.

References


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A Note on Matrix Representations of Split Quaternions
Mahmut Akyiğit, Hidayet Hüda Kösal and Murat Tosun

Abstract. In this study, we establish that there are a total of sixteen distinct ordered sets of three 4 x 4 signed permutation matrices which will serve as the basis of an algebra of split quaternions. After, we investigate properties of the fundamental matrices obtained from the sixteen distinct triplets.

Keywords. Split Quaternion, Fundamental Matrices, Eigenvalues, Eigenvectors.

AMS 2010. 15R52, 15A99.

References


On Integral Invariants of Parallel Ruled Surfaces with Darboux Frame*
Muradiye Çimdiker¹, Yasin Ünlütürk² and Cumali Ekici³

Abstract. In this work, first, we obtain Steiner rotation vector of parallel ruled surfaces with Darboux frame. Then, by using this rotation vector, we compute pitch length and pitch angle of parallel ruled surfaces with Darboux frame. Also, we have some relations among integral invariants of the surface in $E^3$.

Keywords. Parallel Ruled Surface, Darboux Frame, Pitch Length, Pitch Angle.

AMS 2010. 53A05, 53A15.

References


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Directional Bertrand Curves
Mustafa Dede¹ and Cumali Ekici²

Abstract. It is well known that a characteristic property of the Bertrand curve which asserts the existence of a linear relation between curvature and torsion. In this paper, we propose a new method for generating Bertrand curves, which avoids the basic restrictions. Our main result is that every space curve is a directional Bertrand curve with infinite directional Bertrand mates.

Keywords. Bertrand Curves, Offset, Frenet Frame.

AMS 2010. 53A04, 68U05

References


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On the Parallel Ruled Surfaces in Galilean Space
Mustafa Dede1 and Cumali Ekici2

Abstract. In this paper, we investigated the parallel surfaces of the ruled surfaces in Galilean space. There are three types of ruled surfaces in Galilean space. We derived the necessary conditions for each types of the ruled surfaces of the parallel surfaces to be ruled. Consequently, we constructed some examples.

Keywords. Parallel Curves, Galilean Space, Curvatures.

AMS 2010. 53A35; 53Z05

References

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Directional Tubular Surfaces
Mustafa Dede¹, Cumali Ekici² and Hatice Tozak²

Abstract. In this paper, we introduce a new version of tubular surfaces. We first define a new adapted frame along a space curve, and denote this the q-frame. We then reveal the relationship between the Frenet frame and the q-frame. We give a parametric representation of a directional tubular surface using the q-frame. Finally, some comparative examples are shown to confirm the effectiveness of the proposed method.

Keywords. Frenet Frame, Pipe Surface, Tube, Adapted Frame.

AMS 2010. 53A04; 53A05;

References


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Special Proper Pointwise Slant Surfaces of an Almost Constant Curvature Manifold

Mehmet Gülbahar¹, Erol Kılıç² and Semra Saraçoğlu Çelik³

Abstract. The structure of the pointwise slant submanifolds in an almost product Riemannian manifold is investigated and the special proper pointwise slant product surfaces of a locally product manifold are introduced. Two examples of proper pointwise slant surfaces of a locally product manifold which one is special and the other one is not special are given.

Keywords. Almost Product Riemannian Manifold, Special Slant Surface, Curvature.

AMS 2010. 53C15, 53C40, 53C42.

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References


Self-Duality Operator on 2-Forms
Nedim Değirmenci¹ and Hatice Zeybek²

Abstract. It is well known that hodge-duality operator and self-duality concept of a 2-form have great importance in both mathematics and physics [1], [2]. In this work we define a duality operator $T_\varphi$ on the space of 2-forms $\Omega^2(R^n)$ for $n > 4$, where $\varphi$ is a special $(n-4)$-form on $R^n$. We prove that $T_\varphi$ is symmetric, hence have real eigenvalues. We define self-dual and anti-self-dual 2-forms over $R^n$ by using the eigenvalues of $T_\varphi$. We give some explicit constructions in dimensions $n = 5, 6, 7$ and $8$.

Keywords. Hodge-* operator, 2-form, Self-duality.

AMS 2010. 53Bxx, 58Cxx.

References


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Pointwise Slant Submersions from almost Contact Metric Manifolds
Sezin Aykurt Sepet¹ and Mahmut Ergüt²

Abstract. In this paper, we characterize the pointwise slant submersions from almost contact metric manifolds onto Riemannian manifolds and give several examples.

Keywords. Riemannian Submersion, Almost Contact Metric Manifold, Pointwise Slant Submersion.

AMS 2010. 53C15, 53D15, 53C43.

References


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On Constant Ratio Curves in Galilean Spaces
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Abstract. In this study we consider a unit speed curve in Galilean spaces as a curve whose position vector can be written as linear combination of its Serret-Frenet vectors. We show that there is no $T$-constant curve in Galilean spaces and we obtain some results of $N$-constant type of curves in Galilean spaces $G_3$ and $G_4$.

Keywords. Position Vectors, Frenet Equations, Galilean Space.


References

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On Z-Projective Change of Kropina Spaces
Salim Ceyhan¹ and Gülçin Çivi²

Abstract. In this paper, we consider the projective change \( \sigma : F \to \tilde{F} \) of metrics of the Kropina space \( F_n \) and the Finsler space \( \tilde{F}_n \), respectively. It is known that The Douglas and the Weyl Curvature tensors remain invariant under the projective change of the Finsler metrics. Moreover, h-curvature tensor in the Berwald connection is invariant under the a special projective change named as Z-projective change. In [1] M. Fukui and T. Yamada studied in the projective change between two Finsler spaces. Then, in [2], B.D. Kim and H.Y. Park proved that if a symmetric space remains to be symmetric one under the Z-projective change then the space is of zero curvature.

In present paper, we first investigated in the quantities which are invariant under the Z-projective change between two Finsler spaces. Then, we obtained the necessary and sufficient conditions for a projective change \( \sigma : F \to \tilde{F} \) between a Kropina space \( F_n (n > 2) \), and a Finsler space \( \tilde{F}_n (n > 2) \) to be a Z-projective change.

Keywords. Finsler Spaces, R-Curvature Tensor, Riemann Curvature, Z-Projective Transformations.

AMS 2010. 53C20, 53C60.

References

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Seiberg-Witten Equations on 8-Dimensional Manifolds
Serhan Eker¹ and Nedim Değirmenci²

Abstract. Seiberg–Witten equations, which are used to analyze the structure of the 4−dimensional manifolds, consist of two equations [2], [4], [7]. The first of these equations is called Dirac equation and the latter is called Curvature equation. In higher dimensions, to describe the Curvature equation, generalized self-duality concept of a 2 form is needed. Seiberg–Witten equations on 8−dimensional manifolds, with Spin(7) structure were defined in [1], [3] and also with SU(4) structure were defined in [5], [6]. In these works the self−dual part is the \( \Lambda_7 \) which is the first part of the decomposition of 2− form spaces \( \Lambda^2(M) = \Lambda_7 \oplus \Lambda_{21} \). In this work, the Curvature equation on 8−dimensional manifolds is defined by using the second part \( \Lambda_{21} \). We write down explicit form of these equations on \( M = \mathbb{R}^8 \) and give some non−trivial solution.

Keywords. Seiberg-Witten Equations, Dirac Operator, Spin(7)-Structure


References


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Bicomplex Fibonacci Numbers
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Abstract. In this study, we define bicomplex Fibonacci and bicomplex Lucas numbers and give some algebraic properties of them.

Keywords. Fibonacci Numbers, Bicomplex Fibonacci Number, Bicomplex Lucas Number.


References


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A New Version of Bishop Frame and Position Vector of a Timelike Curve in Minkowski 3-Space
Süha Yılmaz¹, Yasin Ünlütürk² and Abdullah Mağden ³

Abstract. In this work, using common vector field as the binormal vector of Serret-Frenet frame, we introduce position vector of a timelike curve according to the Bishop frame in $E^3_1$. We call it "Type-2 Bishop frame" of timelike curves. Moreover, we obtain that the first vector field of the type- Bishop frame of a regular curve satisfies a vector differential equations of the third order in $E^3_1$.

Keywords. Timelike Curve, Position Vector, Minkowski Space, Type-2 Bishop Frame.


References

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On $f$-Biharmonic Submanifolds in Space Forms

Selcen Yüksel Perktaş$^1$, Erol Kılıç$^2$ and Sadık Keleş$^3$

Abstract. As a generalization of biharmonic maps, $f$-biharmonic maps are the extrema of $f$-bienergy functional. In this paper we study $f$-biharmonic submanifolds whose defining isometric immersions are $f$-biharmonic.

Keywords. $f$-Biharmonic Maps, $f$-Biharmonic Submanifolds.

AMS 2010. 58E20, 58C43.

References


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An Examination on the Frenet Ruled Surfaces along the Bertrand Pairs $\alpha$ and $\alpha^*$, according to Their Normal Vector Fields in Euclidean 3-Space
Şeyda Kılıçoğlu¹, Süleyman Şenyurt² and H. Hilmi Hacisalihoğlu³

Abstract. In this paper we consider eight special Frenet ruled surfaces along to the Bertrand pairs $\{\alpha^*, \alpha\}$ respectively. First we find the explicit equations of Frenet ruled surfaces along the Bertrand curve $\alpha$, later we find the explicit equations of Frenet ruled surfaces along its Bertrand mate $\alpha^*$ in terms of the Frenet apparatus of its Bertrand curve $\alpha$. Further, normal vector fields of these Frenet ruled surfaces have been calculated in terms of the Frenet apparatus of its Bertrand curve $\alpha$ too.

Finally we find a matrix which give us all sixteen positions of Normal vector fields of eight Frenet ruled surfaces. Using that matrix we can examine positions, one by one, each pair of Frenet ruled surfaces, in terms of Frenet apparatus of Bertrand curve $\alpha$. For example one of corollaries gives us which Frenet ruled surface are perpendicular.

Keywords. General Helix, Ruled Surface, Nil Space.

AMS 2010. 53A04, 53A05.

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The Steiner Formula and the Holditch Theorem for Homothetic Motions in the Generalized Complex Plane

Tülay Erişir¹, Mehmet Ali Güngör² and Murat Tosun³

Abstract. In this study, we first obtained the Steiner area formula and the Holditch theorem giving the relationship between the areas formed by points for homothetic motions in the generalized complex plane (or \( p \)-complex plane). In this way, for \( p \in \mathbb{R} \) we generalized the Steiner Formula and Holditch theorem consisting the Euclidean \((p=1)\), Galilean \((p=0)\) and Lorentzian \((p=-1)\) cases for homothetic motions.

Keywords. Generalized Complex Plane, Homothetic Motion, Holditch Theorem


References


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Abstract. In this paper, we derive the Euler-Lagrange equations for a relaxed elastic line of second kind on an oriented surface in the Galilean 3-dimensional space $G_3$. These equations will give direct and more geometric approach to questions concerning about relaxed elastic lines of second kind on an oriented surface in $G_3$.

Keywords. Galilean Space, Relaxed Elastic Line of Second Kind, Variational Method, Geodesic.


References


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Centro-equiaffine Differential Invariants of Curve Families

Yasemin Sağiroğlu

Abstract. The generator set of all centro-equiaffine differential invariant rational functions field for arbitrary curves is obtained. By using these generators, the conditions of equivalence for two curve families are found. Then the relations between elements of generator set are investigated.

Keywords. Differential Invariant, Parametric Curve, Equivalence.


References


On Parallel Ruled Surfaces with Darboux Frame

Yasin Ünlütürk\textsuperscript{1}, Muradiye Çimdiker\textsuperscript{2}, Cumali Ekici\textsuperscript{3}

Abstract. In this paper, parallel ruled surfaces with Darboux frame are introduced in $E^3$. Some characteristic properties of parallel ruled surfaces with Darboux frame are given such as developability and striction point. And then, integral invariants are computed for parallel ruled surfaces with Darboux frame in $E^3$.

Keywords. Parallel Ruled Surface, Darboux Frame, Integral Invariants.

AMS 2010. 53A05, 53A15.

References


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On the Metrics of Some Archimedean And Catalan Solids
Zeynep Can¹ and Zeynep Çolak²

Abstract. Polyhedrons are extremely important solids in 3 – dimensional analytical space when they are convex. Some mathematicians have been studied on polyhedra and improved Minkowski Geometry releated with them.

If a polyhedron has congruent faces which are regular polygons and same number of faces intersect at each vertices then this polyhedron is a regular polyhedron, and they are only five (Platonic Solids). If a polyhedron has congruent vertices and faces are regular polygons then it is called semi–regular polyhedron, and they are thirteen (Archimedean Solids). Duals of Archimedean solids are called Catalan Solids. Faces of a catalan solid are one kind of polygon which are not regular.

Unit spheres of Minkowski geometries are some general, symmetric convex sets and there is an important relation between these sets and metrics ([6]). In the previous studies it has been seen that there are some metrics which unit spheres are some of the mentioned solids ([3],[4],[8]). Finding the unit sphere of a known metric depends on some basic calculations. So, naturally a question on the contrary can be asked, “Is it possible to find the metric which unit sphere is a known polyhedron?”. In this study we introduce two new metrics which unit spheres are a Catalan solid Disdyakis Triacontahedron and an Archimedean solid Truncated Octahedron. Also we will give a family of metrics and show that the spheres of the 3 – dimensional analytical space covered by these metrics are some well – known polyhedra.

Keywords. Archimedean Solids, Catalan Solids, Metric, Disdyakis Triacontahedron, Truncated Octahedron, Chinese Checkers Metric.


References


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Tetrakis Hexahedron Space Isometry Group
Zeynep Çolak¹ and Zeynep Can²

Abstract. There are many thinkers that worked on polyhedra among the ancient Greeks. Early civilizations worked out mathematics as problems and their solutions. Polyhedra have interesting symmetries. Therefore they have attracted the attention of scientists and artists from past to present. Thus polyhedra are discussed in a lot of scientific and artistic works. There are only five regular convex polyhedra known as the platonic solids. Semi-regular convex polyhedron which are composed of two or more types of regular polygons meeting in identical vertices are called Archimedean solids. The duals of the Archimedean solids are known as the Catalan solids.

Three essential methods for geometric investigations; synthetic, metric and group approach. The group approach takes isometry groups of a geometry and convex sets plays an substantial role in indication of the group of isometries of geometries. Those properties are invariant under the group of motions and geometry studies those properties.

Some mathematicians have studied isometry groups of Taxicab space, Maximum space and Chinese Checker space in three dimensional space ([2], [1], [4]). We worked on isometry groups of Tetrakis Hexahedron which is a Catalan solid. In this study we show that the group of isometries of the 3-dimensional space with respect to Tetrakis Hexahedron metric is the semi-direct product of octahedral group Oₕ and T(3), where Oₕ is the (Euclidean) symmetry group of the octahedron and T(3) is the group of all translations of the 3-dimensional space.

Keywords. Isometry Group, Catalan Solid, Tetrakis Hexahedron, Polyhedra.


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Conformal Weyl-Euler-Lagrange Equations on Lorentzian Trans
and Para Sasakian Manifolds

Zeki Kasap¹

Abstract. Contact geometry deals with certain manifolds of odd dimension. It is close to symplectic geometry and like the latter it is originated in questions of classical mechanics. Contact geometry can be considered as symplectic geometry such that it has broad applications in physics, geometrical optics, classical mechanics, analytical mechanics, mechanical systems, thermodynamics, geometric quantization and applied mathematics such as control theory. Locally, every symplectic manifold admits a Kähler structure. Every Kähler manifold has a symplectic manifold. Kähler manifolds are of tremendous importance in modern physics. Sasakian manifolds are an analog one dimensional of Kähler manifolds. It is well known that one way of solving problems in classical mechanics use the Euler-Lagrange equations. Weyl offered a conformal structure and this structure was transferred to the mechanical systems. In this study, Weyl-Euler-Lagrange equations as representing the motion of the body were found on Sasakian manifolds. Also, these solution of differential equations are solved by symbolic computation program.

Keywords. Weyl Manifold, Conformal Geometry, Sasakian Manifold, Lorentzian, Mechanical System, Dynamic Equation, Lagrangian Formalism.

AMS 2010. 34B20, 34N05, 53A30, 53D10, 70S05, 81Q05, 82C21.

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Euler-Lagrange Equations on Almost Paracontact Metric Manifolds
Zeki Kasap

Abstract. Almost paracontact metric manifolds are the famous examples of almost para-CR manifolds. Symplectic geometry has its origins in the Lagrangian formulation of classical mechanics such that the phase space of certain classical systems takes on the structure of a symplectic manifold. It is well known that a preferred method to solve the problems of classical mechanics is to with the Euler-Lagrange equations. Classical field theory uses a simple solution method of Euler-Lagrangian dynamics. This theory was extended to time-dependent classical mechanics. In this study, Euler-Lagrange equations, as representing the orbits of moving objects in this space that its are geodesic modeling, found on Lorentzian trans and para Sasakian manifolds. Also, these solutions of differential equations solved by symbolic computation program.

Keywords. Sasakian Manifold, Lorentzian, Mechanical System, Dynamic Equation, Lagrangian Formalism.

AMS 2010. 34B20, 34N05, 53A30, 53D10, 70S05, 81Q05, 82C21.

References


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Abstract. Teachers’ attitudes towards mathematics and mathematics teaching influence students’ attitudes. One needs to have knowledge of mathematics and pedagogical knowledge in mathematics in order to teach mathematics. Teachers need to have not only accurate knowledge of concepts and operations but also they need to understand the connections between mathematical thoughts. In this context, it is of essence for mathematics teachers to become math literates.

An individual needs to study in the faculty of education so as to be a mathematics teacher. Therefore, pre-service teachers should be taught mathematics at the faculties of education in the way they are asked to teach it. Starting from this point, the aim of this study is to examine pre-service mathematics teachers’ mathematical literacy and their attitudes towards mathematics education courses. The research study was conducted with 181 pre-service teachers enrolled in the program of Primary Mathematics Education at Istanbul University.

The research data were collected using the “Math Literacy Self-Efficacy Scale” developed by Özgen and Bindak (2008) and the “Attitude Scale for Mathematics Education Courses” developed by Turanlı, Türker, and Keçeli (2008). The study was carried out considering the variables of grade, order of preference, and reason for preference and the relationship between mathematical literacy and the attitude towards mathematics education courses was determined. Some suggestions were made for further research and researchers in line with the findings.

Keywords. Mathematics Education Courses, Attitude, Mathematical Literacy.

References


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Abstract. Geometric thinking includes geometry-specific ideas which individuals may encounter in their daily lives as well as in their learning process and components that create these ideas. The Model of Geometric Habits of Mind suggested by Driscoll, Wing DiMatteo, Nikula and Egan (2007) describes geometric thinking with four basic geometric habits of mind, which are “reasoning with relationships”, "generalizing geometric ideas", "investigating invariants" and "balancing exploration and reflection" [1].

In elementary school mathematics curriculum it is aimed to foster geometric thinking, nevertheless to enhance geometric thinking becomes difficult if the problems and activities in the textbooks do not support these geometric habits of mind. Textbooks are of great importance in the teaching process considering that geometric thinking is supported with geometric habits of mind and these habits are acquired through problems and activities. In this study it is aimed to determine to what extent mathematics textbooks foster geometric thinking within the framework of Geometric Habits of Mind. Accordingly, four mathematics textbooks being taught in 5, 6, 7 and 8th grades of elementary school were examined and geometry problems and activities in these textbooks were analyzed based on the theoretical framework of Geometric Habits of Mind.

Document analysis which is a qualitative research method has been carried out in data analysis process. In this process, subjects related to geometry learning were determined primarily, and then geometry activities and problems were categorized with reference to the geometric habits of mind for each grade level. For the reliability of the study, activities and problems were coded separately by two researchers based on geometric habits of mind framework. The differences between coders have been resolved through discussions and of compromises of the researchers.

Considering the necessity of supporting of geometric thinking, importance of gaining geometric habits of mind for the students and the inclusion of geometric thinking in the textbooks, it is thought that this study will bring light for further studies.

Keywords. Geometric Thinking, Geometric Habits of Mind, Mathematics Textbooks

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Examination of 6th Students’ Quantitative Reasoning Skills and Developments in Their Problem Solving Process

Dilek Tanışlı¹ and Mehmet Dur²

Abstract. The purpose of this research is to examine middle school grade 6 students’ quantitative reasoning skills and developments in their problem solving process. In this research, qualitative research methods were adopted for data collection, analysis and interpretation. In this context, teaching experiment model was used. The implementations of the research were carried out with 4 sixth grade students, two girls and two boys in public school. During the entire teaching experiment in which it was aimed to identify students’ quantitative reasoning skills and observe their developments, clinical interviews, worksheets, clinical interviews with videotapes of teaching process, student journals, and researcher journals were used as data collection tools, and a thematic analysis was used for data analysis.

As results of the research, it was observed that students who had low quantitative reasoning skills in pre-interviews improved their quantitative reasoning skills notably in post-interviews as a result of the teaching experiment. It was identified that students had higher successes in understanding the problems, selecting appropriate strategies to the problem situation, carrying out the selected strategy and evaluating stages after the teaching experiment. Also, it was observed that using diagrams, tables, and visual representations which take efficient roles during quantitative reasoning became as a habit after the teaching experiment. Besides, it was observed that the development of students’ quantitative reasoning contributed to their algebraic development and achievement levels in mathematics.

Keywords. Quantitative Reasoning, Algebra, Problem Solving

References


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The Investigation of Using Mathematical Language of 7th Graders When Identifying Circle and It’s Elements
Esra Akarsu\textsuperscript{1} and Süha Yılmaz\textsuperscript{2}

Abstract: Mathematical language is the combination of the whole rules which are used together with mathematical concepts, operations and symbols that have the property of expressing scientific thoughts easily [1]. Usage of correct branch language is really important to eliminate the misconceptions which occur in students’ minds [2].

Through this research it is aimed to observe 7\textsuperscript{th} grade students’ ability of using mathematical language when identifying circle and it’s elements. The using of mathematical language skills of students identifying circle and it’s elements when given in scenario and when their names were given were compared. The sample of this study consists of 138 seventh graders selected from several primary schools located in Manisa. A scenario which consists of 7 questions about identifying circle and it’s elements (center, radius, diameter, secant, chord and tangent) was prepared by the researchers and students were asked to answer these questions. Furthermore, students were asked to identify circle and it’s elements when their names were given. The mathematical language skills of the students were examined in terms of their ability to identify visually and verbally. It was concluded that the mathematical language skills of students identifying circle and it’s elements when given in scenario need to be developed. Also, students’ mathematical language skills identifying them when their names were given are sufficient. It was observed that students have most difficulty in defining tangent.

Keywords. Circle, The Elements of Circle, Mathematical Language.

References


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Abstract. Usage of Mathematical software has been increasing constantly since computers are used in education. Sage, Open source Software, is a powerful system for studying and exploring many different areas of mathematics.

Teachers talk about linear algebra using many linear text books in classroom. However, the usage of indispensable teaching method for some issues in linear algebra that is difficult to teach. Therefore, I introduce the principles of working process of Sage and give some examples about basic linear algebra including matrices, determinants.

Keywords. Linear Algebra, Open Source Software, Sage, Mathematics Education

AMS 2010. 97B40, 97C80.

References


Abstract. In this study, high school mathematics teachers, who did not know about computer-assisted mathematics instruction before, were trained on it in the first place, and they were enabled to use Mathematica in their classes for the graphics of quadratic functions (parabola). Obtained through the semi-structured interview, this study then focuses on the views of both teachers and students about computer-assisted mathematics instruction and about Mathematica, a computer algebra system (CAS) benefited during the process. The interview data were examined with the descriptive analysis and content analysis methods to get some codes and themes about the subject. The results show that all the teachers found computer-assisted mathematics instruction interesting on the students’ part just as the students did. While all the students wanted to benefit from computer-assisted mathematics instruction in mathematics and geometry classes, most of the students (67%) wanted to benefit from computer-assisted instruction in different classes as well. It is seen that students did not have any problem with Mathematica, used during the activities of computer-assisted mathematics instruction. However, it is also seen that one of the teachers and of the students believed that the constant application of computer-assisted mathematics instruction in classes would hinder their studies on university entrance exam.

Keywords. Computer-Assisted Mathematics Instruction, Computer Algebra System, Mathematica, Teacher’s View, Student’s View.

AMS 2010. 97A99, 97D40, 97U50

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Mental Components of Mathematical Literacy Success of Secondary School Students
Murat Altun¹ and İşıl Bozkurt²

Abstract. Mathematical Literacy (ML) concept and to what extent mathematics curriculum develops it have been frequently argued. With the participations of students [1], teacher candidates [2] and teachers to examine the levels of ML, various studies have been conducted from different viewpoints such as mental processes, subject fields, mathematical skill levels etc., and some comparisons through PISA results related to ML took place[3]. Differently from those studies, in this study, a Mathematical Literacy Test (MLT) which includes a total of 15 questions selected from different topic fields has been applied to 221 secondary students most of whom are from eight grade. Data tables were formed by specifying the grades that students got for each question and factor analysis was applied to the data. The factors that account for ML success were named as (i) skill to make algorithmic operations, (ii) mathematical proposal development, (iii) justification of mathematical result (iv) understanding and interpretation of the mathematical content and (v) establishing relationships between different data sets and interpretation. It is expected that the results of this study will contribute to curriculum development and organization of the instructional activities.

Keywords. Problem Solving, Mathematical Literacy, PISA

References


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The Competence of Students in Understanding the Properties of a Function from Its Graph
Nevin Mahir

Abstract. Visualization is very important in helping students to understand functions and their properties. The graph of a function, as the picture of a function, can be considered a visual aid while examining the function and its properties. Most of the properties of a function can be determined with the help of its graph. Therefore, it is important for students of mathematics to extract some of the properties of a function such as limit, continuity, derivative, growth and concavity from its graph. In this study, I investigated the competence of students who have taken Calculus I-II courses in understanding the properties of a function from its graph. To this purpose, an examination was given to science and engineering students at a Turkish university. The results showed that the students were unable to extract the properties related to the function from its graph.

Keywords. Function, Graph, Limit

References

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Reasoning in Mathematics Education
Nilüfer Yavuzsoy Köse

Abstract. One of the most important objectives of mathematics teaching is to have students believe they can do mathematics. It will be quite important for the development of students’ mathematical thinking if they can defend their thoughts with appropriate arguments, make logical deductions, and share and discuss using an appropriate language. The most basic component for this development is mathematical reasoning.

Mathematical reasoning is defined as the process of gaining new information by using thinking techniques (induction, deduction, comparison, generalization and so on) and tools specific to mathematics (symbols, definitions, relationships and so on) [1]. In other words, mathematical reasoning is a process in which individuals convince themselves and others to confirm a certain assumption and in which they develop such ways of thinking or argument as solving a problem or gathering various thoughts [2]. In national and international literature, there are several terms used in reasoning studies in relation to mathematical reasoning such as developing assumptions, mathematical explanations, justification, verification, mathematical arguments, mathematical exploration and generalization, and these terms are associated with types of reasoning. Then, what associations can be established between these terms and approaches to reasoning? The answers to this question are likely to vary depending on learners’ level of education and their age, their individual characteristics and attitudes, the learning environment, the context/subject, the mathematics instructor’s theoretical perspective, and on the educational policies according to which curricula and course books are developed. In line with this, the present study discusses the place of mathematical reasoning in elementary school mathematics teaching and provides a synthesis by examining the current theoretical structures.

Keywords. Mathematics Education, Mathematical Reasoning

References

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Concept Association of Prospective Elementary and Secondary Mathematics Teachers
Şüheya Güray¹, Şeyda Kılıçoğlu ² and Merve Koştur ³

Abstract. Concept knowledge competency of prospective teachers is within the scope of researchers in mathematics education (Ball, 1991; Even, 1993; Wilson, Shulman & Richert, 1987). While investigating concept knowledge, it is important to inquire into the relationship of the concepts with each other and defining the concepts interrelatedly (Adams, T. L., 2012; Ball, 1990). In the present study, concept associations of prospective elementary and secondary mathematics teachers were investigated. In the study, the participants were 60 prospective elementary mathematics teachers in 1st and 4th grades and 47 prospective secondary mathematics teachers in 1st, 3rd and 4th grades at a university in Turkey. The definitions for 9 concepts gathered from the prospective teachers were grouped in two as “full definition” and “incomplete definition”. Afterwards, concepts were grouped in two and concept associations of every prospective teacher were analyzed via chi square analysis. As a result, regardless of grade differences, the dependence and independence of concepts with each other were investigated and reported in the study.

Keywords: Mathematical Concept Knowledge, Concept Associations, Mathematics Educations, Prospective Teacher.

References


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Investigating the Concept Knowledge of Prospective Elementary and Secondary Mathematics Teachers
Şeyda Kılıçoğlu¹, Şüheda Güray² and Merve Koştur³

Abstract. Concept knowledge competency of prospective teachers is in the scope of researchers in mathematics education (Ball, 1991; Even, 1993; Wilson, Shulman & Richert, 1987). In recent years, concept knowledge has been analyzed qualitatively and investigated deeply by focusing on knowledge and definition (Ball, 1988, 1991; Even, 1990; Lienhardt & Smith; 1985; Shulman, 1986; Wilson et al., 1987). In defining the concepts, the correct use of mathematical language and supporting the definition by multiple representations are of importance. In this regard, definitions of the total of 107 prospective elementary and secondary mathematics teachers for selected mathematics concepts were investigated. In the study, prospective teachers were asked to define 9 concepts selected among fundamental mathematics concepts in the literature. By using content analysis, the definitions were coded with 5 themes as “complete definition”, “exampling”, “making a drawing”, and “empty”. The results were reported by comparing concept knowledge of elementary and secondary mathematics education program students according to grade and program differences. In addition, the data gathered from the participants via semi structured interviews were analyzed and probable reasons of common misconceptions and incomplete definitions were explained.

Key words: Mathematical Concept Knowledge, Concept Associations, Mathematics Educations, Prospective Teachers.

References


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Asymptotic Results for a Semi-Markovian Random Walk with Generalized Beta Interferences

Cihan Aksop¹ and Tahir Khaniyev²,³

Abstract. In this study, a semi-Markovian random walk with interferences distributed on the interval \([s, S]\) is investigated. Asymptotic expansions for the moments of this process are obtained as a function of moments of ladder heights and moments of the interferences, when the interferences have a generalized beta distribution and \(\gamma \equiv S - s \to \infty\). Moreover, accuracy of the proposed asymptotic expansions is examined with a Monte Carlo simulation method.

Keywords. Ladder Heights, Asymptotic Expansions, Ergodic Moments, Semi-Markovian Random Walk, Generalized Beta Distribution

AMS 2010. 60G50.

References


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A Queueing System Equipped with Two Components Subject to Random Failures and Heterogeneous General Service with Fluctuating Rates Depending on State of the Components

Kailash C. Madan

Abstract. We study a batch arrival queueing system with a single server equipped with two components $C_1$ and $C_2$ both subject to random failures with different failure rates. There are two repair facilities, one each for the two components. The system works in full efficiency as long as both components are in working state. However, the system works in reduced efficiency if $C_2$ is in the failed state, it works in low efficiency if $C_1$ is in the failed state and the system is completely down if both $C_1$ and $C_2$ are in the failed state. The system provides service to customers with different general service times with different service rates depending on the fluctuations in the system efficiency. Steady state probability generating functions are obtained for various states of the system and results for some particular cases have been derived.

Keywords. Batch Arrivals, General Service, Random Breakdowns, Repairs, Fluctuating Efficiency, Steady

AMS 2010: 60K25

References


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Higher-Order Adjustments of the Signed Scoring Rule Root Statistic
Laura Ventura¹, V. Mameli and M. Musio²

Abstract. Proper scoring rules (see e.g. Parry et al., 2012), different from the log-score, can be used as an alternative to the full likelihood, when the aim is to increase the robustness or to simplify computations. Proper scoring rule inference is usually based on the first-order approximations to the distribution of the scoring rule estimator or of the scoring rule ratio test statistic. However, several examples (see Dawid et al., 2015, Mameli and Ventura, 2015) illustrate the inaccuracy of first-order methods, even in models with a scalar parameter, when the sample size is small or moderate. Analytical higher-order asymptotic expansions for proper scoring rules, generalizing results for likelihood quantities but allowing for the failure of the information identity, have been discussed in Mameli and Ventura (2015). However, the calculation of the quantities involved in the analytical adjustments of the signed and signed profile scoring rule root statistic is cumbersome, even for simple models. The aim of this work is to discuss the alternative approach to higher-order adjustments, based on a parametric bootstrap. In particular, focus is on the signed profile scoring rule root statistic.

Keywords. Bootstrap, Higher-Order Asymptotics, Robustness, Scoring Rules.

AMS 2010. 62F05, 62F35.

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In the Ridge Regression Method, ‘k Point Estimation Method’ (Approach) in the Estimation of the Parameter ‘‘k’’
Mücahit Kurtuluş¹

Abstract. In this study, multiple linear regression analysis, Ridge Regression method that is one of the methods to overcome the problems arising among the independent variables in the case of multicolinearity was studied. Ridge Regression method was compared with Least squares method. In ridge Regression method, ‘k Point Estimation Method’ as an alternative to the methods that was used to determine the parameters ‘‘k’’ has been proposed.

\[ k = \sqrt{\frac{\lambda_{\text{max}} - 100\lambda_{\text{min}}}{99}} \] (1)

Keywords. Ridge Trace, Multicolinearity, ‘‘k Point Estimation Method’’, Mean Squared Error.

References


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A Comparison of Information Criteria in Clustering based on Mixture of Multivariate Normal Distributions
Serkan Akoğul¹ and Murat Erişoğlu²

Abstract. Clustering analysis based on mixture of multivariate normal distributions is commonly used in the clustering of multidimensional data sets which are unknown natural cluster structure. The most important problems are to choose the number of components and to identify the structure of variance-covariance matrix in the clustering based on modelling with multivariate normal distributions of each cluster (components). In this study, the efficiency of information criterion which is commonly used in the model selection is examined. The effectiveness of information criteria has been determined according to the success in the estimation of the number of components and in the selection of appropriate variance-covariance matrix.

Keywords. Cluster Analysis, Mixture Models, Information Criteria.


References


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The Performance of the Optimal Extended Balanced Loss Function Estimators and Predictors
Selahattin Kaçıranlar¹ and Issam Dawoud²

Abstract. The optimal heterogeneous, homogenous and homogenous unbiased estimators of the mean square error (MSE) are introduced and discussed by many authors but the goodness of fitted model criterion is quite often ignored which is used to investigate the performance of estimators. Therefore, Shalabh et al. (2009) proposed the extended balanced loss function (EBLF) in which the MSE, the Zellner’s balanced loss function and the predictive loss function are just special cases of it. So, we derive the optimal heterogeneous, homogenous and homogenous unbiased estimators of the EBLF and discuss the performances of these estimators and their predictors.

Keywords: Linear Model; Estimation; Extended Balanced Loss Function; Optimal Heterogeneous Estimator; Optimal Homogenous Estimator, Prediction Mean Square Error.

AMS Subject Classifications: 62J05, 62J07.

References


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Abstract. Stein-rule and ridge estimators have been extensively used for estimating the coefficient vector in a regression model. These estimators lead to an improvement in the risk properties of the ordinary least squares (OLS) estimator. Instead of using one or the other estimator, both of them may be appropriately combined. We introduce an alternative estimator that combines the approaches followed in obtaining the restricted Stein-rule estimation and the ridge regression estimation. A Monte Carlo simulation is performed to compare the behavior of the proposed estimator.

Keywords. Stein-Rule Estimator; Ridge Regression Estimator; Restricted Estimator; Quadratic Loss Function.

AMS Subject Classifications: 62J05, 62J07.

References


On the Stationary Characteristics of a Renewal Reward Processes with Generalized Reflecting Barrier

Tahir Khaniyev 1, Basak Gever 1 and Zulfiyya Mammadova 2

Abstract. In this study, a semi–Markovian renewal–reward process with generalized reflecting barrier is investigated and the ergodicity of the process is proved under some weak conditions. Next, in general case, the explicit form of the first four moments for the ergodic distribution is found and using these expressions, the asymptotic expansions for the ergodic moments are obtained. To give these results, construct the considered process mathematically. The independent and identically distributed initial random pairs \(\{(\xi_n, \eta_n)\}, \ n = 1,2,3,...\) defined on a same probability space \((\Omega, \mathcal{F}, P)\). Moreover, the positive–valued random variables \(\xi_n\) and \(\eta_n\) are mutually independent. Their distribution functions are notated as follows:

\[
\Phi(t) = P\{\xi_n \leq t\}; \ F(x) = P\{\eta_n \leq x\}; \ n = 1,2,...; \ x, t \geq 0.
\]

Using the initial random pairs, construct the following renewal sequences \(\{T_n\}\) and \(\{S_n\}\):

\[
T_0 = S_0; \ T_n = \sum_{i=1}^{n} \xi_i; \ S_n = \sum_{i=1}^{n} \eta_i; \ n = 1,2,...
\]

With the help of the renewal sequence \(\{S_n\}\), the following integer – valued random variables are defined:

\[
N_0 = 0; \ \nu_0 = z \geq 0; \ N_1 = N_1(\lambda z) = \inf\{k \geq 1: \lambda z - S_k < 0\};
\]

\[
N_n = N_n(\lambda \nu_{n-1}) = \inf\{k \geq N_{n-1} + 1: \lambda \nu_{n-1} - (S_k - S_{N_{n-1}}) < 0\};
\]

\[
\nu_n = \nu_n(\lambda \nu_{n-1}) = |\lambda \nu_{n-1} - (S_{N_n} - S_{N_{n-1}})|; \ n = 1,2,...
\]

Here, \(\lambda \geq 1\) is an arbitrary positive constant. By means of \(\{N_n\}\), define the sequence \(\{\tau_n\}, n = 1,2,...\) as follows:

\[
\tau_0 \equiv 0; \ \tau_1 = \tau_1(\lambda z) = \sum_{i=1}^{N_1} \xi_i; \ \tau_2 = \sum_{i=1}^{N_2} \xi_i; \ \ldots; \ \tau_n = \sum_{i=1}^{N_n} \xi_i; \ n = 1,2,...
\]

Moreover, define \(v(t) = \min\{n \geq 1: T_n > t\}, t > 0\). Now, the considered process can be constructed mathematically as follows:

\[
X(t) = \lambda \xi_n - (S_{v(t)-1} - S_{N_n}); \ \forall \ \tau_n \leq t < \tau_{n+1}; \ n = 1,2,...
\]

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The defined process $X(t)$ is called as “Renewal reward process with generalized reflecting barrier”. The aim of this study is to investigate the ergodic moments of the considered process. Define the following notations to give the main result of this study.

$$m_n \equiv E(\eta_1^n); \quad E(X^n) = \lim_{t \to \infty} E(X(t)^n); \quad n = 1,2, ...$$

Now, present the main result of the study as follows:

**Theorem.** Assume that the initial random variables $\{\xi_n\}$ and $\{\eta_n\}$, $n = 1,2,...$ are satisfied the following supplementary conditions:

i) $0 < E(\xi_1) < \infty$;  
ii) $E(\eta_1) > 0$;  
iii) $E(\eta_1^{n+2}) < \infty$;  
iv) $\eta_1$, is a non – arithmetic random variable.

Then, the following asymptotic expansions can be written for the $n^{th}$ order moment for the ergodic moments of the process $X(t)$, when $\lambda \to \infty$:

$$E(X^n) = \frac{2m_{n+2}}{(n+1)(n+2)m_2}\lambda^n + B_n\lambda^{n-1} + C_n\lambda^{n-2} + o(\lambda^{n-2}); \quad n = 1,2, ...$$

Here, the coefficient $B_n$ and $C_n$ are indicated in the exclusive version of the study.

**Keywords.** Renewal Reward Process, Reflecting Barrier, Ergodic Distribution, Ergodic Moments, Asymptotic Expansion.

**AMS 2010.** 60K05, 60K15.

**References**


TOPOLOGY
Ideal Rothberger Spaces
Aslı Güldürdek

Abstract. In this work we introduce the notion of ideal Rothberger space, and examine some basic properties. Also, we give some characterizations of almost Rothberger and weakly Rothberger spaces by using ideal Rothberger property.

Keywords. Ideal Topological Space, Rothberger, Almost Rothberger, Weakly Rothberger.

AMS 2010. 54D20, 54D30.

References


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A New Almost Continuity for $\delta$-b-Open Sets
Aynur Keskin Kaymakci

Abstract. In this talk, first of all we introduce a weaker form of R-maps which is called almost $\delta$-b-continuity. Then, we investigate and obtain its some properties and characterizations. Finally, we show that $f: (X, \tau) \to (Y, \varphi)$ is almost $\delta$-b-continuous if and only if $f: (X, \tau s) \to (Y, \varphi s)$ is b-continuous, where $\tau s$ and $\varphi s$ are the semi-regularizations of $\tau$ and $\varphi$, respectively.

Keywords. R-Maps, Almost $\delta$-b-Continuity, b-Continuity, Semi-Regularization.

AMS 2010. 54C08

References


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Cardinal invariants of the Vietoris Topology on the Space of Minimal CUSCO Maps
Branislav Novotný¹ and Žubica Holá²

Abstract. Let X be a topological space. Among upper semicontinuous multifunctions with values in real numbers, there is an important class, namely CUSCO maps; that is upper semi-continuous and non-empty, compact and convex valued maps. Identifying multifunctions with their graphs, we can equip the space of CUSCO maps with the Vietoris topology inherited from the space of subsets of $X \times R$.

Let MC(X) be the space of all minimal CUSCO maps on X; minimal with respect to the ordering of their graphs by $\subseteq$. We investigate cardinal invariants and related properties on this space equipped with the Vietoris topology depending on the properties of X.

Keywords. Vietoris Topology, Minimal CUSCO Map, Cardinal Invariant.

AMS 2010. 54A25, 54C35, 54C60.

References


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Fg Morphisms and Their Some Properties
Ceren Sultan Elmalı¹ and Tamer Uğur²

Abstract. We defined Fan-Gottesman morphism (FG-morphism, for short). We mean a continuous map \( q: X \to Y \) such that \( q(X) \) is openly dense in \( Y \) and the topology of \( X \) is the inverse image of \( Y \) by \( q \). We investigated the properties of FG-Morphism.

Keywords: Fan-Gottesman Compactification, Categories
AMS 2010. 54D35, 18A40.

References


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Simplicial Cohomology Rings of a Connected Sum of Minimal Simple Closed Surfaces
Gülseli Burak¹ and İsmet Karaca²

Abstract. In this study, we research digital versions of some concepts of algebraic topology [1]. We present some general notions of digital images and compute simplicial cohomology groups of a connected sum of minimal simple closed surfaces [2]. We define a simplicial cup product for digital images and use it to establish ring structure of digital cohomology [3]. We give an example about computing the cohomology ring of a connected sum of a minimal simple closed surface. Then we present algebra structures of digital cohomology with the cup product. Finally, we show that $H^{*,d}(X,G)$ is a graded $G$-algebra with the cup product.

Keywords. Digital Simplicial Cohomology Group, Cup Product, Cohomology Ring.

References

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Introduction to Disoriented Knot Theory
İsmet Altıntaş¹

Abstract. This paper is an introduction to disoriented knot theory, which is a generalization of the oriented knot and link diagrams and an exposition of new ideas and constructions, including the basic definitions, some numerical invariants such as the disoriented diagram number, the linking number and the complete writhe and the polynomial invariants such as the extended bracket polynomial, the Jones polynomial, the complete Jones polynomial for the disoriented knot and link diagrams.

Keywords. Disoriented Diagrams, Disoriented Diagram Number, Complete Jones Polynomial.

AMS 2010. 57M25.

References


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Digital Homotopy Fixed Point Theory
İsmet Karaca¹ and Özgür Ege²

Abstract. Fixed point theory is in relationship with several areas of mathematics such as mathematical analysis, general topology and functional analysis. There are various applications of fixed point theory in mathematics, game theory, computer science, engineering, image processing. Fixed point theorems are used to solve some problems in mathematics and engineering. In this study, we construct the Notion of the digital homotopy fixed point property. Some results regarding digital retractions and the fixed point property are given. We prove that the digital homotopy fixed point property is a topological invariant. Finally we give a nice application of the digital homotopy fixed point theory to digital images.

Keywords. Digital Image, Digital Homotopy, Fixed Point.


References


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Some Classes of Functions Between Continuous and Quasicontinuous Functions

Ján Borsík

Abstract. A real function $f$ is quasicontinuous at a point $x$ if for every positive $\varepsilon$ and for every neighbourhood $U$ of $x$ there is an open nonempty subset $G$ of $U$ such that $|f(y)-f(x)|<\varepsilon$ for each $y$ from $G$. A function $f$ is quasicontinuous if it is such at each point. Quasicontinuous functions need not be measurable. Further, the set of all points of discontinuity of a quasicontinuous function is of first category, however it need not be of measure zero. In the talk, we will investigate classes of functions between continuous and quasicontinuous functions for which the set of discontinuity points is of measure zero or even $\sigma$-porous.

Keywords. Quasicontinuous Functions, Points of Discontinuity, Porosity.

AMS 2010. 54C08, 54C30.

References


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HOMFLY Polynomials of Torus Links as Generalized Fibonacci Polynomials
Kemal Taşköprü¹ and İsmet Altuntaş²

Abstract. The focus of this paper is to study the HOMFLY polynomial of (2,n)-torus link as a generalized Fibonacci polynomial. For this purpose, we first introduce a form of generalized Fibonacci and Lucas polynomials and provide their some fundamental properties. We define the HOMFLY polynomials of (2,n)-torus link with a way similar to our generalized Fibonacci polynomials and provide its fundamental properties. We also show that the HOMFLY polynomials of (2,n)-torus link can be obtained from its Alexander-Conway polynomial or the classical Fibonacci polynomial. We finally give the matrix representations and prove important identities, which are similar to the Fibonacci identities, for the our generalized Fibonacci polynomial and the HOMFLY polynomial of (2,n)-torus link.

Keywords. HOMFLY Polynomial, Alexander-Conway Polynomial, Torus Link, Fibonacci Polynomial, Binet's Formula, Fibonacci Identities.

AMS 2010. 57M25, 11B39, 11C08.

References


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Minimal Usco and Minimal Cusco Maps and Compactness

Ľubica Holá¹ and Dušan Holý²

Abstract. We prove Ascoli-type theorems for the space of minimal usco and minimal cusco maps. Let \( X \) be a locally compact space, \((Y, d)\) be a metric space and \( MU(X, Y) \) be the space of minimal usco maps from \( X \) to \( Y \). The family \( \mathcal{E} \), subset of \( MU(X, Y) \) is compact in \( MU(X, Y) \) equipped with the topology \( \tau_{UC} \) of uniform convergence on compact sets if and only if \( \mathcal{E} \) is closed, compactly bounded and densely equicontinuous. If \((Y, d)\) is a complete metric space the family \( \mathcal{E} \), subset of \((MU(X, Y), \tau_{UC})\) is compact if and only if \( \mathcal{E} \) is closed, pointwise bounded and densely equicontinuous. The same result holds also for compact subsets of \((MC(X, Y), \tau_{UC})\), the space of minimal cusco maps from \( X \) to a Banach space \( Y \).

Keywords. Densely Equicontinuous, Minimal Usco Map, Minimal Cusco Map.


References


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On $\gamma$-P-Open Sets in Bitopological Spaces
Merve İlkhan\textsuperscript{1}, Mahmut Akyiğit\textsuperscript{2} and Emrah Evren Kara\textsuperscript{3}

\textbf{Abstract.} In this study, we introduce the concept of $\gamma$-P-open sets in bitopological spaces. Also, we investigate some properties related to this concept.

\textbf{Keywords.} Bitopological Spaces, $\gamma$-Open Sets, $(i, j)$-$\gamma$-P-Open Sets.

\textbf{AMS 2010.} 54A05, 54D10.

\textbf{References}


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Invariant Measures and Controllability of Affine Control Systems

Meme Kule

Abstract. In this paper, which is a continuation of the paper [6], we show that affine control systems on general Lie groups to be controllable is used the concept of measure of invariant vector fields and is established the desired implication for analytic systems under a Poisson stability condition.

Keywords. Affine Control Systems, Lie Groups, Lie Algebras, Invariant Measures, Poisson Stability

AMS 2010. 37A05, 37N35, 93B05, 93C10.

References


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Soft Topological Questions and Answers
Milan Matejdes

Abstract. The paper deals with a few questions stated for a soft topological space in [5]. The main goal is to point out that any soft topological space is homeomorphic to a topological space \((A \times X, \tau_{A\times X})\) where \(\tau_{A\times X}\) is a topology on the product \(A \times X\), consequently many soft topological notions and results can be derived from general topology. Examples answering the questions of [5] are given.


AMS 2010. 54C60, 54C65, 26E25.

References


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A Fixed Point Criterion for $p$-adic Actions

Mehmet Onat

Abstract. In this study, it is given that the criterion for the existence of fixed point for effective actions of some compact, connected, abelian non-Lie groups. This criterion is implemented for effective actions of $p$-adic solenoid.

Keywords. Classifying Space, $p$-Adic Solenoid, Compact Connected Abelian Groups.

AMS 2010. 57S25, 55N91.

References


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Complex Valued Dislocated Metric Spaces and an Application to Differential Equations
Özgur Ege¹ and İsmet Karaca²

Abstract. In this paper, we introduce complex valued dislocated metric spaces. We prove Banach contraction principle in this new space. Moreover, we give an application of the theory to differential equations.

Keywords. Fixed Point, Dislocated Metric Space, Banach Contraction Principle.


References


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Principal P-adic Bundles Over Circle Groups
Seda Eren

Abstract. In this work it is shown that p-adic solenoid is a principal p-adic bundle over circle groups.

Keywords. p-adic Solenoid, Principal G Bundle

AMS 2010. 54B25, 57S10.

References


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Topological Group-2-Groupoids and Topological 2G-Crossed Modules
Sedat Temel$^1$ and Nazmiye Alemdar$^2$

**Abstract.** The main purpose of this paper is to construct the group structure on a topological 2-groupoid which we call topological group-2-groupoid and to obtain an algebraic structure which we call topological 2G-crossed module by using topological crossed modules corresponding to topological group-2-groupoids. Moreover we prove that the category of topological group-2-groupoids and of topological 2G-crossed modules are equivalent.

**Keywords.** Topological 2-Groupoid, Topological Group-2-Groupoid, Topological 2G-Crossed Module.

**AMS 2010.** 18B30, 18D05, 22A05, 22A22, 54H11.

**References**


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Textures and Approximation Spaces
Şenol Dost

Abstract. By a texturing [1] of a set \( S \) we mean a subset \( \delta \) of the power set \( P(S) \) which is a point separating complete, completely distributive lattice with respect to inclusion which contains \( S \) and \( \emptyset \), and for which arbitrary meets coincide with intersections and finite joins coincide with unions. The pair \( (S, \delta) \) is then called a texture space, or simply texture.

Difunctions [2] arise often in the study of textures and ditopological texture spaces. A difunction is a direlation \((f, F)\) satisfying certain additional conditions.

The theory of rough set is first introduced by Pawlak [5]. It should be noted that the basic tools for this theory are lower and upper approximation operators. A discussion is presented on rough set theory from the textural point of view [3]. Here is observed that the presections which are defined in terms of direlations are generalizations for rough sets. The dual operators of a textural rough set algebra which are defined on a complemented texture spaces are called approximation operators. Furthermore, if \((r; R)\) is a complemented direlation then the inverse of the relation \(r\) (the corelation \(R\)) of is a lower (an upper) approximation operator.

The aim of this study is to investigate the link between rough set approximation operators and textural approximation operators in view of categorical approach. We consider generalized interior-closure spaces (gic-space) [4] which their operators satisfy some conditions, and they are called i-c* spaces. Further, we observe that a textural rough set algebra is a complemented gic-space. Bicontinuous difunction between gic-spaces are used as morphisms, and some categories of the above mentioned approximation operators are formed.

Keywords. Rough Set, Interior-Closure Space, Texture, Textural Approximation Space

AMS 2010. 54A40, 06A15, 18B30.

References


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THE OTHER AREAS
A Numerical Analysis of Non Newtonian flow through Microchannels

Arunabha Chanda

Abstract. Understanding non-Newtonian flow in microchannels is required for various micro fluidic devices to explore both fundamental and practical significance of the flow with a special reference to the effect of viscosity, slip velocity and different power law indices. Flow channel cross sections in the order of micro scale gives rise to very high heat and mass transfer in non-Newtonian flow which has a connection to slip flow at microchannel walls and electro viscous effect. The occurrence of slip near solid boundary has created a challenging problem in fluid mechanics. Flow through microchannels introduces an electric field which applies an electric resistance on charged fluid in the opposite direction of the fluid flow. This is known as electro viscosity effect which retards the flow and on contrary, wall slip phenomena increases the flow velocity. The role of different indices of power law to the combined effect of wall slip and electro viscosity has not been well studied. Different models along with dimensionless numbers has been proposed to describe non Newtonian flow through microchannels but still there exists discrepancies in results.

A finite difference analysis has been carried out in the present work in an attempt to investigate numerically the combined effect of wall slip and electro viscosity for the different indices of power law. Different combinations of steady state, laminar and constant fluid properties in power law model can yield various results which can be used to justify the numerical analysis.

Keywords: Microchannels, Electro Viscosity, Wall Slip

Reference


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**Abstract.** In this article we try to solve "Mysterious number 6174" or "Kaprekar's constant". We solve this problem in two step or two theorem. This problem is this:
Consider a 4-digit number (which is not a multiple for 1111). Sort the digits in bigger-smaller, and reverse order. Subtract the smaller number from the bigger one. Perform the same operation with the remainder (it is called Kaprekar operation). After a number of steps we reach 6174. For example:

\[
\begin{align*}
3452 & \Rightarrow 5432 - 2345 = 3087 \\
3087 & \Rightarrow 8730 - 378 = 8352 \\
8352 & \Rightarrow 8532 - 2358 = 6174
\end{align*}
\]

The question is why these numbers reach 6174?

This question was told by an Indian scientist Kaprekar who had lived from 1905 till 1986. A question that after about 50 years no one is able to solve it with mathematical rules and reasons.

As what was talked about, lots of people have tried to solve this abstruse question but they couldn’t yet.

However in all of their detection, s.th is collective and that is:

If set all the numbers, after a level we have a particular group of digit numbers that the magnitude of them is 91. And again if set them from the smallest till the biggest, the magnitude will change to 30. And they are shown in series named “S”.

\[
S = \{9810, 9771, 9621, 9531, 9441, 8820, 8721, 8622, 8532, 8442, 8730, 7731, 7632, 7533, 7443, 8640, 7641, 6642, 6543, 6444, 8550, 7551, 6552, 5553, 5544, 9990, 9981, 9972, 9963, 9954\}
\]

In first step or theorem, I proof that why these numbers arrive to the series "S" with parameter and rules of mathematic. After that I proof that why the numbers of series "S" arrive to 6174 with
Abstract. Computational material science uses computers to model, understand and predict material properties. One of the most innovative and challenging areas of materials theory has centered on predicting some physical properties. This predictive ability in some areas competes with experimental measurements. Density functional theory (DFT) is a topic of interest in mathematics, physics and in chemistry. Modern DFT simulation codes can calculate a vast range of structural, elastic, electronic, vibrational and thermodynamic phenomena. We present an overview of the capabilities of solid-state DFT simulations in all of these topics, illustrated with recent example for TiAsTe compound using the VASP computer program. The obtained results are in the agreement with the available experimental results.

Keywords: Density Functional Theory, ab initio Calculations
Mathematical Ratio in Painting
Elif Gürsoy¹ and Semra Kaya Nurkan²

Abstract. Mathematical ratio or Golden ratio is one of the oldest rate system which can be described as the relation of the part with the whole and the relation of the objects with each other, in terms of symmetry and balance. And it brings to our lives balance, harmony and coherence.

In this study we sought the mathematical ratio in painting. Works of art are dated back to Medieval Europe and examples of religious painting.

Keywords. Mathematical Ratio, Mathematical Ratio in Painting, Painting.

AMS 2010. 00A67, 97M80.

References


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Non-linear Analysis of Rotating Cracked FGM Beams

G. Pohit

Abstract. The dynamic characteristics of cracked structures are of considerable importance in structural health monitoring. It is known that a crack in a structure introduces a local flexibility, reduces the stiffness and may change the dynamic behavior of the structure [1, 2]. Presence of crack in rotating structure may pose higher risk of failure. The present analysis is carried out for a cantilever beam fixed with a rotating hub. The effect of centrifugal stiffening on the nonlinear response of a cracked Timoshenko beam is determined. Material is assumed to have a gradation relation along the depth of the beam. Crack is modeled as a mass less rotational spring. Centrifugal force and axial displacement raised due to the rotating hub is incorporated in the strain energy equations. Ritz approximation followed by an iterative technique is employed to obtain the nonlinear vibration responses. Effects of rotational speeds, hub radius, crack depths, crack locations and different gradation relations on the nonlinear frequencies are obtained for different vibration modes. Effect of crack on the system characteristics are obtained by varying crack size and position. Comparison study of some of the results with the available solutions confirms the accuracy of the method.

Keywords. Rotating Beam, Crack, Nonlinear Vibration, Functionally Graded Material, Timoshenko Beam

References


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Different Viewpoint for Puzzle Problems as Artificial Intelligence Toy Problems: Heuristic Angular Metric Approach
İhsan Ömür Bucak¹ and Murat Tatlıhoğlu²

Abstract. In this study, the behaviours of heuristic metrics for the solutions of the puzzle problems with different sizes have been investigated. It has been expressed systematically that what features a good metric should require have been expressed systematically by comparing Manhattan, Euclidean, Chebyshev heuristic metrics up to 99-puzzle. A novel angular metric approach has been developed and a different perspective to the metric concept has been revealed. The developed angular metric approach has been tested and proven to be correct. Heuristic metrics provide nearest-optimal solutions in the shortest time possible in such problems having variables with astronomical values. As in toy problems such as 8-Puzzle, heuristic metrics which do the search, selection and optimization in a very short period of time can be seen very important. Comparison of the heuristic metrics on the puzzle problems can easily be done and observed. Solving behaviour of different metrics are easily observable when we increase the size of the puzzle. This allows one to examine the heuristic metrics much better. Under the light of three features of heuristic functions such as dominance, admissibility and consistency, the metrics can become a straight-line starting from a half-circle. Having it a half-circle is due to the necessity of triangle rule. In this approach, in the geometric representation of the metric, a heuristic acquisition is obtained in proportion to the length of a circle slice. As part of this study, operational and experimental results have been provided in detail in the original manuscript. As a result, the characters of heuristic metrics regarded as solid foundations of Artificial Intelligence can be identified easily according to the approach developed here.

Keywords. Angular Metric Approach, Heuristic Metrics, Heuristic Functions.

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Development of Mathematical Model using Group Contribution Method to Predict Exposure Limit Values in Air for Safeguarding Health

Mohanad El-Harbawi¹ and Phung Thi Kieu Trang²

Abstract. Occupational Exposure Limits (OELs) are representing the amount of a workplace health hazard that most workers can be exposed to without harming their health. In this work, a new Quantitative Structure Property Relationship (QSPR) model to estimate occupational exposure limits values has been developed. The model was developed based on a set of 100 exposure limit values, which were published by the American Conference of Governmental Industrial Hygienists (ACGIH). MATLAB software was employed to develop the model based on a combination between Multiple Linear Regression (MLR) and polynomial models. The results showed that the model is able to predict the exposure limits with high accuracy, $R^2 = 0.9998$. The model can be considered scientifically useful and convenient alternative to experimental assessments.

Keywords: OELs, Group Contribution Method, QSAR, MATLAB.

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The Way Ahead for Bug-fix time Prediction
Meera Sharma

Abstract. The bug-fix time i.e. the time to fix a bug after the bug was introduced is an important factor for bug related analysis, such as measuring software quality [1] or coordinating the development effort during bug triaging to maintain the software systems effectively [2]. In literature efforts have been made to construct many bug-fix time prediction models, based on machine learning algorithms, on both open source and commercial projects [3-5]. Previous work has proposed many bug-fix time prediction models that use various bug attributes (number of developers who participated in fixing the bug, bug severity, bug-opener’s reputation, number of patches) for predicting the fix time of a newly reported bug. In this paper we investigate the associations between bug attributes and the bug-fix time. Our prediction method is based on the association rule mining method which was first explored by [6]. We have proposed an approach to apply association mining by using Apriori algorithm to predict the fix time of a newly coming bug based on the bug’s severity, priority summary terms and assignee. We demonstrate our approach on collection of 1,695 bug reports of Thunderbird, AddOnSDK and Bugzilla products of Mozilla open source project.

Keywords. Bug-fix Time, Association Rule Mining, Association Rules.


References


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Construction of Lossless Broadband Matching Networks with Lumped Elements

Metin Şengül¹

Abstract. For microwave and communication engineers, construction of broadband matching networks has been regarded as a vital problem [1]. For this purpose, broadband matching analytic theory [2], [3] and computer aided design (CAD) tools are available [4]-[6]. But it is well known that analytic theory is quite difficult to use and is not practical. Therefore, it is always preferred to employ CAD tools to construct broadband matching networks. All CAD tools optimize the performance of the system. At the end of optimization, the element values of the broadband matching network are obtained. Here it should be emphasized that performance optimization is highly nonlinear with respect to element values and needs very good initials. So initial element value selection is important for successful optimization. Therefore, in this work, a well established initialization process is introduced for construction of broadband matching networks. It is expected that the proposed algorithm can be used as a front-end for commercially available CAD tools to design practical broadband matching networks for microwave communication systems.

Keywords. Broadband Matching, Real Frequency Techniques, Matching Networks, Lossless Networks.


References


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American options with regime-switching uncertainty
Saul D. Jacka\textsuperscript{1} and Adriana Ocejo\textsuperscript{2}

Abstract. We study the minimal payoff scenario for the holder of an American-style option in the presence of regime-switching uncertainty, for a large class of payoff functions. We assume that the transition rates are only known to lie within level-dependent compact sets, and so the holder takes a worst-case scenario position. We show that the minimal payoff identifies with the value function of an optimal stopping problem associated with a certain extremal rate matrix and characterized as the probabilistic solution of a free-boundary problem. The approach is via time-change and classical PDE techniques. We apply our results to the context of American option pricing under the Markov-modulated constant elasticity of variance and Markov-modulated geometric Brownian motion models.

Keywords. American Option, Regime-switching, Markov-modulated, Stochastic Control, Time-change, Stochastic Volatility, Uncertainty.

AMS 2010. 93E20, 49J20, 60G40, 91G20, 91G80.

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Designed Filter with the New Generation Current Conveyor and Analysis Of Ecg
Şükrü Kitiş¹, Etem Köklükaya² and Rüştü Güntürkün³

Abstract. In this study, a model was designed and practiced for ECG measurements which are tend to be used in detecting heart disorders [1]. This model was designed covering CCII+ structure. Before designing the model, filter structures [2] and amplifier circuits was simulated PSPICE program. In this research, an ECG circuit without CCII+ was examined and practiced in order to observe the advantages of CCII+ structures. In the ongoing process, filter and amplifier parts of that circuit was detected and redesigned as involving CCII+ structures. The difference between them and also designed ECG circuit and other ECG circuits [3],[4],[5],[6] were determined.

Keywords. ECG, Next-Generation Current Conveyors, CCII+, Instrumentation, Amplifier, Low-Pass Filter, High-Pass Filter, Inverting Amplifier.

References


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A Study on Mathematical Modelling for Open Source Software

Optimal Release Planning

V.B. Singh

Abstract: The main characteristics of open source software are the release early and release often [1]. The software engineering community has devoted little attention to release engineering [2]. Regarding releases, volunteer-driven open source projects usually employ one of two strategies. Many projects issue a new release after implementing a certain set of features [3 and 4]. This involves numerous challenges. Alternatively, projects might adopt a time-based strategy, in which releases are planned for a specific date as mentioned by [3 and 5]. The frequent changes in the source code make the source code complex. It is evident that for fixing bugs, new features introduction and feature improvements, different files of the software need to be changed. It is always desirable to meet the users need before releasing the next version of the software. Release time problem for proprietary software has been widely discussed by considering only one factor, the bugs which have been fixed in different releases. In this paper, we have studied a quantified approach for open source release time problem based on the implementations of bug fixing, new feature introduction and feature enhancement.

Keywords. Release Planning, Code Changes, Open Source.


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Equivariantly Formal Solenoidal Actions
Ali Arslan Özkurt

Abstract. \(X\) is said to be equivariantly formal \(G\)-space if \(i^*: H^*_G(X,k) \rightarrow H^*(X,k)\) is onto. It is well known fact that equivariantly formal compact Lie group actions have fixed points. In this study, it is shown that the same statement is true for equivariantly formal solenoidal actions.

Keywords. Equivariantly Formal Actions, Solenoidal Groups

AMS 2010. 57S25, 55N91.

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An Extension of Srivastava's Triple Hypergeometric Function \( H_C \)
A. Çetinkaya ¹, M. B. Yağbasan² and İ. O. Kıymaz³

Abstract. Recently, some extensions of the well-known special functions such as hypergeometric, confluent hypergeometric and Mittag-Leffler have been studied by several authors. The main object of this study is to introduce an extension of Srivastava's triple hypergeometric function \( H_C \) by using extended beta function. Some integral representations are also obtained for this extension.

Keywords. Extended Beta Function, Srivastava's Triple Hypergeometric Function \( H_C \), Integral Representations.

AMS 2010. 33C60, 33C65, 33C70

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Construction of Independent Spanning Trees for Bi-Rotator Graphs
Cheng-Jhe Lee¹, Chiun-Chieh Hsu², Yu-Ting Tsai³ and Yu-Chun Chu⁴

Abstract. The families of Cayley graphs, including star, hypercube, and rotator graphs, have been extensively studied in recent years [1], [2], [3], [4]. All these graphs possess the rich structural properties such as symmetry, recursive construction, small diameter, and small degree. In addition, these properties have been proved to be very useful and outperform those of others in terms of network transmission, computation, broadcasting, communication, fault tolerance, and so on [2], [3], [4]. Rotator graphs were modified by adding generation functions to make all edges bi-directional, which is called bi-rotator graphs. A bi-rotator graph with size \( n \) (abbreviated to \( n\)-BR), a member of Cayley graphs, contains \( n! \) nodes, where each node is labeled with a unique permutation of \( n \) distinct symbols of \( \{1, 2, 3, \ldots, n\} \), and has degree of \( 2n-3 \) [1]. \((n-1)\)-BR subgraphs can be connected with each other via the highest order of generation functions.

A spanning tree of a graph is composed of all nodes of the original graph and parts of edges which connect all nodes and form no cycles. Spanning trees are said to be independent if a directed edge can only be contained in one tree. If a number of independent spanning trees rooted at a source node can be found, a message can then be sent to one node through different paths via the different independent spanning trees. Moreover, fault-tolerant broadcasting can also be achieved by utilizing these independent spanning trees.

The method proposed in this paper adopts recursive construction for finding all independent spanning trees. With the increasing of the scale, two edges are added to each node. Based on the 4-BR, we can construct all independent spanning trees of the 5-BR using the rich structural properties and the added neighbors. In a similar way, we can construct independent spanning trees of the \( n\)-BR based on the spanning tree construction of the \((n-1)\)-BR. Using the explored properties of symmetry and recursive construction, the paper proposes an efficient algorithm of constructing independent spanning trees for a bi-rotator graph. The proposed method constructs \( 2n-3 \) independent spanning trees rooted at a designated node for an \( n\)-BR, where the number of the spanning tree is proved to be maximum.

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**Keywords.** Bi-Rotator Graph, Independent Spanning Trees Algorithm, Fault Tolerance Broadcasting

**References**


Pre-service Mathematics Teachers’ Views of Language in Mathematics Teaching and Their Math Literacy Self-Efficacies
Dilek Çağrigan Gülten¹ and Yavuz Yaman²

Abstract. Learning and teaching mathematics requires good knowledge of language, which is a tool used by individuals to communicate in a society. Using language in mathematics is of great concern to the first grade primary students who are in the stage of learning and developing a language. Mathematical literacy involves using mathematical knowledge properly in everyday life, having an idea about the historical development of mathematics, using the language of mathematics to communicate and problem solving skills. The concept of self-efficacy is vital to the development of mathematical literacy.

In consideration of the above mentioned, this study aims to investigate pre-service mathematics teachers’ views of language used in mathematics teaching and their self-efficacies in terms of certain variables. The research data were obtained from the study conducted with the first and fourth grade university students enrolled in the program of Primary Mathematics Education at İstanbul University. The data were collected using the “Language in Mathematics Teaching Scale” developed by Bali-Çalıkoğlu (2002), the “Math Literacy Self-Efficacy Scale” developed by Özgen and Bindak (2008) and a demographical form. While there is not a similar research study to compare with, the results of the data analysis will pave the way for further research contributing both to the literature and the training of mathematics teachers. The findings were discussed in the light of the literature and some suggestions were made for further research and researchers.

Keywords. Language in Mathematics Teaching, Mathematical Literacy, Self-Efficacy.

References


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Fixed Points of Involutions in a Lie Algebra of the Form $F/R$

Dilek Ersalan ¹ and Naime Ekici ²

Abstract: Let $F$ be a free Lie algebra of rank two and $\varphi$ be the automorphism of $F$ which is permuting the generators. If $R$ is a $\varphi$-invaryant ideal of $F$ then $\varphi$ induces an automorphism $\overline{\varphi}$ of the Lie algebra $L = F/R$. We investigate for which cases the automorphism $\overline{\varphi}$ has no non-trivial fixed points. Also we prove that if $L$ is a free metabelian Lie algebra then $\overline{\varphi}$ can has non-trivial fixed points.

Keywords. Free Lie Algebra, Automorphism, Fixed Point

AMS 2010. 17B01, 17B40

References:


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Stability of vertical Cylindrical Cavity with Circular Gross –Section view of Elastic-Plastic Deformations at Small Homogenous Subcritical States
E.A.Hazar¹, M.K.Cerrahoğlu² and E. Cerrahoğlu³

Abstract. Within a three dimensional linear stability theory, using the general solution method, exact solutions for some problems in the case of homogenous initial tension have been obtained. Approximate analytical solutions have also been built by employing a small parameter method while very strong homogeneous initial plastic deformations are present.(1),(2),(3).

Keywords. Stability, Elastic - Plasticity, Cavity, Critical Load.

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The Mathematical Equations of a New Five Phases Segmental Switched Reluctance Motor

Erdal Büyükbıçakcı¹ and Ali Fuat Boz²

Abstract. In this study, the mathematical equations of five phase segmental switched reluctance motor (SARM) was established by using basic electrical motor model. Phase currents and magnetic flow variations with respect to prominent inductance of SARM which has different rotor structure were calculated. In addition, the momentum equation of SARM was obtained by determining the situations of different phases. It was understood that the magnetic flow equations depend not only on the function of rotor position, but also the changing current.

Keywords. Switched Reluctance Motor, Mathematical Model, State Equation

AMS 2010. 93A30, 97M50

References


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Dynamic Simulation Results of a New Five Phases Segmental Switched Reluctance Motor

Erdal Büyükbıçakcı¹, Ali Fuat Boz² and Zeynep Büyükbıçakcı¹

Abstract. In this study, the dynamic simulation results of a new five phases segmental switched reluctance motor were developed by using gained statement equations of them. In computer media, the SARM was rotated from 0° to 90° by 1° increment in order to see the change of function of current by using algorithmic code parts. In every rotation angle of SARM, the adjacent two phases were energized to generate common inductance. In analyses, the variation of obtained phase currents was explained by simulating and visualizing every current.

Keywords. Switched Reluctance Motor, Mathematical Model, Simulation

AMS 2010. 93A30, 93B40

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Investigation of the Effect of Project – Based Learning Method on Academic Success for Mathematic Course in Higher Education

Erdal Büyükbıçakcı¹ and Zeynep Büyükbıçakcı¹

Abstract. The aim of this study is to investigate the effect of project-based learning method on academic success for mathematic course by comparing the traditional learning methods and applying ideas of students the in higher education. A qualitative type research was applied to first year students of Sakarya University Vocational School of Karasu Department of Computer Technologies. In first semester, the Mathematic course was done by traditional education, and in second semester, the project-based learning method was applied to students. After that, the students were questioned to compare the two learning methods by completing a questionnaire form. At the end of the study, the project-based learning method was seen more favourable than traditional one.

Keywords. Project-Based Learning, Mathematic Education, Traditional Learning

AMS 2010. 97B40, 97B70.

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On the Existence of Bertrand Curves in Dual Space $D^4$

Emel Karaca\textsuperscript{1} and Mustafa Çalışkan\textsuperscript{2}

Abstract. Bertrand curves were defined and some characterizations for these curves were studied in $IR^3$ by J. Bertrand in 1850. According to definition, a Bertrand curve in $IR^3$ is a curve such that its principal normal vectors are the principal normal vectors of an other curve. Aminov proved that a Bertrand curve does not exist in $IR^n$ if $n \geq 4$. In this study, we defined Bertrand curves in $ID^4$ and proved that the curves whose principal normal vectors are pure dual vectors are Bertrand curves on the unit dual sphere in $ID^4$. We gave two conclusions under special conditions in $ID^4$. One of them is that two dual curves are Bertrand curves if $\lambda_1$ and $\lambda_2$ are obtained pure reel. The other is that there is no curve whose principal normal vectors are linear dependent if the dual curves $\vec{a}$ and $\vec{b}$ are unique dual vectors.

Keywords. Dual Frenet Frames, Bertrand Curves, Dual Space.

AMS 2010. 53A04

References


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Surface Growth Kinematics in Minkowski 3 Space
Gül Güner¹, Zehra Özdemir² and F. Nejat Ekmekeci³

Abstract. In [1], the authors developed the modelling of the surface growth by taking a curve evolving in space. Such a curve generates some surfaces like seashells and horns. We generalize this modelling to the curves in Minkowski 3 Space. Hence, we can analyze the surface growth by means of space and time.

Keywords. Frenet Frame, Growth Velocity, Seashell, Mathematical Model.


References


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On the Codimension-Two and -Three Bifurcations of a Food Web of Four Species
Hsiu-Chuan Wei\textsuperscript{1}, Yuh-Yih Chen\textsuperscript{2}, Shin-Feng Hwang\textsuperscript{3} and Jenn-Tsann Lin\textsuperscript{4}

Abstract. This work is concerned with codimension-two and -three bifurcations of a food web developed by Bockelman and Deng [1]. It contains a bottom prey $X$, two competing predators $Y$ and $Z$ on $X$, and a super predator $W$ only on $Y$. Parameter conditions for a part of codimension-two bifurcations and a codimension-three bifurcation are derived. Three-parameter bifurcation diagrams are computed using an adaptive grid method [2,3] to locate the bifurcations determined by the eigenvalues of equilibria.

Keywords. Food Web, Bifurcation, Numerical Computation.

AMS 2010. 34D20, 37C35, 92D25, 92D40.

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Algorithms for Calculating the Limits of Convergent Infinite Series
Héctor Luna García\textsuperscript{1}, Luz María García Cruz\textsuperscript{2} and A. E. García\textsuperscript{3}

Abstract. We use algorithms to calculate the exact limits of a wide range of convergent infinite series by means of special functions, this are polygamma functions. However, in the case of alternating series, these algorithms do not allow the use of such functions, but allow them to find the limits of this series. Finally, these methods are used as a powerful and simple tool for calculating the limits of many infinite series as shown in the examples included. You write the text of your abstract.

Keywords. Polygamma Functions, Convergent Infinite Series, Laplace Transform.
AMS 2010. 33E50, 40A05, 44A10.

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An Extension of Srivastava's Triple Hypergeometric Function $H_B$

İ. O. Kıymaz¹, M. B.Yağbasan² and A. Çetinkaya³

Abstract. Recently, some extensions of the well-known special functions such as hypergeometric, confluent hypergeometric and Mittag-Leffler have been studied by several authors. The main object of this study is to introduce an extension of Srivastava's triple hypergeometric function $H_B$ by using extended beta function. Some integral representations are also obtained for this extension.

Keywords. Extended Beta Function, Srivastava's Triple Hypergeometric Function $H_B$, Integral Representations.

AMS 2010. 33C60, 33C65, 33C70

Acknowledgement: This work was supported by Ahi Evran University Scientific Research Projects Coordination Unit. Project Number: PYO-FEN.4001.14.014

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Canonical Transformations to the Schrödinger Equation: Hypergeometric Solutions and Exponential-Type Potentials

J. J. Peña¹, J. Morales² and J. García-Ravelo³

Abstract. In this work, a direct point canonical transformation and a gauge transformation is applied to the Schrödinger equation to convert it into a hypergeometric differential equation. This method leads to exactly solvable multiparameter exponential-type potentials with eigen-functions given in terms of the hypergeometric function. The proposal is general because it permits to identify one-dimensional exponential potentials as well as radial exponential potentials by means of a simple choice of the involved parameters. As useful applications, the method shows the treatment of some specific exponential-type potentials for the cases of singular and non-singular exponential potentials, such as Wood-Saxon [1] and Schöberg [2] potentials, among others, all of them with hypergeometric-type solutions.

Keywords. Canonical Transformation, Hypergeometric Solution, Exponential-Type Potentials.

AMS 2010. 44A203, 81Q05.

References


Siacci’s Resolution of the Acceleration Vector for a Non-Null Space Curve in Minkowski Space

Kahraman Esen Özen¹, Murat Tosun² and Mahmut Akyiğit³

Abstract. In [1], a resolution of the acceleration vector is well known by Siacci for motion of a material point along a space curve. In this resolution, the acceleration vector is expressed as the sum of two special oblique components in the osculating plane to the curve. In this paper, we have studied the Siacci’s theorem for the curves defined in Minkowski space. Also, an example is given for a helix lying on a cylinder.

Keywords. Siacci’s theorem, Minkowski space, kinematics.


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Two Parameter Homothetic Motions on the Galilean Plane
Muhsin Çelik¹ and Mehmet Ali Güngör²

Abstract. The one-parameter motions on the Galilean plane, the relations between absolute, relative, sliding velocities and accelerations and pole curves were studied in ref [9]. In this study, sliding velocity, pole lines, Hodograph and acceleration poles of two parameter homothetic motions on the Galilean plane at \( \forall (\lambda, \mu) \) positions are obtained. Some characteristic properties about the velocity vectors, the acceleration vectors and the pole curves are given.

Keywords. Two Parameter Motion, Shear Motion, Galilean Plane, Planar Kinematics, Homothetic Motion.


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Exact Traveling Wave Solutions of some Nonlinear Evolution Equations
Meryem Odabaşi and Emine Mısırlı

Abstract. In nonlinear sciences, it is important to obtain traveling wave solutions of nonlinear evolution equations to understand the phenomena they describe. In this study, we obtained the exact traveling wave solutions of the two-dimensional Bratu equation, generalized heat conduction equation, generalized Benjamin-Bona-Mahony equation and coupled nonlinear Klein-Gordon equations by means of the trial equation method and the complete discrimination system. This method is reliable, effective and enables to get soliton, single-kink and compacton solutions of the generalized nonlinear evolution equations and systems of equations.


AMS 2010. 35Q79, 35Q35, 35Q40, 35A25.

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On Reflections and Cartan-Dieudonné Theorem in Minkowski 3-space
Mustafa Özdemir¹ and Melek Erdoğdu²

Abstract. In this paper, we investigate the reflections in Minkowski 3-space by three different approaches. Firstly, we define Lorentzian reflections with Lorentzian inner product. Then, we examine Lorentzian reflections in view of Lorentzian Householder matrices. Finally, we use pure split quaternions to derive Lorentzian reflections. For each case, we find the matrix representation of Lorentzian reflections and characterize the plane of reflection by using this matrix representation. Moreover, we prove the Cartan-Dieudonne Theorem in the Minkowski space.

Keywords. Minkowski Space, Reflections, Rotations, Cartan-Dieudonne Theorem.

AMS 2010. 5B10, 15A16, 53B30

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Analytical Problem Solution About Initial Step of Pressing Powder Material Tube

M.Ya. Flax¹, A.V. Bochkov², V.A. Goloveshkin³ and A.V. Ponomarev⁴

Abstract. Prediction of finite size in the process of hot isostatic pressing (HIP) of powder material tubes is a difficult task which is important for practical purposes. In this paper, we propose an analytical problem solution about initial step of the process.

Full problem statement is represented as follows [1-2]. Suppose that in the area of the cylindrical coordinate system area \(R_1 \leq r \leq R_2\), \(R_3 \leq r \leq R_4\) (capsule) filled by plastically incompressible material, area \(R_2 \leq r \leq R_3\) filled by plastically compressible powder material. It is assumed that the deformation rate \(\varepsilon_z\) is constant throughout the entire volume. The initial moment of the pressing process is considered, so it is assumed that the density is constant throughout the entire volume. Let \(u(r)\) - radial displacement speed.

Steady-state equation: \(\frac{d\sigma_r}{dr} + \frac{\sigma_r - \sigma_\varphi}{r} = 0\).

The equation of the yield surface for the powder material is taken in the form of Green:

\[
\left(\sigma_r + \sigma_\varphi + \sigma_z\right)^2 + \frac{1}{6f_1^2}\left[2(\sigma_r - \sigma_\varphi - \sigma_z)^2 + (2\sigma_\varphi - \sigma_r - \sigma_z)^2 + (2\sigma_z - \sigma_r - \sigma_\varphi)^2\right] = T^2.
\]

The equation of the yield surface to plastically incompressible material has the form:

\[
\frac{1}{6}\left[2(\sigma_r - \sigma_\varphi - \sigma_z)^2 + (2\sigma_\varphi - \sigma_r - \sigma_z)^2 + (2\sigma_z - \sigma_r - \sigma_\varphi)^2\right] = T^2_i.
\]

Solution of the problem:

Using the flow law and equilibrium equation to determine the speeds of movement in the powder material have the following equation:

\[
\frac{d\varepsilon_r}{dr}\left[(C+D)\varepsilon_r^2 + (C+D)\varepsilon_\varphi^2 + 2D\varepsilon_r\varepsilon_\varphi\right] + \frac{d\varepsilon_\varphi}{dr}\left[D\varepsilon_r^2 - (C+D)\varepsilon_r\varepsilon_\varphi\varepsilon_\varphi - D\varepsilon_r\varepsilon_\varphi\varepsilon_\varphi\right] + \frac{\varepsilon_r - \varepsilon_\varphi}{r}\left[C\left(\varepsilon_r^2 + \varepsilon_\varphi^2 + \varepsilon_z^2\right) + 2D\left(\varepsilon_r\varepsilon_\varphi + \varepsilon_r\varepsilon_\varphi + \varepsilon_\varphi\varepsilon_\varphi\right)\right] = 0.
\]

The parametric representation of its solution has the form:
\[
\begin{align*}
    r &= \frac{R_0}{\sqrt{c h \delta (\psi - \psi_0) \sin \psi + \delta h \delta (\psi - \psi_0) \cos \psi}}, \\
    u &= \varepsilon_z \frac{R_0}{\sqrt{c h \delta (\psi - \psi_0) \sin \psi + \delta h \delta (\psi - \psi_0) \cos \psi}} \left[ -\gamma \text{sh} \delta (\psi - \psi_0) - \frac{\cos \alpha}{1 + \cos \alpha} \right], \\
    \varepsilon_\phi &= \varepsilon_z \left[ -\gamma \text{sh} \delta (\psi - \psi_0) - \frac{\delta^2 - 1}{2 \delta^2} \right], \\
    \varepsilon_r &= \varepsilon_z \left[ -\gamma \text{sh} \delta (\psi - \psi_0) - \frac{\delta^2 - 1}{2 \delta^2} + \frac{2 \gamma \delta}{1 + \delta^2} \left( c h \delta (\psi - \psi_0) \gamma \psi + \delta \text{sh} \delta (\psi - \psi_0) \right) \right], \psi \leq \left[ 0; \frac{\pi}{2} \right].
\end{align*}
\]

Investigation of this solution allows to reveal the various modes of deformation process.

**Keywords.** Powder Material. Green's Condition. Hot Isostatic Pressing. Analytical Solution. Predictive Analytics

**AMS 2010. 74Cxx**

**References**


Abstract. (2Z, 3E)-3-(((E)-3-Ethoxy-2-Hydroxybenzylidene)Hydrazono)Butan-2-One Oxime (1) has been synthesized and characterized by IR, UV/vis and X-ray diffraction. The molecular structure of the title compound in the ground state (in vacuo) were optimized by Density Functional Theory (DFT) to include correlation corrections with the 6–311G(d, p) and B3LYP/6-31G basis sets. In DFT calculations, hybrid functionals are also used, including the Becke’s three-parameter functional (B3) [1], which defines the exchange functional as the linear combination of Hartree-Fock, local, and gradient-corrected exchange terms. The B3 hybrid functional was used in combination with the correlation functionals of Lee et al. [2]. In addition to the experimental studies, the optimized structure, vibrational parameters, chemical shifts, molecular orbital energies, thermodynamic properties, ionization energy, electron affinity, electronegativity, global chemical hardness and chemical softness of the molecule have been investigated by using DFT. The HOMO and LUMO energies were calculated by time-dependent TD-DFT approach. The experimental results of the compound have been compared with theoretical results and it is found to show good agreement with calculated values. Single crystal X-ray results show that 1 crystallizes in the monoclinic system, space group P2₁/c.

Keywords. Oxime, Hydrazone, DFT.

References


Fixed Points of Certain Automorphisms of Free Solvable Lie Algebras

Naime Ekici

Abstract: Let $F_n$ be a free Lie algebra of finite rank $n$ ($n > 1$) over a field $K$ and $\theta$ be an automorphism of $F_n$ of finite order $n$ which has no nontrivial fixed points and permutes the generators of $F_n$ cyclically. We describe form of the fixed points of an automorphism of the free solvable Lie algebra $\delta^{m-1}(F_n)/\delta^m(F_n)$ which is induced by $\theta$, where $\delta^m(F_n)$ is the $m$-th derived term and $\omega \in \delta^{m-1}(F_n)/\delta^m(F_n)$. Form of the fixed point subalgebras of an automorphism of a free metabelian Lie algebra were given by N. Ekici and Z. Esmerligil. We generalize this result for solvable Lie algebras. This work is an extension of results of W. Tomaszweski in group theory for Lie algebras.

Keywords. Free Solvable Lie Algebra, Automorphism, Fixed Point

AMS 2010. 17B01, 17B40

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Generalizations of Sherman's Inequality by Lidstone's Interpolating Polynomial
Ravi P. Agarwal¹, Slavica Ivelić Bradanović² and Josip Pečarić³

Abstract. In majorization theory, the well known Majorization theorem plays a very important role. More general result is obtained by S. Sherman. In this paper, concerning 2n-convex functions, we get generalizations of these results applying Lidstone's interpolating polynomials and Čebyšev functional. Using obtained results, we generate new family of exponentially convex functions. The outcome are some new classes of two-parameter Cauchy-type means.

Keywords. Majorization, n-convexity, Schur-convexity, Sherman's Theorem, Lidstone Interpolating Polynomial, Čebyšev Functional, Grüss Type Inequalities, Ostrowsky-Type Inequalities, Exponentially convex Functions, Log-convex Functions, Means

AMS 2010. Primary 39B82; Secondary 44B20, 46C05.

References


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Abstract. State variables that determine a system’s dynamics should be known for analysis and control of dynamical systems [1-2]. Specifically, dynamics feedback for pole placement is required. Furthermore, estimation of state variables in real time is a very important problem in adaptive control applications [3]. Unfortunately, all of the state variables cannot be measured in practice. As a result, use of a suitable state observer or estimator is unavoidable in order to obtain immeasurable state variables. There exist a variety of state observers in the literature [4-5]. Implementation of state observers that use only input and output measurements of the systems are carried out via solution of the observer state integral equations pertinent to the observer. There are several numerical solution algorithms for a solution of the observer state integral equations in the literature [6]. Even though the Runge-Kutta numerical integration algorithm is frequently used for this purpose, it has several drawbacks that depend on the step-size h. First, accuracy gets poorer as h increases. Second, computation time becomes an issue if h is too small. Third, round-off errors may become important for small values of h because the number of cycles required to cover the desired time interval [0, t] increases. Note that equations are evaluated for each t in the interval [0, t] in all of the above mentioned algorithms.

In this study, a simple general algorithm is proposed for state variables estimation of linear, time-invariant multi-input multi output systems. The proposed algorithm is based on Taylor series approximation and has an analog solution. The solution that results from the proposed algorithm gets closer to the true solution when more and more terms are kept in the Taylor series. Finally, the proposed method gives the approximate solution of the estimation vector \( \hat{x}(t) \) as a function of time in the interval \([0, t]\). Consequently, computation of the state integral equations for each t is eliminated. The Taylor series are defined on the interval \( t \in [0,1] \) and have the orthogonality property like the Walsh, Chebyshev and Legendre series [7-8]. The proposed algorithm uses some important properties such as the operational matrix of integration for Taylor vector [9-10]. The algorithm consists of four steps. In the first step, the feedback gain matrix \( G \), which will force the estimation error to go to zero in a short time, is determined by using a suitable method [4]. In the second step, the observer state equation is
converted into integral equation by integrating the terms on either side of the equation. After some algebraic manipulations, the time dependent terms on either side of the integral equation are removed. Hence, the problem is reduced to a set of nonlinear equations with constant coefficients. System outputs are used by the observer equations. Therefore, we have to calculate it’s as the function of time. They can obtained from plant output measurement by using curve fitting methods such as Linear Least Squares, Levenberg-Marquardt and Gauss-Newton [11]. Finally, in the last step, nonlinear equations for unknown state vector are converted into a recursive form whose solution can be obtained easily by a computer program. The proposed estimation algorithm was implemented in MATLAB™ and it was applied to different cases. Results obtained by the proposed algorithm are in harmony with the real results.

Keywords. State Estimation, Taylor Series, State Observers, Curve Fitting

References

On the Classical Zariski Topology over Prime Spectrum of a Module

Seçil Çeken¹ and Mustafa Alkan ²

Abstract. Let R be an associative ring with identity and Spec(M) denote the set of all prime submodules of a right R-module M. In this talk, we deal with the classical Zariski topology on Spec(M) which is denoted by \( \tau^c \). We prove that if (Spec(M), \( \tau^c \)) is a Noetherian topological space, then M has finitely many minimal prime submodules. We characterize all the irreducible components of (Spec(M), \( \tau^c \)) and all the minimal prime submodules of M for a non-zero flat module M over a commutative ring R. We obtain some results concerning compactness and connectedness of (Spec(M), \( \tau^c \)) by using algebraic properties of the module M. We give some equivalent conditions for (Spec(M), \( \tau^c \)) to be a Hausdorff space or T₁-space when M is a right module over a left perfect ring R.

Keywords. Prime Submodule, Prime Spectrum, Classical Zariski Topology.


References


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Strongly \( k \)-Spaces

Soley Ersoy \(^1\), Ibrahim Ince \(^2\) and Merve Bilgin \(^3\)

Abstract. In this paper, we introduce the notion of strongly \( k \)-spaces (with the weak (=finest) pre-topology generated by their strongly compact subsets). We characterize the strongly \( k \)-spaces and investigate the relationships between pre-closedness, locally strongly compactness, pre-first countability and being strongly \( k \)-space.

Keywords. Strongly Compact Sets, Preopen Sets, \( k \)-Spaces.

AMS 2010. 54A05; 54C08, 54D50.

References


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On the Study of the Matrix in a Model of Economic Dynamics
Sabir I. Hamidov

Abstract. In the study of some reproduction models equilibrium mechanisms are often used. In this paper we consider a diversified Leontief type model. In the paper [1] it is shown that the equilibrium vector \( \bar{x} = (\bar{x}^1, ..., \bar{x}^n) \) is a solution of the equation \( \Psi(f, x) = 0 \), where \( \Psi = (\psi_1, ..., \psi_n) \) is a mapping of \( \mathbb{R}^n_+ \) to itself.

It is also proved there that the function \( \Psi(f, x) \) is differentiable with respect to \( x \), and \( \frac{\partial \psi}{\partial x} \) is a block matrix, the elements of which depends on the matrix \( A_i = \nabla^2 \phi_i(\bar{x}^i) \) of the second partial derivatives of the function \( \phi_i \) calculated in point \( \bar{x}^i \). Then we introduce the matrix \( C_i = q_i A_i \), \( i = 1, n \).

In the present paper the case \( n = 3 \) is considered in detail and Metzler matrix \( C = (c_{ij})_{i,j=1}^n \), i.e. the matrix with \( c_{ij} \geq 0 \) \( (i \neq j) \) is investigated. The estimations for the norms \( \|C\| \) and \( \|C_i^{-1}\| \) are obtained.

Keywords. Discrete dynamical models, consumption, Cobb-Douglas production function.

References
Numerical Solutions of Steady Incompressible Dilatant Flow in an Enclosed Cavity Region

Serpil Şahin¹ and Hüseyin Demir²

Abstract. In this study, we consider flow properties of Dilatant fluid motion generated by top wall motion for 2-D steady incompressible flows. Pseudo time derivative is used to solve the continuity and momentum equations with suitable initial and boundary conditions. Therefore, the governing equations of fluid of vorticity-stream function formulations are solved numerically using finite difference and Gauss Elimination method. The stream function and vorticity results are obtained for the steady two-dimensional Dilatant incompressible flow. These results are presented both in tables and figures. The stream function and vorticity equations are solved separately with the numerical solution method used in this study. Each equation with pseudo time parameter on very fine grid mesh is solved step by step with a pair of tridiagonal system. The advantage of this process is that it gives the solution of the flow problems effectively and accurately.

Keywords. Finite Difference Method, Pseudo Time Parameter, Dilatant Fluid.

AMS 2010. 76D05, 76M20, 76M25.

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Smarandache Curves of Mannheim Curve Couple According to Frenet Frame
Süleyman Şenyurt ¹ and Abdussamet Çalışkan ²

Abstract: In this paper, when the Frenet vectors of the partner curve of Mannheim curve are taken as the position vectors, the curvature and the torsion of Smarandache curves are calculated. These values are expressed depending upon the Mannheim curve. Besides, special Smarandache curves belonging to $\alpha^*$ Mannheim partner curve such as $T^* N^*$, $N^* B^*$, $T^* B^*$ and $T^* N^* B^*$ drawn by Frenet frame are defined and some related results are given.

Keywords. Mannheim Curve, Mannheim Partner Curve, Smarandache Curves, Frenet Invariants

AMS 2010. 53A04.

References


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Smarandache Curves of Involute-Evolute Curve Couple According to Frenet Frame
Süleyman Şenyurt¹, Selin Sivas² and Abdussamet Çalışkan³

Abstract. In this paper, when the Frenet vectors of involute curve are taken as the position vectors, the curvature and the torsion of Smarandache curves are calculated. These values are expressed depending upon the evolute curve. Besides, special Smarandache curves belonging to α∗ involute curve such as T∗N∗, N∗B∗, T∗B∗ ve T N∗B∗ drawn by Frenet frame are defined and some related results are given.

Keywords. Evolute Curve, Involute Curve, Smarandache Curves, Frenet Invariants.

AMS 2010. 53A04.

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Abstract. Mathematical modelling is a process of translating the real life problems into the language of mathematics using mathematical terms, or expressing a real life situation mathematically (Cheng, 2001). Model eliciting activities, on the other hand, are problem-solving activities which include nonroutine, open-ended, and complicated real life situations with nontraditional problems and which have various possible solutions (Lesh & Doer, 2003). According to Lesh et al. (2000), a model construction activity must involve the following principles: the model construction principle, the reality principle, the self-assessment principle, the model documentation (construct documentation) principle, the model generalizability principle, and the effective prototype principle.

In the secondary mathematics education program in Turkey, the significance of creating learning environments based on modelling activities that are appropriate for the level of students and that can ensure active participation is highly emphasized (MoNE, 2013). Yet, modelling activities are seldom used in courses (Tekin & Bukova Güzel, 2011; Urhan & Dost, 2015). One of the reasons behind this situation is that the coursebooks are qualitatively and quantitatively insufficient as far as modelling activities are concerned (Vural et al., 2013; Urhan & Dost, 2015).

The aim of the current study is to analyze the activities in the ninth grade mathematics coursebook that was prepared in line with the new curriculum based on the model construction activity principles. The data collection procedure involved document analysis, which is one of the qualitative data collection methods. Frequency and percentage values were calculated to reveal the congruence between the activities analyzed and the principles. The results of the analysis indicate that model construction activities that employ all the principles are seldom found in the coursebook. It was found that of the seventy three activities in the coursebook, fourteen activities (19%) are model construction activities. It was revealed that the model construction activities are mostly seen in “Equations and Inequalities” unit. Modelling activities were not found in “Congruence and Similarity in Triangles” and “Right Angled Triangle, Trigonometry, Area of the Triangle, Vectors” units. While five of the model construction activities partially follow the self-assessment principle, they fully follow all the
other principles. Within the framework the obtained results, it is recommended that ninth grade mathematics coursebooks be revised in terms of the modelling activities they involve, and that similar analyses be conducted on other coursebooks as well.

**Keywords.** Mathematical Modelling, Modelling Activities, Modelling Principles, Coursebooks

**AMS 2010.** 53A40, 20M15.

**References**


On Geodesic Paracontact CR-Lightlike Submanifolds
Selcen Yüksel Perktaş¹ and Bilal Eftal Acet²

Abstract. In this paper we study geodesic paracontact CR-lightlike submanifolds of para-Sasakian manifolds. We derive some necessary and sufficient conditions for totally geodesic, $\tilde{D}$– geodesic, $\hat{D}$– geodesic and mixed geodesic paracontact CR-lightlike submanifolds. Also we examine geodesic paracontact screen CR-lightlike submanifolds of para-Sasakian manifolds.

Keywords. Para-Sasakian Manifolds, Lightlike Submanifolds.

AMS 2010. 53C15, 53C25.

References


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A Generalized Method for Centres of Trajectories in Kinematics

Tülay Erşiţ1, Mehmet Ali Güngör2 and Murat Tosun3

Abstract. In this paper, we study on one-parameter planar motion in generalized complex plane or \( p \)-complex plane \( \mathcal{C}_p = \{x+iy : x, y \in \mathbb{R}, \ i^2 = p\} \) which is defined as system of the generalized complex numbers. Firstly, we define a canonical relative system for one-parameter planar motion in \( p \)-complex plane. From this, we obtain the generalized Euler-Savary formula, which gives the relationship between the curvatures of trajectory curves in the generalized complex plane.

Keywords. Generalized Complex Plane, Generalized Euler Savary Formula


References


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A New Generalization of the Steiner Formula and the Holditch Theorem
Tülay Erişir¹, Mehmet Ali Güngör² and Murat Tosun³

Abstract. In this study, we first obtained the Steiner area formula in the generalized complex plane. Then, with the aid of this formula, we determined a new approach for the Holditch theorem giving the relationship between the areas formed by points in the generalized complex plane (or $P^-$ complex plane). Finally, according to the special values of $p \in \mathbb{R}$ we examined the cases of the Steiner Formula and Holditch Theorem. In this way, for $p \in \mathbb{R}$ we generalized the Steiner Formula and Holditch theorem consisting the Euclidean ($p = 1$), Galilean ($p = 0$) and Lorentzian ($p = -1$) cases.

Keywords. Generalized Complex Plane, The Steiner Formula, The Holditch Theorem


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On the Construction of Generalized Bobillier Formula
Tülay Erişir¹, Mehmet Ali Güngör² and Soley Ersoy³

Abstract. In this paper, one-parameter planar motion in the generalized complex plane (or \( p \)-complex plane) \( \mathbb{C}_p = \{ x + iy : x, y \in \mathbb{R}, i^2 = p \} \) which is defined as a system of generalized complex numbers is studied. Firstly, generalized Bobillier formula is obtained by using the geometric interpretation of generalized Euler-Savary formula in the \( p \)-complex plane. Moreover, it is shown that the Bobillier formula may be obtained by an alternative method without the use of Euler-Savary formula in the generalized complex plane. Thus, this formula generalizes the Euclidean, Lorentzian and Galilean cases.

Keywords. Generalized Complex Plane, Generalized Bobillier Formula, Generalized Euler Savary Formula


References


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Generalized $F$-Expansion Method and Application to Nonlinear Fractional Differential Equation

Yusuf Ali Tandoğan$^1$ and Yusuf Pandir$^2$

Abstract. Many researches have been done to create the solutions of fractional differential equations [1-4]. Firstly, Zhang and Xia offer generalized F-expansion method to solve partial differential equations according to the power series [5]. In this study, we apply generalized F-expansion method in order to achieve new jakobi elliptic function classes of the fractional differential equations within modified Riemann-Liouville derivative. By using this approach, we find some new results for the nonlinear differential equation. As a result, many non-travelling wave solutions are acquired such as single and combined non-degenerate Jacobi elliptic function solutions, soliton solutions and trigonometric function solutions.


References


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Views of Pre-service Elementary Mathematics Teachers Toward The Reasons for Student’s Mistakes About Fractions and Preventing These Mistakes

Yasemin Kıyıma

Abstract. To evaluate the students’ works, to analyze the students’ mistakes and with taking into account these situations to provide learning environments for students that facilitate their understanding are some of the important tasks that pre-service teachers will confront in the future. In this study, pre-service elementary mathematics teachers are asked the reasons for student’s mistakes about fractions and how they prevent these mistakes. Data were collected through a survey that contained open ended questions. 71 pre-service teachers who attended a state university participated in this study. The collected data will be analyzed through content analysis.

Keywords. Misconception, Fractions, Teacher Education

AMS 2010. 97B50, 97C70, 97D70.

Acknowledgement: This work is supported by Ahi Evran University PYO with project number PYO-EGT.4001.15.005.

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Interface Design for Comparative Solution of Mathematical Equations by Classical Interpolation Methods and Artificial Nerve Network Approaches

Zeynep Batık¹ and Erdal Büyükbıçakcı²

Abstract. As a result of the experiments, measurements, observations and calculations realized in applied sciences, many data is obtained. Methods such as interpolation, smallest squares, halving, tangent-beam, Newton Raphson and Regula–False. In recent years' developments, artificial nerve networks, blur logic, intuitionial and generic algorithms are used in sciences designing new systems by replicating the human brain functions. Classical Interpolation Methods (CIM) and Artificial Nerve Networks (ANN) are used in many fields such as math, physics, electric, computer engineering and many applications such as optimization, control, sample completion-matching, voice and vision detection, calculation and classification.

In this study solution of mathematical equations were given comparatively by using interpolation methods and artificial nerve network approaches. In simulations realized in MATLAB GUI ambiance designed by graphical user interface program, results of equation systems are shown as numerical and graphical interface. At the same time the program ensures us to select the mathematical function on interface with the help of interpolation method parameters and artificial nerve network parameters.

Keywords. Classical Interpolation, Nerve Network, Matlab Interface Design

AMS 2010. 65D05, 65D17, 68R10

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Interface Design for Genetic Algorithm Based Solution of Polynomial Equations
Zeynep Batık¹ and Erdal Büyükbıçakcı²

Abstract. Various analytical methods have been and are being developed for solution of mathematical equation systems (linear and nonlinear equations). Instead of using classical methods in solution of mathematical equation systems using computer supported numerical analysis methods that realizes multiple iterations more rapidly ease the solution. In recent years computer supported Genetic Algorithms (GA) are prevalently used in solution of all kinds of optimization problems. Generic algorithms are especially used in calculating roots of high degree polynomials easily. In order to ensure the solution of equations mathematical operations such as start up conditions, root interval and iterations are necessary.

In this study genetic algorithms which are used in optimization field in recent years are adopted to polynomial equation solutions and accordingly graphical interface program was designed and results were compared with other numerical methods. But using the graphical user interface program designed in MATLAB GUI ambiance, roots of determined polynomial equations are calculated by using generic algorithm and other numerical methods. This program which can also be used for education purpose, polynomial coefficients and sensitivity values are inputted and the roots can be calculated by generic algorithms and classical equation solution methods on intervals determined by the user.

Keywords. Genetic Algorithm, Polynomial Root Calculation, Matlab Interface

AMS 2010. 65H04, 68U07, 68R10

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Abstract: Let $A_n$ and $M_n$ be a free abelian Lie algebra and a free metabelian Lie algebra of finite rank $n$ respectively.

We describe fixed point subalgebras of an automorphism of permuting cyclically free generators of $A_n$ and free generators of $M_n$.

We prove that if $\theta$ is an automorphisms of order $n$ which permutes free generators of $M_n$ then the form of the fixed point subalgebra of $M_n$ is \{\[v + \theta(v) + \cdots + \theta^{n-1}(v): v \in M_n\}\}. The motivation of this work is based on the results of C. Baginski and W. Tomaszewski.

Keywords. Free Solvable Lie Algebra, Automorphism, Fixed Point

AMS 2010. 17B01, 17B40

References:


Mechanics Equations of Frenet-Serret Frame on Minkowski Space
Zeki Kasap¹ and Emin Özyılmaz²

Abstract. It is well known that Minkowski space is the mathematical space setting and Einstein’s theory of special relativity is most appropriate formulated. Dynamical systems theory is an area of mathematics used to describe the behavior of complex dynamical systems in which usually by employing differential equations or difference equations. The Frenet-Serret formulas describe the kinematic properties of a particle which moves along a continuous, differentiable curve in Euclidean space three-dimensional real space or the geometric properties of the curve itself in any case of any motion. The Frenet-Serret trihedron plays a key role in the differential geometry of curves such that its shows ultimately leading to a more or less complete classification of smooth curves in Euclidean space up to congruence. In this paper, we established mechanics Equations of Frenet-Serret frame on Minkowski space and we considered a relativistic for an electromagnetic field that it is moving under the influence of its own Frenet-Serret curvatures. Also, we obtained the mechanical equations of motion for several curvatures dependent actions of interest in physics.

Keywords. Frenet-Serret Curvature, Mechanical System, Minkowski Space, Lagrangian Equation.

AMS 2010. 51B20, 70S05, 70Q05.

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Test Elements of Free Metabelian Leibniz Algebras

Zeynep Özkurt

Abstract. Let F(M) be a free metabelian Leibniz algebra in two variables over a field K of characteristic zero. In this paper it is determined some test elements of F(M).

Keywords. Free Metabelian Leibniz Algebra, Test Element, Automorphism.

AMS 2010. 17A32, 17A50.

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