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Van Yüzüncü Yıl University

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BOOK OF ABSTRACTS

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Zeynep Kayar (Van Yüzüncü Yıl University)
Ali Hakan Tor (Abdullah Gül University)

Abstracts of Invited Talks

Extended affine Lie algebras

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The theory of affine Lie algebras and its related objects has played a central role within and outside mathematics in the past fifty years, this has been mostly because of its applications to Mathematical Physics. In 1985, motivated by applications in singularity theory the notion of extended affine root systems, as a natural generalization of finite and affine root systems, was created. Since then this notion and its corresponding Lie algebraic structures, called extended affine Lie algebras, have been under intensive investigation. We give a brief survey of the developments in the subject.

Conditional measures of determinantal point processes: the Gibbs property and the Lyons-Peres conjecture

ALEXANDER I. BUFETOV

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Determinantal point processes arise in many different problems: spanning trees and Gaussian zeros, random matrices and representations of infinite-dimensional groups. How does the determinantal property behave under conditioning? The talk will first address this question for specific examples such as the sine-process, where one can explicitly write the analogue of the Gibbs condition in our situation. We will then consider the general case, where, in joint work with Yanqi Qiu and Alexander Shamov, proof is given of the Lyons-Peres conjecture on completeness of random kernels.

The talk is based on the preprint arXiv:1605.01400 as well as on the preprint arXiv:1612.06751 joint with Yanqi Qiu and Alexander Shamov.

Schrödinger operators changing abruptly their spectral character

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The aim of this talk is to discuss several classes of Schrödinger operators with potentials that are below unbounded but their negative part is localized in narrow channels. A prototype of such a behavior can be found in Smilansky-Solomyak model devised to illustrate that an irreversible behavior is possible even if the heat bath to which the systems is coupled has a finite number of degrees of freedom. We review its properties and

analyze a regular version of this model, as well as another system in which $x^p y^p$ potential is amended by a negative radially symmetric term. All of them have the common property that they exhibit an abrupt parameter-dependent spectral transition: if the coupling constant exceeds a critical value the spectrum changes from a below bounded, partly or fully discrete, to the continuous one covering the whole real axis. We also discuss resonance effects in such models. The results come from a common work with Diana Barseghyan, Vladimir Lotoreichik and Miloš Tater.

About some problems in spectral theory of differential operators

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First, we investigate the dependence of spectral data of Sturm-Liouville operator on parameters defining the boundary conditions. With this aim we introduce the concept of "Eigenvalues function of family of Sturm-Liouville operators" (EVF) and investigate its properties.

Secondly we solve the inverse Sturm-Liouville problem by EVF.

We also provide an analogue of uniqueness theorem (in inverse problem) of Marchenko and one generalization of theorem of Ambarzumian.

New uniqueness theorems we also prove in inverse problems for canonical Dirac systems.

We give the description of isospectral Dirac operators.

We have proved, that in general case the analogue of Ambarzumian theorem for Dirac operator is not true, but in the same time, we describe particular cases, where we can formulate the analogues of Ambarzumian theorem.

We also give some new results in constructive solution of inverse problem for Dirac system.

Acknowledgement: This work was supported by State Committee of Science MES RA in frame of the research project No.15T-1A392.

Negative eigenvalues of two-dimensional Schrödinger operators

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According to the celebrated Cwikel-Lieb-Rozenblum inequality, the number $N_-(V)$ of negative eigenvalues of the Schrödinger operator $-\Delta - V$, $V \geq 0$ on $L_2(\mathbb{R}^d)$, $d \geq 3$ is estimated above by

$$\text{const} \int_{\mathbb{R}^d} V(x)^{d/2} dx.$$

It is well known that this estimate does not hold for $d = 2$. The talk will present estimates for the number of negative eigenvalues of a two-dimensional Schrödinger operator in terms of weighted L_1 norms and $L \log L$ type Orlicz norms of the potential.

MSC 2000: 35J10 (35P15, 35P20)

Keywords: Schrödinger operator, two-dimensional, negative eigenvalues, Orlicz

On some theorems of Reiter/Varopoulos/Saeki/Helson, and sets of synthesis

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Consider the group algebra $(L^1(\mathbb{R}^n), +, *)$ of the group $(\mathbb{R}^n, +)$. For a closed subset E of \mathbb{R}^n , let $J(E)$ be the closure in $L^1(\mathbb{R}^n)$ of the ideal $\{f \in L_1(\mathbb{R}^n) : \text{Supp}(\hat{f}) \cap E = \emptyset\}$ and $k(E) = \{f \in L^1(\mathbb{R}^n) : \hat{f} = 0 \text{ on } E\}$, where \hat{f} is the Fourier transform of f . These are the smallest and the largest closed ideals of $L_1(\mathbb{R}^n)$ with hull E . If $J(E) = k(E)$, the set E is said to be a set of synthesis. In this talk I will present a series of new/recent results about the following old but good theorems. Below $S = \{x \in \mathbb{R}^n : \|x\| = 1\}$ is the unit sphere of \mathbb{R}^n .

Theorem-1(Reiter, Math. Ann. (135), 1958). Let $n \geq 3$ and E be a closed subset of \mathbb{R}^n . Then the set $F = E \cup S$ is a set of synthesis iff $S \subseteq E$ and E is a set of synthesis.

The fact that S is not a set of synthesis does not explain the reason why this theorem holds. Whence the question:

Question-1. What makes that Reiter's theorem holds?

Theorem-2. (Varopoulos, Proc. Phil. Soc. Camb. (62), 1966). For $n = 3$, the equality $J(S)^\perp \cap C_0(\mathbb{R}^n) = k(S)^\perp \cap C_0(\mathbb{R}^n)$ holds.

It is rare that for a closed set F that fails to be a set of synthesis the equality $J(F)^\perp \cap C_0(\mathbb{R}^n) = k(F)^\perp \cap C_0(\mathbb{R}^n)$ holds. Whence the question:

Question-2. What makes that this equality holds?

A closed $H \subseteq \mathbb{R}^n$ is said to be an Helson set if the restriction homomorphism $\phi : L_1(\mathbb{R}^n) \rightarrow C_0(H)$, $\phi(f) = \hat{f}|_H$, is surjective.

Theorem-3. (Saeki, J. Math. Soc. Jap. (21), 1969). If H is an Helson set of synthesis then, for any set of synthesis E , the union $H \cup E$ is a set of synthesis.

Given that whether the union of two sets of synthesis is a set of synthesis or not is not known, it is natural to wonder:

Question-3. What makes that Saeki's theorem holds?

In this talk I shall try to answer these and some other related questions.

A couple of the results are extracted from joint works with E. Kaniuth (Germany) and with A. To-Ming Lau (Canada).

MSC 2000: 43A30, 43A45, 43A46

Keywords: Group algebra, set of synthesis, Ditkin set

Abstracts of Invited Talks by Young Mathematicians (under 40)

Recent developments on deterministic and probabilistic well-posedness for nonlinear Schrödinger and wave equations

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Dispersive equations such as nonlinear Schrödinger and wave equations arise as mathematical models in a variety of physical settings and serve as model equations for studying fundamental issues in many aspects of nonlinear PDE. Key questions of interest include issues of well-posedness (existence, uniqueness, and continuous dependence on initial data) both locally and globally in time. In this talk, we will give an overview of several recent results concerning the local and global (long-time) theory, including some results where probabilistic tools are used to obtain estimates for randomly chosen initial data which are not available in deterministic settings. A recurring theme is the notion of supercriticality with respect to the natural scaling of the equations - this poses a difficulty when seeking to characterize long-time behavior for initial data of very low regularity, or when the relevant scale-invariant norms are not controlled by any known conserved quantities. The techniques involved include a balance of ideas from PDE, harmonic analysis, and probability.

MSC 2000: 35Q55, 35L71, 35B44, 35P25, 37K05, 60G15

Keywords: Nonlinear dispersive PDE, global well-posedness, nonlinear Schrödinger equation, nonlinear wave equation, randomized initial data, Gibbs measure

An extension of the mixed Novikov-Kazamaki condition

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Given a continuous local martingale M , the associated stochastic exponential $\mathcal{E}(M) = \exp\{M - \frac{1}{2}\langle M \rangle\}$ is a local martingale, but not necessarily a true martingale. To know whether $\mathcal{E}(M)$ is a true martingale is important for many applications, e.g., if Girsanov's theorem is applied to perform a change of measure. We give several generalizations of Kazamaki's results and finally construct a counterexample which does not satisfy the mixed Novikov-Kazamaki condition, but satisfies our conditions.

MSC 2000: 60G44

Keywords: Stochastic exponential, Girsanov's transformation, Lower function

References

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Asymptotic analysis of fundamental solutions of hypoelliptic equations

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Radiation conditions were first derived by A. Sommerfeld for Helmholtz operator [1] and subsequently were generalized in the following papers [2], [3]. Here are obtained Sommerfeld type conditions at infinity for polymetaharmonic equations, which ensure uniqueness of solutions in \mathbb{R}^n . In the paper [2] is studied uniqueness of solution of the polymetaharmonic equation, where characteristic polynomial has multiple zeros. In the monograph [4] were obtained radiation conditions for hypoelliptic differential equations, where characteristic polynomials have real simple zeros.

We generalize the results obtained in [4] and consider the case when the corresponding characteristic polynomials of the hypoelliptic differential equations have real multiple zeros. We investigate asymptotic properties at infinity of fundamental solutions of the hypoelliptic differential equations. On the basis of asymptotic analysis of fundamental solution we find conditions at infinity, which ensure that these equations are uniquely solvable.

MSC 2000: 35E05, 35H10, 35C20, 35B40, 35G05, 35A02

Keywords: Asymptotic expansion, fundamental solution, hypoelliptic equations, radiation conditions, uniqueness theorem

References

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Constructing and obstructing Stein cobordisms between singularity links

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It is well known that any pair of closed and oriented 3-manifolds cobound a 4-manifold. In this talk, we'll explore a refined problem of whether a pair of contact 3-manifolds cobound a compatible Stein 4-manifold. To get some partial answers, we utilize powerful tools from symplectic geometry, Floer homology and singularity theory. This is a joint work with F. Ozturk.

MSC 2000: 57R17, 57R90

Keywords: Geometric topology, symplectic geometry, Stein manifolds

Comparison of Cayley graphs of semigroups and Cayley graphs of groups

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The Cayley graphs of groups are very well-known and useful structures in mathematics and computer science. By this motivation, the Cayley graphs of semigroups have been introduced and investigated in combinatorial semigroup theory. However there are many significant differences and at the same time similarities between these structures. The reason of these differences is mainly because of the existence of the identity element and inverse function in groups. In this talk, first we mention some results about vertex-transitivity, planarity and connectivity of Cayley graphs of semigroups (see [1]-[5]). Then we compare them with similar results about Cayley graphs of groups.

MSC 2000: 05C25, 05C20

Keywords: Cayley graphs of semigroups, Cayley graphs of groups, vertex-transitive graphs, planar graphs, connected graphs.

References

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Scattering of vortices in Abelian Higgs models on Riemann surfaces

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Abelian Higgs models on Riemann surfaces are generalizations of the well-known (2+1)-dimensional Abelian Higgs model on the plane which arises in the theory of superconductivity. For any given complex line bundle on a compact Riemann surface X with positive Chern number N all the static solutions of the model in this bundle are parametrized (up to gauge equivalence) by N -tuples of points in X (so-called positions of vortices). So the moduli space of such N -vortex solutions is an N -dimensional complex manifold.

The kinetic energy functional of the model defines the Riemannian metric on the moduli space (it is called kinetic metric). The adiabatic principle states that geodesics of kinetic metric on such moduli space are good approximations to "slow" dynamical solutions of the model. If it is true we can obtain results on forms of trajectories of moving vortices by studying the properties of geodesics in kinetic metric. In particular, the smoothness property of the metric allows us to predict the behaviour of the trajectories after the symmetric head-on collision of vortices. Unfortunately, the adiabatic principle for models on compact Riemann surfaces remains in general heuristic, although it was proved in some particular cases.

MSC 2000: 58J90, 58J45

Keywords: Abelian Higgs models, Riemann surfaces, hyperbolic systems of nonlinear PDE, adiabatic principle

Abstracts of Participants' Talks

A summary on submanifolds of conformal Kenmotsu manifolds satisfying some conditions

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In this study, conformal Kenmotsu manifolds by using an idea of conformal Kaehler manifolds are introduced. Also we give an example of a conformal Kenmotsu manifold that is not Kenmotsu. Hence category of conformal Kenmotsu manifolds and Kenmotsu manifolds is not the same. Then we present the following problem:

Can we characterize submanifolds in a conformal Kenmotsu manifold satisfying certain conditions such that Lee vector field is tangent (normal) to the submanifold?

Before considering the answer of this question, an example for existence of this type submanifolds is constructed. Then we characterize submanifolds in a conformal Kenmotsu manifold satisfying certain conditions on the shape operator, second fundamental form and Ricci tensor.

MSC 2000: 53C25, 53C40

Keywords: Kenmotsu manifold, conformal Kenmotsu manifold, Lee vector field

A summary on Willmore submanifolds in space forms

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Let $x : M \rightarrow \bar{M}$ be an immersion of n -dimensional submanifold M into $(n+p)$ -dimensional Riemannian manifold. The non-negative willmore functional is given by

$$W(x) = \int_M \rho^n dv = \int_M (S - nH^2)^{\frac{n}{2}} dv. \quad (1)$$

Where S, H are the square of the length of the second fundamental form and the mean curvature of M , respectively. Using Euler-Lagrangian equation and integral inequalities of Simons' type for compact Willmore submanifolds in $(S^{n+p}, \mathbb{C}H^{n+p}, \mathbb{R}^{n+p}, \dots)$, were presented a classification. In this study, we give a summary about classification of these compact Willmore submanifolds.

MSC 2000: 53A10, 53C42

Keywords: Willmore functional, space form manifold, Euler-Lagrangian equation

On projective curvature tensor of nearly cosymplectic manifold

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The present paper is largely devoted to study the geometric properties of projective curvature tensor for nearly cosymplectic manifold. In particular, the flatness properties of projective tensor have been studied, so related to the flatness properties we defined three special classes of almost contact manifolds. Finally, we found the necessary conditions for which the nearly cosymplectic manifold is one of these special classes.

MSC 2000: 53C55, 53B35.

Keywords: Projective curvature tensor, Nearly cosymplectic manifold, Almost contact manifold

A numerical solution of non-linear deformation problems of multilayered shells of revolution based on the refined theory

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It is considered a numerical solution of the problems based on the theory, which takes into account the non-homogeneity of shifts along the layers. A particular example of the deformation of the mentioned type will be given. The results of the numerical realization of this example will be compared with the results obtained by means of the linear theory.

MSC 2010: 74K25, 74A10

Keywords: Deformation, multilayered shells of revolution, numerical realization.

References

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Groups and chemical Cayley graphs

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Let G be a finite group, $S \subseteq G \setminus \{1\}$ and $S = S^{-1}$. The Cayley graph of G with respect to S is an undirected graph with vertex set G and edge set $\{\{g, sg\} \mid s \in S\}$. Determining whether a graph is Cayley graph is one of the most important problems. In particular, determining chemical Cayley graphs is very important. In this lecture, we introduce some important Chemical Cayley graphs. Also we discuss about the spectrum of these graphs using representation theory of finite groups.

MSC 2000: 05C50, 05C25, 05C31

Keywords: Cayley graph, Chemical graph, Representation of group.

References

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Positive solutions for a new fractional boundary value problem

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Fractional differential equations have excited in recent years a considerable interest both in mathematics and in applications. They were used in modeling of many physical and chemical processes and in engineering (see, for example, [1, 2, 3]).

It is mentioned that, one can find more than one definition of fractional derivative in the literature. They range from Riemann-Liouville to new Atangana-Baleano fractional

order derivative. The Atangana-Baleano is the new fractional derivative that was recently proposed [4]. In this paper we study the boundary value problem

$${}^{ABR}_t D_0^\alpha u(t) + a(t)f(u(t)) = 0, \quad t \in [0, 1], \quad 1 \leq \alpha < 2 \quad (1)$$

$${}^{ABR}_t D_0^{\alpha-1}(0) = u(1) = 0 \quad (2)$$

where ${}^{ABR}_t D_0^\alpha$ is the Atangana-Baleano fractional derivative in sense of Reimman-Liouville. In fact we use Krasnosel'skii's cone expansion and compression fixed point theorem will to show the existence at least one positive solution to a fractional boundary value problem (1)-(2).

MSC 2000: 34AXX, 34A08

Keywords: Boundary value problem, fractional differential equation, fixed point theorem

References

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On the stability of solutions of first order neutral differential equations by fixed point method

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Abstract. In this work, stability of solutions of first order neutral differential equations is discussed by using fixed point theory. By this work, we aim to do a contribution to literature.

MSC 2010: 34K20, 34K40, 34K13

Keywords: Fixed points, stability, neutral differential equation, first order, delay.

References

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Some new applications of reproducing kernel method

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In this work, we give some applications of the reproducing kernel method. The numerical approximations to the exact solutions are obtained. The comparison of the results with exact ones is made to prove the validity and efficiency of the method.

We obtain some useful reproducing kernel functions. We find associated linear operator. We give the main results. The exact and approximate solutions of some problems and an iterative method are enhanced in the reproducing kernel space. We have proved that the approximate solutions converge to the exact solutions uniformly. We show some numerical examples. We present some conclusions [1, 2, 3].

MSC 2000: 47B32, 26A33, 46E22 and 74S30.

Keywords: Reproducing kernel functions, series solutions, reproducing kernel space.

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Approximation to generalized Riemann derivatives by integral operator families

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Abstract

We use generalized operators examination of the problem of approach to derivatives is both theoretical and practical of great importance. Integral operator's family Asymptotic value of the x -point approach to f function mathematicians Convolute type problems such as Weierstrasse, Gauss, Perron, Landau, Picard, Lebesgue, Faddeev, Romanovsky, Natanson, Korovkin, Butzer Have been studied by mathematicians. In the mentioned studies approach to the derivation of a f function from a n th order to a point The problem of speed is investigated Our approach to Riemann derivatives generalized by integral operator families we will examine

Theorem 1. Get there are second order ordinary derivative at the $x = 0$ point of function $f(x)$, $K_\lambda(t)$ kernel positive and double function,

$$\int_{-\infty}^{\infty} K_\lambda(t) dt = 1 \quad (1)$$

to be. At the same time, while $\lambda \rightarrow \infty$, let $\Delta_\lambda = \int_0^\infty t^4 K_\lambda(t) dt \rightarrow 0$
In this case,

$$L_\lambda(f, x_0) = \int_{-\infty}^{\infty} f(x_0 + t) K_\lambda(t) dt \quad (2)$$

to be,

$$\lim_{\lambda \rightarrow \infty} \frac{L_\lambda(f, x_0) - f(x_0)}{\Delta_\lambda} = f^{[2]}(x_0) \quad (3)$$

equality is true.

Keywords: Riemann derivative, kernel function, differentiable function, operator theory

References

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Fixed point of continuous mappings defined on an arbitrary interval

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In this work, we consider an iterative method given by Karaca and Yildirim for finding a fixed point of continuous mappings on an arbitrary interval. Then, we give the necessary and sufficient conditions for the convergence of this iteration for continuous mappings on an arbitrary interval. We also compare the rate of convergence between the other iteration methods. Finally, we provide a numerical example which supports our theoretical results.

MSC 2000: 26A18, 47H10, 54C05

Keywords: continuous mapping, convergence theorem, fixed point

References

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Reduced second Zagreb index of unicyclic graphs

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Recently a novel degree based topological index, reduced second Zagreb index, defined for any connected graphs as follows;

$$RM_2 = \sum_{uv \in E(G)} (d_u - 1)(d_v - 1)$$

where d_u and d_v are the number of edges incident to the vertices u and v , respectively. We determine the minimum and maximum reduced second Zagreb index in the class of n -vertex unicyclic graphs and characterize the corresponding extremal graphs.

MSC 2000: 05C07, 05C90

Keywords: Reduced second Zagreb index, Unicyclic graphs, Zagreb indices

Connectedness of the cut-system complex of nonorientable surfaces

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Let N be a compact, connected, nonorientable surface of genus $g \geq 1$ with n boundary components. After we give some preliminaries on surfaces and some other related structures, we will outline the proof the fact that the cut-system complex of N is connected.

MSC 2000: 57N05, 57M99

Keywords: Curves on surfaces, nonorientable surfaces, cut-system complex

Investigation matrices obtaining integrals involving polynomials and Daubechies scaling functions

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In this paper, we will introduce an algorithm for obtaining integrals of the form

$$\int_0^x t^m \varphi(t) dt, \quad m \in \mathbb{N} \cup \{0\},$$

where φ is the scaling functions of Daubechies wavelet. In order to obtain these integrals in dyadic points for x 's, we have to solve a linear system. We show that these matrices which obtaining by integrals involving Daubechies scaling functions and plynomials are bounded. Also, we will investigate, sparseness, well-conditioning and strictly diagonal dominant of matrices of these systems.

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Numerical study of unsteady mixed convection of nanofluid in a lid-driven square cavity

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The behavior of unsteady mixed convection flow of Cu -water based nanofluids is investigated numerically inside a square lid-driven partially heated flow below. Dual Reciprocity Boundary Element Method (DRBEM) is used to solve stream function-vorticity form of the governing equations of the problem. The need of time integration scheme is eliminated by transforming the vorticity transport and energy equations to modified Helmholtz equations. This procedure also diminish the stability problems. The resulting modified Helmholtz equations are solved by DRBEM using the fundamental solution $\frac{1}{2\pi}K_0(x)$ whereas in the stream function Poisson's equation $\frac{1}{2\pi}\ln(x)$ is made use of. The solution procedure needs considerably small number of iterations and large time increments with suitable values of relaxation parameters which occur in the argument of Bessel function $K_0(x)$. The inhomogeneities are approximated by using coordinate functions $f = 1 + r$ and $f = r^2 \ln r$ in the stream function and vorticity-energy equations, respectively, and the missing vorticity boundary conditions are also obtained with the help of coordinate matrix F. The numerical results are given for several values of Reynolds number, Rayleigh number, heat source length and for different locations of the heat source. The steady-state results are in good agreement with the results available in the literature.

MSC 2000: 65M69, 76D05, 35Q30

Keywords: DRBEM, mixed convection flow, nanofluid, lid-driven cavity.

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Special associated curves in Galilean 4-Space G_4

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In this paper, we prove some characterizations of special associated curves such as Mannheim curves and Bertrand curves in 4-dimensional Galilean space.

MSC 2000: 53B30, 53A35.

Keywords: Galilean 4-Space, Associated curve, Mannheim curve.

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Asymptotic properties of solutions to systems of neutral type differential equations with periodic coefficients

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In this work, we find sufficient conditions for the asymptotic stability of the zero solution to a delay system of linear differential equations of neutral type with periodic coefficients and estimate the decay rate. A modified Lyapunov-Krasovskii functional is used.

MSC 2000: 34K20, 34K40

Keywords: Neutral type differential equation, asymptotic stability, Lyapunov- Krasovskii functional

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Fitted difference method for singularly perturbed Volterra delay integro-differential equation

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Exponentially fitted finite-difference method for a linear Volterra delay integro-differential with initial layer is developed. The difference scheme is constructed by the method of integral identities with the use of interpolating quadrature rules with weight and remainder terms in integral form. Uniform convergence in perturbation parameter is established. Numerical results illustrate the effectiveness of the numerical method.

MSC 2000: 65L05, 65L12, 65L20, 65R20, 34K26

Keywords: Delay-integro-differential, delay difference scheme, uniform convergence, singular perturbation

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Totally 2-closed finite groups

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Let G be a permutation group on a set Ω . Then G acts naturally on $\Omega \times \Omega$ by $(\alpha_1, \alpha_2)^g = (\alpha_1^g, \alpha_2^g)$, where $g \in G$ and $\alpha_1, \alpha_2 \in \Omega$. The 2-closure of G on Ω , denoted by $G^{(2),\Omega}$, is the largest permutation group of Ω whose orbits on $\Omega \times \Omega$ are the same orbits of G . The study of 2-closures of permutation groups has been initiated by Wielandt [8] in 1969, to present a unified treatment of finite and infinite permutation groups, based on invariant relations and invariant functions. An abstract group G is called *totally 2-closed group* if it is 2-closed in all of its permutation representations. In this lecture, we review some applications of 2-closures of permutation groups. Also we classify finite nilpotent totally 2-closed groups, a result which recently has been published by the authors [1].

MSC 2000: 20B05, 20D15, 20F18

Keywords: Permutation group, 2-closure, totally 2-closed, nilpotent group

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A robust numerical method for solving multi-point boundary value problem with boundary layer behavior

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In this paper, second-order linear singularly perturbed multi-point boundary value problem is discussed on Shishkin mesh with finite difference method. The exact solution $u(x)$ has boundary layers at $x = 0$ and $x = 1$. This problem is the following

$$-\varepsilon u''(x) + b(x)u(x) = f(x), \quad 0 < x < 1, \quad (1)$$

$$u(0) = 0 \quad (2)$$

$$u(1) = \sum_{i=1}^m c(i)u(s_i) + d \quad (3)$$

where $0 < \varepsilon \ll 1$ is a small perturbation parameter, b , d and c_i are given constants, and the functions $b(x)$ and $f(x)$ are sufficiently smooth on interval $[0, 1]$. Also, $0 < s_1 < s_2 < \dots < s_m < 1$ and $b(x) \geq b^2 > 0$. First, we give some properties of the exact solution, which are needed in later section for analysis of the numerical solution. And then, we establish uniformly convergent finite difference scheme on Shishkin mesh and we show uniform first-order error estimates in discrete maximum norm. Finally, the numerical results are present in table and graphs, and these results reveal the validity of the theoretical results of our method.

MSC 2000: 34B05, 34A08

Keywords: Singular perturbation, finite difference method, Shishkin mesh, uniformly convergence, nonlocal condition.

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Novel stability and passivity analysis for nonlinear descriptor systems

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We consider linear non-autonomous systems governed by second order ordinary differential equations that generated from a class of RLC circuit. In this paper, the connection between global asymptotic stability and strict passivity is established by Liapunov's direct method. A concrete example is given to illustrate the obtained results. The results are given with proofs.

MSC 2000: 34D23, 34D20

Keywords: Global asymptotic stability, Liapunov's direct method, nonlinear descriptor systems

On a problem of minimal non-FC-groups

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In this paper Problem 17.13 by A.O.Asar in The Kourovka Notebook is studied which is 'Let G be a totally imprimitive p -group of finitary permutations on an infinite set. Suppose that the support of any cycle in the cyclic decomposition of every element of G is a block for G . Does G necessarily contain a *minimal non-FC-subgroup*?' and an example of a group G satisfying these conditions but not having a *minimal non-FC-subgroup* is given.

AMS Subject Classification: 20B35, 20F24, 20F05

Keywords: Minimal non-FC-group, finitary symmetric group

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Transitions to instability in a logistic metapopulation model with nonlocal competition

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Presence of one or more species at some spatial locations but not others is a central matter in ecology. This phenomena is related to ecological pattern formation. One of the mechanisms causing such a phenomena can be considered as nonlocal resource competition. We find that traveling and stationary wave type patterns arise in a single-species, continuous time metapopulation model with a nonlocal competition term. We chose to model nonlocal interaction by using discrete probability kernels. This choice relies on the biological fact that consumption of resources at a spatial location for mobile individuals does not only depend on the local population density but also on its weighted average at that point. A linear stability analysis shows that solutions to this equation exhibit pattern formation if the diffusion rate of the species is sufficiently small and the discrete interaction kernel satisfies certain conditions. We also use weakly nonlinear analysis to better understand the behavior of formed patterns. We show that observed patterns arise through both supercritical and subcritical bifurcations from spatially homogeneous steady states. We observed that decreasing the diffusion rate results in larger amplitude patterns. For subcritical transitions to instability, we also show the existence of a threshold for the amplitude of the initial composition, above which, pattern formation is observed.

MSC 2000: 34E05, 34E13, 92D40

Keywords: Metapopulation, nonlocal competition, weakly nonlinear analysis

Some properties of weakly finite modules

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Assume that (R, \mathfrak{m}) is a local Noetherian ring and \mathfrak{a} is an ideal of R . In this talk we introduce a new class of R -modules denoted by weakly finite modules that is a generalization of finitely generated modules and containing the class of Big Cohen-Macaulay modules and \mathfrak{a} -cofinite modules. We improve the non-vanishing theorem due to Grothendieck for weakly finite modules. Finally we define the notion $\text{depth}_R(M)$ and we prove that if M is a weakly finite R -module and $H_{\mathfrak{m}}^i(M) \neq 0$ for some i , then $\text{depth}_R(M) \leq i \leq \dim M$.

MSC 2000: 13D45

Keywords: Local Cohomology Modules, Grothendieck's non-vanishing theorem, Big Cohen-Macaulay modules.

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Fractional second-order difference equations

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In this study, we define fractional second-order difference operators within Riemann-Liouville and Grünwald-Letnikov fractional operators. We show self-adjointness of the fractional second-order difference operator for the first time and prove some spectral properties, like orthogonality of distinct eigenfunctions, reality of eigenvalues, paralelly in integer and fractional order differential operator counterparts.

In this work, we use generally these references [1-5].

MSC 2000: 34B24, 39A70, 34A08

Keywords: Sturm-Liouville, fractional difference, self-adjointness, eigenvalue, eigenfunction

References

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Dynamics in the Bishop frame

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Dynamics is concerned with studying the motion of particles and rigid bodies. We consider the motion of a particle described by an action that is a functional of the Bishop frame curvatures associated with the embedding of its worldline in Euclidean space. We have developed a general treatment to find the velocity of a particle sliding on an arbitrary, concave-downward surface with friction, thereby providing a framework to find the point of departure.

MSC 2000: 34B05, 34A08

Keywords: Bishop curvature, motion of particle, dynamics system theory

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An effective approach to numerical soliton solutions for the Schrödinger equation via modified cubic B-spline differential quadrature method

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In this study, an effective differential quadrature method (DQM) which is based on modified cubic B-spline (MCB) has been implemented to obtain the numerical solutions for the nonlinear Schrödinger (NLS) equation. After separating the Schrödinger equation into coupled real value differential equations is discretized by using DQM and then ordinary differential equation systems are obtained. For time integration, low storage strong stability-preserving Runge-Kutta method has been used. Numerical solutions of five different test problems have been obtained. The efficiency and accuracy of the method have been measured by calculating error norms L_2 and L_∞ and two lowest invariants I_1 and I_2 . Also relative changes of invariants are given. The newly obtained numerical results have been compared with the published numerical results and a comparison has shown that the MCB-DQM is an effective numerical scheme to solve the nonlinear Schrödinger equation.

MSC 2000: 65M99, 65D07, 65L06.

Keywords: Partial differential equations, differential quadrature method, strong stability-preserving Runge-Kutta method, modified cubic B-Splines, Schrödinger equation.

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Simulations of mechanisms using GeoGebra and Matlab

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A mechanism is constructed by connecting rigid bodies together with joints that constrain their relative movement. The kinematic equations of the special designed mechanisms are investigated. In this paper, Matlab and GeoGebra are used for simulations of some special mechanisms.

MSC 2000: 53A17, 70B15

Keywords: GeoGebra, kinematics, Matlab, mechanisms

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Asymptotic behaviours of non-linear functional differential equations with variable advanced arguments

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In this paper, we give explicitly sufficient conditions guaranteeing the convergence and exponential convergence of the solutions to the following non-linear advanced functional differential equation of the first order:

$$x'(t) + a(t)x(t) + b(t)f(x(t+h(t))) + c(t)g(x(t+r(t))) = 0.$$

The obtained results make improvements and extension of the former the results in literature. We give examples to verify the obtained results and for illustrations.

MSC 2000: 34B05, 34A08

Keywords: Fixed points, advanced differential equations, asymptotic behaviours.

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Mobile augmented reality application for the basic concepts of statistics

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Effective teaching of the basic concepts in statistics is important in terms of understanding the new topics to be built on these concepts. If the teaching of these abstract concepts is not correctly associated with real life situations, misconceptions and learning difficulties arise. Teaching abstract concepts in other areas of mathematics such as statistics can be done in a highly effective way with today's technology. Augmented reality technology among these technologies is becoming increasingly popular. In this study, a mobile augmented reality application based on basic statistical topics will be designed. The waterfall model was used as the design model and the design was realized in the Unity3D program with the c # language. As a result, a mobile application has been developed. The developed application includes the examples of statistical concepts by creating 3D real-life problems / examples with the help of the camera of the mobile device. The application works interactively with the user (student) and supports the formation of the students' knowledge by calculating the statistics in a procedural way. Also, the effect of the software on students' achievement levels and attitudes can be investigated.

MSC 2010: 97U60, 97U50

Keywords: Augmented reality, statistic education, computer aided.

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Strongly \oplus –supplemented lattices

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In this work, strongly \oplus –supplemented lattices are defined and some properties of these lattices are investigated. Let L be lattice with $(D1)$ property. Then L is strongly \oplus –supplemented.

Results

Definition 1 Let L be a supplemented lattice. If every supplement element in L is a direct summand of L , then L is called a strongly \oplus –supplemented lattice.

Lemma 2 Let L be a strongly \oplus –supplemented lattice. Then for every direct summand a of L , the quotient sublattice $a/0$ is strongly \oplus –supplemented.

Corollary 3 Every strongly \oplus –supplemented lattice is completely \oplus –supplemented.

Proposition 4 Let L be a lattice with $(D1)$ property. Then L is strongly \oplus –supplemented.

MSC 2000: 06C05, 06C15

Keywords: Lattices, small Elements, supplemented lattices, Complemented Lattices.

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α_f^p -asymptotically Lacunary equivalent sequences spaces

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This paper presents introduce some new notions asymptotically α_f^p -lacunary equivalence with order α , and asymptotically α_f -lacunary statistical equivalence with order α , which is a natural combination of the definition for asymptotically equivalent, statistically limit, Lacunary sequence, modulus function and a sequence of positive real numbers $p = (p_k)$. In addition to these definitions, natural inclusion theorems were presented.

The sequence space of lacunary strongly convergent sequences N_θ was defined by Freedman et al.[1]. The notion of modulus function was introduced by Nakano [3].

Marouf presented definitions for asymptotically equivalent sequences and asymptotic regular matrices in [2]. Patterson extended these concepts by presenting an asymptotically statistical equivalent analog of these definitions and natural regularity conditions for nonnegative summability matrices in [4].

MSC 2000: 40A05, 40A35, 40A99, 40G15

Keywords: Asymptotically equivalence, statistically limit, Lacunary sequence, modulus function

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Laplace-Beltrami equation on hypersurfaces and Γ -convergence

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Let us consider heat conduction by an "isotropic" media, governed by the Laplace equation with the classical Dirichlet-Neumann mixed boundary conditions on the boundary in the layer domain $\Omega^\varepsilon := \mathcal{C} \times (-\varepsilon, \varepsilon)$ of a thickness 2ε . More precisely we impose zero Dirichlet and non-zero Neumann data on the corresponding parts of the boundary

$$\begin{aligned}\Delta_{\Omega^\varepsilon} T(x, t) &= f(x, t), & (x, t) \in \mathcal{C} \times (-\varepsilon, \varepsilon), \\ T^+(x, t) &= 0, & (x, t) \in \partial\mathcal{C} \times (-\varepsilon, \varepsilon), \\ \pm(\partial_t T)^+(x, \pm\varepsilon) &= q(x, \pm\varepsilon), & x \in \mathcal{C},\end{aligned}$$

where $\pm\partial_t = \partial_\nu$ represents the normal derivative on the surfaces $\mathcal{C} \times \{\pm\varepsilon\}$. Here $\mathcal{C} \subset \mathcal{S}$ is a smooth subsurface of a closed hypersurface \mathcal{S} with smooth nonempty boundary $\partial\mathcal{C}$.

The suggested approach is based on the fact that the Laplace operator $\Delta_{\Omega^\varepsilon} = \partial_1^2 + \partial_2^2 + \partial_3^2$ is represented as the sum of the Laplace-Beltrami operator on the mid-surface and the square of the transversal derivative:

$$\Delta_{\Omega^\varepsilon} T = \sum_{j=1}^4 \mathcal{D}_j^2 T = \Delta_{\mathcal{C}} T + \partial_t^2 T.$$

In the report we will review what happens with the above mentioned mixed boundary value problem when the thickness of the layer converges to zero in the sense of Γ -convergence. It is proved that the limit coincides with the Dirichlet BVP for the Laplace-Beltrami equation, which is described explicitly. It is shown how the Neumann boundary conditions from the initial BVP transform during the Γ -limit and wanders to the right hand side of the limit BVP. For this we apply the variational formulation and the calculus of Günther's tangential differential operators on a hypersurface and layers, which allow global representation of basic differential operators and of corresponding boundary value problems in terms of the standard Euclidean coordinates of the ambient space \mathbb{R}^n .

A similar results on Γ -limits of BVP for the Laplace equation, but for a plate, with a different approach and for different boundary conditions, was obtained in [1].

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Existence of traveling wave solutions for a Keller-Segel model with population growth

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This work studies the existence of traveling wave solutions for a Keller–Segel model with exponential population growth. We show that the existence of the traveling waves is affected by the population growth and chemical consumption rate.

MSC 2000: 35C07, 35K55, 46N60, 62P10, 92C17.

Keywords: Chemotaxis, Keller–Segel model, population growth, traveling wave solutions.

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Numerical solution of singularly perturbed nonlocal problem with delay

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The numerical solution of a singularly perturbed nonlocal problem with delay is considered. First some properties of the continuous problem are examined. The difference schemes are constructed by the method of integral identities with the use of exponential basis functions and interpolating quadrature rules with weight and remainder terms in integral form. The numerical method presented is also based on equidistant meshes

for solving this problem. It have shown that the scheme is uniformly convergent with respect to the singular perturbation parameter ' ε ' in the discrete maximum norm. The effective iterative algorithm for solving the difference problem is given. Furthermore some numerical experiments illustrate in practice the result of convergence proved theoretically.

MSC 2000: 34B10, 34K10, 65L11, 65L12, 65L20

Keywords: Singular perturbation, boundary-value problem, fitted difference method, delay differential equation, nonlocal condition

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Striction lines of non-developable ruled surfaces in Euclidean 3-space

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The ruled surfaces, one of the areas of interest of differential geometry, have been one of the surface types studied by many mathematicians from the past to the present day. It is known that if a surface is formed by the movement of a line, this surface is called the ruled surface. A ruled surface is the locus of a line depending on a parameter. We assume that this line does not have an envelope, hence the surface is non-developable [5]. In other words, it is mean that a non-developable surface free of points of vanishing Gaussian curvature in a 3-dimensional Euclidean space [1].

We denote the Euclidean 3-space by E^3 and a regular parameter surface with the parameters u and v in E^3 by $X(u, v)$. Let

$$X(u, v) = a(u) + vb(u). \quad (1)$$

be a non-developable ruled surface in E^3 with $b^2(u) = 1$ and the parameter u is the arc length parameter of $b(u)$ as a unit spherical curve in E^3 [3, 6]. If $a'(u) \cdot b'(u) = 0$, base curve $a(u)$ is striction line of ruled surface. Some special curves which are helix, slant helix, Bertrand and Mannheim curves are examined in [2, 4].

In this study, it is proved that striction line $a(u)$ is helix, slant helix, Bertrand or Mannheim curve in some special cases.

MSC 2000: 53A04, 53A05

Keywords: Non developable ruled surface, line of striction, helix curve, Bertrand curve, Mannheim curve.

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On the stratified domination number of Mycielskians of some graphs

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A graph G is 2-stratified if its vertex is partitioned into two classes in which the vertices in one color class red and the other color class blue. Let F be 2-stratified graph with one fixed blue vertex v specified. We say that F is rooted at v . The F -domination number of a graph G is the minimum number of red vertices of G in a red-blue coloring of the vertices of G such that every blue vertex v of G belongs to a copy of F (not necessarily induced in G) rooted at v . This paper investigates F -domination number of Mycielskians of some graphs.

MSC 2000: 05C69; 05C90

Keywords: stratified domination, 2-stratified graphs, F -domination number, Mycielski graphs

Some direct and inverse theorems for deferred Riesz and deferred Nörlund means

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One of the main problem in approximation theory is determination a saturation class for given method. The paper is concerned with give some direct and inverse theorems for $(D_a^b R, p)$ Deferred Riesz and $(D_a^b N_n, p)$ Deferred Nörlund means. Also we examine some of their results.

MSC 2000: 41A40, 41A25

Keywords: Fourier Series, Deferred Nörlund means, Deferred Riesz means, direct and inverse theorems.

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Form of the periodic solutions of some systems of higher order difference equations

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This study deals with the periodicity and the general form of the solutions of some systems of higher order rational difference equations

$$x_{n+1}^{(k)} = \frac{x_{n-r}^{(k+1)}}{x_{n-(2r+1)}^{(k+2)} (\pm 1 + x_{n-r}^{(k+1)})}, \quad n, r \in \mathbb{N}_0, \quad k = \overline{1, 3}.$$

$$x_{n+1}^{(k)} = \frac{x_{n-r}^{(k+2)}}{x_{n-(2r+1)}^{(k+1)} (\pm 1 + x_{n-r}^{(k+2)})}, \quad n, r \in \mathbb{N}_0, \quad k = \overline{1, 3}.$$

where the initial values are arbitrary real numbers such that the denominator is always nonzero. Moreover, some numerical examples are presented to verify our theoretical results.

MSC 2000: 39A11

Keywords: periodicity, system of rational difference equations, positive solutions.

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A summary on the collapse of the wave function in the asymptotically flat space time

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In this study, the influence of gravity in the collapse of the wave function in the asymptotically flat space time is examined. In which quantum superposition of two different mass distribution is stationary. The structure of space- time geometry around any mass distribution is based on the principles of general relativity , but because of incompatibility of general covariant principle with quantum superposition, the space- time superposition according to asymptotically flat space- time geometry is taken into account. Features of this space time and incompatibility with the principle of general covariant led to inaccurate definition of time evolution operator for space- time superposition. The Inaccurate , leading to uncertainly in the energy of superposition state in the Newtonian limit is proportional to the difference between the mass distribution. that suggests the finite lifetime for the superposed state.

MSC 2000: 51P05, 51P99

Keywords: Superposition, Newtonian limit, collapse of the wave function

Asymptotic analysis of dynamical interface crack problems for metallic and electro-magneto-elastic composite structures

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We consider 3-dimensional dynamical interface crack problems when the metallic and electro-magneto-elastic bodies are bonded along some proper parts of their boundaries where interface cracks occur. Using the Laplace transform, potential theory and theory of pseudodifferential equations on a manifold with boundary, we investigate the solvability and asymptotic properties of solutions to the crack problems under consideration. We prove the existence and uniqueness theorems and analyse the regularity and asymptotic properties of the mechanical and electro-magnetic fields near the crack edges and near the curves where the different boundary conditions collide. In particular, we characterize the stress singularity exponents and show that they can be explicitly calculated with the help of the principal homogeneous symbol matrices of the corresponding pseudodifferential operators. For some important classes of anisotropic media we derive explicit expressions for the corresponding stress singularity exponents and show that they essentially depend on the material parameters. The questions related to the so called oscillating singularities are treated in detail as well.

Based on joint work with T.Buchukuri and D.Natroshvili.

MSC 2000: 74H10, 74H35, 74H20, 74H25, 74H30, 35B65, 47G30, 74F15, 74G40, 74G70

Keywords: Dynamical problems, electro-magneto-elasticity, mixed and crack problems, potential method, pseudodifferential equations, asymptotic behaviour of solutions

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Functional interval integral equations of fractional order

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In this presentation, we consider the following functional interval integral equation of fractional order,

$$X(t) = \frac{1}{\Gamma(\alpha)} \int_a^t (t-s)^{\alpha-1} u(t, s, X(s)) ds. \quad (1)$$

We present a theorem giving sufficient conditions for existence of solution of the above equation in the space of interval-valued and continuous functions on the interval $[a, b]$. To prove this theorem, we use Banach fixed point theorem. Also we give some examples satisfying the conditions of our main theorem.

MSC 2000: 28B20, 45M99, 47H09, 47H10

Keywords: Interval-valued function, fractional interval integral equations, Banach fixed point theorem, existence of solutions.

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Contact surgeries

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Contact surgery techniques play a central role in studying contact topology of 3-manifolds. Neighborhood of a knot in a 3-manifold is a solid torus. Performing a topological Dehn surgery along a knot given in a 3-manifold is roughly defined as removing the neighborhood of a knot K and gluing a solid torus back using a homeomorphism. Contact surgeries are roughly defined as removing a neighborhood of a Legendrian knot and gluing a contact solid torus back for which we can extend the contact structure on its boundary to the inside.

Performing a contact $(+1)$ -surgery in a tight contact manifold does not always yield an overtwisted manifold. For example, in the tight contact 3-sphere S^3 , contact $(+1)$ -surgery along a Legendrian unknot yields the tight $S^1 \times S^2$. During this talk, I will focus on the following questions and further will discuss the exciting work that is going on in this area: When does $(+1)$ -surgery preserves tightness? Under which constraints contact $(+1)$ -surgery yields an overtwisted contact manifold? Which tight contact structures on which 3-manifolds can be obtained by a single contact (-1) -surgery along a Legendrian knot in 3-sphere with some contact structure?

MSC 2000: 57N10, 57M99

Keywords: contact structure, tight, overtwisted, Legendrian knot, contact surgery

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Translation surfaces according to q-frame in Euclidean 3-space

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In this paper we studied the translation surfaces according to q-frame in three dimensional Euclidean space. The curvatures of the translation surface are obtained in terms of q-frame curvatures. Finally some special cases are investigated for these surfaces.

MSC 2000: 57R25, 53A05, 53C42

Keywords: q-frame, curvatures, translation surfaces

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Tameness of graded generalized local cohomology modules

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Let $R = \bigoplus_{n \geq 0} R_n$ be a standard graded ring with local base ring (R_0, \mathfrak{m}_0) and irrelevant ideal R_+ . Moreover, we use I_0, J_0 that is denoted proper ideals of R_0 and we set $I = I_0 + R_+, J = J_0 + R_+$, and $\mathfrak{m} = \mathfrak{m}_0 + R_+$. In this paper, we study the following question: For graded ideals I and J when does $H_{I,J}^i(M)_n$ is finitely generated. Further, we study the Tameness of such modules.

MSC 2000:13D45, 16W50, 13E10

Keywords: Graded module, Tameness, Local cohomology module

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Rings whose modules have a flat-locally projective cover

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It is well known that a ring is perfect if and only if flat covers of any module are projective covers of the module. In this talk, we study on the rings with the property that flat covers of a given module M are (generalized) locally projective covers of M . In particular, we obtain some characterizations of (semi) perfect, A -perfect and B -perfect rings.

MSC 2000: 16D40, 16L30

Keywords: perfect ring, flat module, flat-locally projective cover

A fractional order epidemic model with vaccination

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In recent years, fractional order differential equations are being used in mathematical models, frequently. In this talk, we present a fractional order epidemic model including vaccination. We give a detailed analysis of stability of equilibrium points and obtain the basic reproduction number, R_0 , for the model. Finally, we give a numerical example.

MSC 2000: 26A33, 34D20, 92D30

Keywords: Fractional differential equations, stability, epidemic model

Total magnetic curves in 3D Riemannian manifolds

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In this study, we firstly consider a moving charged particle under the action of resultant force in a magnetic field \mathcal{B} . Then, we define trajectories of the particle associated with the given magnetic field as corresponding to total magnetic curves of magnetic vector field \mathcal{B} on 3D Riemannian manifold. Finally, we reach some geometrical and physical applications and interpretations on the particle.

MSC 2000: 78A45, 70K40, 53C15, 53C40, 53A17

Keywords: Magnetic field, resultant force, energy, magnetic force

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A new approach to the definitions and relations of the concepts of mathematics, eternity, infinity, death, time and the first point

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Mathematics is like a habitat in which all the branches of science flourish. Mathematical Science: Creates the denominator of the Science Cluster. Other branches of science form the shares of the Science Cluster. The Sum of shares and denominator: represents The Cluster of Science. Mathematical knowledge is like the heart of science. Science without mathematics can not work [1], [2] .

In This Presentation, firstly, the position and definition of mathematics in science will be done. The original definitions of eternity, infinity, death, time and first point concepts and their relations will be given. Later, these concepts will be related to the Big Bang Theory and the Big Rip Theory [2].

Before the the Planck time (10-43 seconds) from the Beginning of Big Bang Theory: the occurrence of time, space, speed and gravitational dimensions will be mathematically related [3], [4].

Information about the starting point of the universe will be given. Mathematical explanations of 4 basic forces in the universe will be done. There are 4 conventionally accepted fundamental interactions: gravitational, electromagnetic force, strong nuclear force and weak nuclear force. [3].

As a result, the concepts of Eternity, Infinity, Death, Time, and First Point in mathematics will match the equivalents in the universe.

MSC 2000: 01A50, 00A30

Keywords: Eternity, infinity, death, time, the first point

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A complete semi-local commutative Noetherian ring related to an Artinian module, and duality

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It is an elementary fact that, if N is an R -module, then N has a natural structure as a module over $R/(0 : N)$. Whenever N is Noetherian then so too is $R/(0 : N)$, as a ring. If N is a finitely generated Artinian R -module, then we have the analogous result that $R/(0 : N)$ is Artinian and so it is Noetherian as a ring.

In general, in the case that A is an (arbitrary) Artinian R -module, there is, at least one way to find a ring, R' say, such that R' is a Noetherian ring over which A has a natural module structure and a subset of A is an R -submodule if and only if it is an R' -submodule.

The ring R' is obtained by completion of R with respect to a suitable topology and then factoring out an appropriate annihilator [2].

We aim, in this work, is to present a generalization of duality (due to Matlis) which applies to a complete semi-local Noetherian ring. The classical duality was originally developed for a complete local (Noetherian) ring (see [1] or [3, Chapter 5]). While we could approach such a generalization by use of the fact that a complete semi-local Noetherian ring is isomorphic to the direct product of finitely many complete Noetherian local rings and appeal to the standard version of Matlis duality.

MSC 2010: 13E10, 13E05

Keywords: Artinian modules, finite dimensional algebras, Commutative Algebra.

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Mixed boundary value problems for the Laplace-Beltrami equation

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Let \mathcal{C} be a smooth hypersurface in \mathbb{R}^3 with a smooth boundary decomposed into two connected $\partial\mathcal{C} = \Gamma = \Gamma_D \cup \Gamma_N$ and non-intersecting $\Gamma_D \cap \Gamma_N = \emptyset$ parts. Let $\nu(\omega) = (\nu_1(\omega), \nu_2(\omega), \nu_3(\omega))$, $\omega \in \overline{\mathcal{C}}$ be the unit normal vector field on the surface \mathcal{C} . Let us consider the Laplace-Beltrami operator written in terms of the Günter's tangent derivatives $\Delta_{\mathcal{C}} := \mathcal{D}_1^2 + \mathcal{D}_2^2 + \mathcal{D}_3^2$, $\mathcal{D}_j := \partial_j - \nu_j \partial_\nu$, $j = 1, 2, 3$, $\partial_\nu = \sum_{j=1}^3 \nu_j \partial_j$. Let $\nu_\Gamma(t) = (\nu_{\Gamma,1}(t), \nu_{\Gamma,2}(t), \nu_{\Gamma,3}(t))$, $t \in \Gamma$, be the unit normal vector field on the boundary Γ , which is tangential to the surface \mathcal{C} and directed outside of the surface. We study the following mixed boundary value problem for the Laplace-Beltrami equation

$$\begin{cases} \Delta_{\mathcal{C}} u(t) = f(t), & t \in \mathcal{C}, \\ u^+(\tau) = g(\tau), & \tau \in \Gamma_D, \\ (\partial_{\nu_\Gamma} u)^+(\tau) = h(\tau), & \tau \in \Gamma_N, \end{cases} \quad \partial_{\nu_\Gamma} := \sum_{j=1}^3 \nu_{\Gamma,j} \mathcal{D}_j. \quad (1)$$

Lax-Milgram Lemma applied to the BVP (1) gives that it has a unique solution in the classical setting $f \in \tilde{\mathbb{H}}^{-1}(\mathcal{C})$, $g \in \mathbb{H}^{1/2}(\Gamma)$, $h \in \mathbb{H}^{-1/2}(\Gamma)$.

But in some problems, for example in approximation methods, it is important to know the solvability properties in the non-classical setting

$$\begin{aligned} f \in \tilde{\mathbb{H}}_p^{s-2}(\mathcal{C}), \quad g \in \mathbb{W}_p^{s-1/p}(\Gamma), \quad h \in \mathbb{W}_p^{s-1-1/p}(\Gamma), \\ 1 < p < \infty, \quad s > \frac{1}{p}. \end{aligned} \quad (2)$$

We prove the following.

THEOREM. *Let $1 < p < \infty$, $s > \frac{1}{p}$.*

The BVP (1) is not Fredholm in the non-classical setting (2) if and only if

$$\cos^2 \pi s - \left| \sin 2\pi \left(s - \frac{1}{p} \right) \right| \neq 0. \quad (3)$$

In particular, the BVP (1) has a unique solution u in the non-classical setting (2) if the pair of the space parameters (s, p) belongs to some open connected subset of \mathbb{R}^2 around the point $(s, p) = (1, 2)$.

MSC 2000: 35J57, 45E10, 47B35

Keywords: Laplace-Beltrami equation, Hypersurface, Boundary value problem mixed type, Non-classical setting, Fredholm criteria, Unique solvability

On adaptive mesh for the initial boundary value singularly perturbed delay Sobolev problems

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We consider a uniform finite difference method on a B-mesh is applied to solve the initial-boundary value problem for singularly perturbed delay Sobolev equations. For this problem, finite difference scheme on a special non-uniform mesh, whose solution converges pointwise independently of the singular perturbation parameter is constructed and analyzed. The stability and convergence analysis of the method is discussed. An error analysis shows that the method is second order convergent in the discrete maximum norm, independently of the perturbation parameter. A numerical example and the simulation results show the effectiveness of our theoretical results.

MSC 2000: 39A10, 35L35, 34D15, 34K28, 65M50, 41A25

Keywords: Difference scheme, Sobolev problem, Singular perturbation, Partial delay differential equation, B-mesh, Uniform convergence.

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Numerical solution for linear complex differential equations via Pell matrix polynomial

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In this paper, the numerical solutions of linear complex differential equations are provided by the Pell polynomials. By this results, the exact solutions and numerical one's have compared by tables and graphs that the method is practical, reliable and functional. The matrix operates between the Pell polynomials and their derivatives, we utilized the Pell method to solve linear complex differential equation..

Keywords: Pell polynomials, linear complex differatial equations, numerical solution

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On the stratified domination number of generalized Petersen graphs $P(n, 1)$ and $P(n, 2)$

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A graph G is 2-stratified if its vertex is partitioned into two classes in which the vertices in one color class red and the other color class blue. Let F be 2-stratified graph with one fixed blue vertex v specified. We say that F is rooted at v . The F -domination number of a graph G is the minimum number of red vertices of G in a red-blue coloring of the vertices of G such that every blue vertex v of G belongs to a copy of F (not

necessarily induced in G) rooted at v . In this paper we study the F -domination number of generalized Petersen graphs $P(n, 1)$ and $P(n, 2)$ when F is a 2-stratified path P_3 on three vertices rooted at a blue vertex which is a leaf and is adjacent to a blue vertex and with the remaining vertex colored red. We prove that for $n \geq 5$,

$$\gamma_F(P(n, 1)) = 2 \left\lceil \frac{n}{5} \right\rceil$$

and

$$\gamma_F(P(n, 2)) = \begin{cases} 2 \left\lceil \frac{n-1}{6} \right\rceil + 1, & \text{if } n \text{ is odd} \\ 4 \left\lceil \frac{n}{12} \right\rceil, & \text{if } n \equiv 0 \pmod{4}, \\ 4 \left\lceil \frac{n+2}{12} \right\rceil + 2, & \text{if } n \equiv 2 \pmod{4}. \end{cases}$$

MSC 2000: 05C69; 05C90

Keywords: stratified domination, 2-stratified graphs, F -domination number, generalized Petersen graphs

On $g\delta pr$ -open sets

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In 2006, Ekici and Noiri introduced the concept of $g\delta pr$ -open sets [On a generalization of normal, almost normal and mildly normal spaces II, *Filomat*, 20 (2) (2006), 67-80]. In that paper, the concept of $g\delta pr$ -open sets were used for the characterizations of some kinds of normal spaces. In this paper, new applications of $g\delta pr$ -open sets are studied.

MSC 2000: 54A05

Keywords: $g\delta pr$ -open set, $g\delta pr$ -closed set, normal space

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On the continuity with some conditions

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The notion of almost clopen functions was introduced and studied in 2005 [Generalization of perfectly continuous, regular set-connected and clopen functions, *Acta Mathematica Hungarica*, 107 (3) (2005), 193-206]. Properties of almost clopen functions with some spaces were investigated. The aim of this paper is to study the continuity with some conditions in topological spaces.

MSC 2000: 54C05

Keywords: continuity, topological space, condition

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On existence of periodic solutions of nonlinear differential equations of third order with multiple delays

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The aim of this study is to establish new sufficient conditions which guarantee the existence of periodic solutions of a nonlinear differential equation of the third order with multiple delays. We prove a theorem by using the Lyapunov functional approach, and give an example to verify the applicability of the results obtained.

Keywords: Lyapunov functional approach, nonlinear differential equation, periodic solution, third order.

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Time-spherical particles of biharmonic particles and its transformations in Heisenberg spacetime

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In this paper, we introduce a new spacetime using Heisenberg group and call this space as “Heisenberg spacetime”. We give a geometrical description of time-Spherical particle of timelike biharmonic particle in \mathcal{H}_1^4 . Moreover, we obtain Lorentz transformations of time-Spherical particles.

MSC 2000: 53C41, 53A10

Keywords: Energy, Bienergy, Heisenberg group, Faraday tensor, Lorentz transformations, Time spherical particle

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On a family of singular integrals involving infinite sum

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In this study, we prove the pointwise convergence of the family of singular integrals closely related to the singular integrals studied in [1] at some characteristic points of the integrable functions. In contrast to indicated study, we use infinite sum within the integral setting.

MSC 2000: 41A35, 41A25

Keywords: Characteristic points of integrable functions, pointwise convergence, family of singular integrals

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On one inequality for characteristic functions

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This paper deals with an inequality for characteristic functions. This inequality finds connection between "measure of almost normality" and characteristic functions. Also an analysis of accuracy in the local limit theorem and connection between the central limit and local limit theorem are given.

MSC 2000: 60E10, 60E15

Keywords: Characteristic functions, limit theorems, central limit theorem, local limit theorem

The integrality properties of the sunflower hypergraphs

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It is known that we can study the properties of hypergraphs by its representation, particularly by its adjacency, Laplacian and Seidel matrix. Thus we will find the spectrum of hypergraphs. A hypergraph is said integral if all eigenvalue of its representation matrix are integers. In this talk, we will study an integrality of sunflower hypergraphs.

Keywords: Eigen value, hypergraph, spectrum, sunflower

Development of an iterative procedure to investigate the mathematical model of drug release in spherical polymers

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A nonlinear moving boundary problem results from the mathematical modelling of solvent penetration and drug release from a spherically shaped polymeric drug delivery device is considered in this study. This problem describes the interface changes between the glassy and rubbery states of the polymer. The main equation of the problem may derived as follows

$$\frac{\partial u}{\partial t} = \frac{\partial}{\partial x} \left(D(u) \frac{\partial u}{\partial x} \right), \quad s(t) < x < 1. \quad (1)$$

According to the physical situations, this equation can be supported with some linear and nonlinear initial and boundary conditions. An iterative time variable finite difference method is established to solve the proposed problem.

MSC 2000: 35R37, 65M06, 65M99.

Keywords: Iterative method, spherical polymers, drug delivery, time variable, finite differences

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Asymptotically weighted f -statistical equivalence of sequences

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The aim of this work is to obtain a generalization of weighted statistical convergence of asymptotically equivalent sequences by using modulus function f and to obtain some inclusion results related to this concept.

MSC 2000: 40A35, 40C05, 46A45, 40615

Keywords: Weighted statistical convergence, sequence space, modulus function, asymptotically equivalent sequences

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Automatic continuity of derivations on Lau product of Banach algebras

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Let \mathcal{A} be a Banach algebra (over the complex field \mathbb{C}), and \mathcal{U} be a Banach \mathcal{A} -bimodule. A linear map $\delta : \mathcal{A} \rightarrow \mathcal{U}$ is called a *derivation* if $\delta(ab) = a\delta(b) + \delta(a)b$ holds for all $a, b \in \mathcal{A}$. The problem of continuity of derivations is related to the subject of automatic continuity which is an important subject in mathematical analysis. Many studies have been performed in this regard and it has a long history. We may refer to [1] for more information which is a detailed source in this subject.

Let \mathcal{A} and \mathcal{U} be Banach algebras and $\theta \in \Delta(\mathcal{A})$ where $\Delta(\mathcal{A})$ is the set of all non-zero characters of \mathcal{A} . If we equip the set $\mathcal{A} \times \mathcal{U}$ with the usual \mathbb{C} -module structure, then the multiplication

$$(a, x)(b, y) = (ab, \theta(a)y + \theta(b)x + xy).$$

turns $\mathcal{A} \times \mathcal{U}$ into an associative algebra. The *Lau product* of Banach algebras \mathcal{A} and \mathcal{U} , denoted by $\mathcal{A} \times_{\theta} \mathcal{U}$, is defined as the space $\mathcal{A} \times \mathcal{U}$ with the above algebra multiplication and with the l^1 -norm. The Lau product $\mathcal{A} \times_{\theta} \mathcal{U}$ is a Banach algebra. This product is firstly introduced by Lau [2] for a special class of Banach algebras which are pre-dual of von Neumann algebras where the dual unit element is a multiplicative linear functional. Afterwards, various studies have been performed to it. For instance, Monfared in [3] has verified the structure of this special product.

In this article we consider the Lau product of Banach algebras as mentioned above and study the automatic continuity of derivations on this special product of Banach algebras. Indeed, we obtain some sufficient or necessary conditions for continuity of derivations on $\mathcal{A} \times_{\theta} \mathcal{U}$ in term of continuity of derivations on \mathcal{A} or \mathcal{U} .

MSC 2010: 46H40; 46H25.

Keywords: Automatic continuity, Derivation, Lau product, Banach algebra.

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A note on the dual of the split-off matroids

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The matroid notation and terminology used here will follow Oxley [2]. Split-off operation was introduced by Lovasz [1], and Shikare, Azadi and Wapare [3] extended the notation of this operation from graphs to binary matroids. They characterized the bases of the matroid M_{xy} (split-off matroid) in terms of the bases of M . The dual of a split-off matroid is not always equal to the split-off of dual of the original matroid. In this paper, we first characterize the cobases of the split-off matroid M_{xy} in terms of the cobases of the original matroid M . Then we characterize those binary matroid M for which the two matroids will be same for a given pair of its elements. Indeed, for a binary matroid M on set E with $x, y \in E$, $(M_{xy})^* = M_{xy}^*$ if and only if $M = N \oplus N'$ where N is an arbitrarily binary matroid and N' is $U_{0,2}$ or $U_{2,2}$

MSC 2000: 05B35

Keywords: Binary matroid, uniform matroid, direct sum, splitting off

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A note on the stability and boundedness of Lienard equation

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In this paper, we consider a functional Lienard equation. We discuss stability of the zero solution and the boundedness of solutions. The result obtained generalize that found in the literature and have contribution to the literature. The method of the proofs based on the Lyapunovs functional approach.

MSC 2000: 37B25

Keywords: Lyapunov functions, stability, boundedness

A study on the relationship between primary school social studies curriculum with math curriculum

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Social Studies is one of the lesson that is undergoing a comprehensive change after 2004 program change in our country. The social studies course which starts from the 4th year and continues until the 7th year is composed of many disciplines of social sciences. The program has been tried to be associated with human sciences such as mathematics under the heading "associating with in-class and other courses". In this study, it is aimed to reveal which learning areas, units and achievements in primary school social studies course are related to which learning areas, units and achievements in primary school mathematics course and related. In the research, it was benefited from document analysis method which is one of the qualitative data collection methods. The data obtained from the study were analyzed according to the stages of the document analysis method. The result of the research evaluated generally, It seen that the People, Places and Environments learning area and The "Place We Live" unit in the social studies curriculum has been associated with the Data learning field and The Column Graph sub-learning field in the math course curriculum; " the unit name of the "From production to consumption" in the the social studies curriculum has been associated with The Numbers learning area and the Subtraction and Addition With the Natural Numbers sub-learning area in the math course curriculum; the "I Have Good" and "I Know Yourself" unit in the the social studies curriculum has been associated with the Measuring learning area and Time Measuring sub-learning area in the math course curriculum; "The Place We Live" unit in the the social studies curriculum has been associated with Measuring learning area and Measuring Lengths sub-learning area area in the math course curriculum. Apart from these associations, Individual and Community learning area and I know Myself unit,

Culture and Heritage learning area and Family History Research in the the social studies curriculum can be associated with Numbers learning area and the sub-learning areas such as Pattern and Ornaments.

MSC 2010: 00A17.

Keywords: Primary School Social Studies Curriculum, Primary School Math Curriculum, Associating with In-Class and Other Courses.

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Improved criteria on exponential stability of neutral differential equations of first order

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In this work, we establish sufficient conditions guaranteeing the global exponential stability of the zero solution of a neutral differential equation. The obtained result includes and improves some results in the literature..

MSC 2000: 34K20, 93D09, 93D20

Keywords: Neutral differential equations, exponential stability, linear matrix inequality (LMI), time-varying delay.

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Some spectral properties of Bessel equation on time scales

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We consider the below Bessel eigenvalue problem on an arbitrary time scale \mathbb{T}

$$-u^{\Delta\Delta}(t) + \left\{ w_0(t) + \frac{l(l+1)}{t^2} \right\} u^\sigma(t) = \lambda u^\sigma(t), t \in [\rho(a), b] \cap \mathbb{T}, \quad (1)$$

with the boundary conditions

$$u^\Delta(\rho(a)) = 0, \quad (2)$$

$$\gamma u(b) + \delta u^\Delta(b) = 0, \quad (3)$$

where λ is a spectral parameter and l is positive number, $w_0 : [\rho(a), b] \cap \mathbb{T} \rightarrow \mathbb{R}$ is continuous potential function; $a, b \in \mathbb{T}$ with $a < b$, $u^\sigma = u(\sigma)$ and $(\gamma^2 + \delta^2) \neq 0$ and $u(t)$ is eigenfunction of the problem (1)-(3). We prove some basic theorems and get asymptotic estimate of eigenfunction by using some techniques for the Bessel eigenvalue problem (1.1)-(1.3) on \mathbb{T} .

MSC 2000: 34N05, 34L40, 34L05

Keywords: Time scales, Bessel equation, spectral theory

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On the second variation of the action in classical mechanics

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We analyze first and second variations for the action functional of a mechanical system in classical mechanics, then, we introduce a necessary condition. Under this condition the extremal found from the first variation of the action is a local minimum for the action.

MSC 2010: 49S05

Keywords: Action, classical mechanics, first variation, second variation.

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The effect of a natural numbers subjected educational software on students' attitudes and success

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In this study, an educational software was developed with Adobe Flash CS6 to correct mistakes and misconceptions of the 9th grade students regarding the natural numbers. The usefulness and scope validity of the software were investigated by a pre test - post test quasy experiment with control group method. Additionally, the differences between attitudes towards mathematics and achievements have been examined with various variables. The research was conducted in the academic year of 2015-2016, at a high school which located in the Central District of Van province, with two classes of 9th grade. A diagnostic test consisting of 19 items was used as data collection tool. In addition, a mathematical attitude scale consisting of 21 items was applied as well. All the obtained results were interpreted with the help of SPSS 16 package program. The answers given by the students to the Diagnostic Test were examined separately and the student responses were evaluated as 10 points for complete and correct answers and the percentages and frequency distributions of student responses were determined according to these categories. In addition, comparison is made according to the variables (e.g. gender, age etc.). The analysis of the variables by their attitude scale did not reveal any significant difference.

MSC 2010: 97A30, 97M10

Keywords: Teaching mathematics, misconception, common mistakes, natural numbers, eliminating misconceptions

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The second Laplace-Beltrami operator on rotational hypersurfaces in the Euclidean 4-Space

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We consider rotational hypersurface in the four dimensional Euclidean space. We calculate the mean curvature and the Gaussian curvature, and some relations of the rotational hypersurface. Moreover, we define the second Laplace-Beltrami operator and apply it to the rotational hypersurface.

MSC 2000: 53A10, 53C45

Keywords: 4-space, the second Laplace-Beltrami operator, rotational hypersurface, Gaussian curvature, mean curvature,

Multi-sublinear operators generated by multilinear fractional integral operators and commutators on the product generalized local Morrey spaces

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The aim of this paper is to get the boundedness of certain multi-sublinear operators generated by multilinear fractional integral operators on the product generalized local Morrey spaces under generic size conditions which are satisfied by most of the operators in harmonic analysis. We also prove that the commutators of multilinear operators generated by local campanato functions and multilinear fractional integral operators are also bounded on the product generalized local Morrey spaces.

MSC 2010: 42B20, 42B25, 42B35

Keywords: Multi-sublinear operator, multilinear fractional integral operator, commutator, generalized local Morrey space, local Campanato space

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On p -angular and skew p -angular distances in normed linear spaces

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First, we study geometric properties of a p -angular distance as a metric on the set of nonzero elements of a normed linear space. Secondly, we compare two different p -angular distances with each other, which generalizes the classical results in this area. Finally introducing the notion of skew p -angular distance, we give some new characterizations of inner product spaces.

MSC 2000: 46B20, 46C15

Keywords: Inner product space, p -angular distance, skew p -angular distance, metric space, inequality

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A review of provable security of encryption systems

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Cryptography splits into two branches as symmetric key and public key according to the key used in the schemes. The former is also called private key cryptography and only one key is used for both encryption and decryption; the latter, there are two keys while public key is used for encryption, the secret key is for decryption and these keys are related to each other via mathematically hard problems such that it is computationally infeasible to derive the secret key from the public key [1].

The aim of the cryptographic community is to examine the ways for building such encryption schemes which are practical, applicable and low-cost as well as secure.

In this talk, we specially focus on the security of public key encryption schemes. First, we give the meaning of provable security which is an important aspect of modern cryptography [2]. It satisfies the security of the encryption schemes in a theoretical way via a reductionist approach, i.e., assuming that there is an algorithm which breaks the system in reasonable amount of time and using this algorithm as a subroutine, having another polynomial time algorithm to solve the underlying mathematically hard problem which leads a contradiction so we say that the system is secure. Besides this reductionist approach, we give the definitions of adversarial goals and capabilities in security models. We define what security actually means to decide whether a scheme is secure. We review the definition of provable security by means of several games between the challenger and the adversary in some security models, namely the standard model. Finally, we analyse the security of some best known public key encryption schemes; RSA, Rabin and ElGamal and discuss under which circumstances they satisfy which security notions [3].

MSC 2000: 94A60, 68P25

Keywords: cryptography, public key encryption, provable security, reductionist approach, security notions

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The first fundamental theorem for the group $LS(2, D)$ in dual plane D^2

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Let $D = \{a + \epsilon a^* : a, a^* \in R, \epsilon^2 = 0\}$ be the set of dual numbers and D^2 be the dual vector space such as $\{(A, B) : A, B \in D\}$ and $LS(2, D)$ be Dual Linear Similarity Transformations' Group in D^2 . Then we investigated the first fundamental theorem of dual vectors for $LS(2, D)$ in this study. Then we compared this obtaining results with real vector space.

MSC 2000: 22D20 , 13A50, 14L24.

Keywords: Dual Invariants, Linear similarity, first fundamental theorem

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Some fixed point theorems with applications

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In a wide range of mathematical problems, the existence of a solution is equivalent to the existence of a fixed point for a suitable map. The existence of a fixed point is therefore of paramount importance in several areas of mathematics and other sciences. Fixed point results provide conditions under which maps have solutions. In particular, fixed point techniques have been applied in such diverse fields as biology, chemistry, computer science, economics, engineering, game theory and physics (for example, see [1, 2, 3, 4]). In this study, we investigate fixed point results obtained in [5], after giving a brief introduction of fixed point theory.

MSC 2000: 47H10, 54H25

Keywords: Common fixed point, point of coincidence, α -contraction, weakly compatible mapping, two point boundary value problem

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Application of an educational mobile games with mathematics teaching for prospective primary teachers

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It seems that different approaches have been started to use in the teaching of mathematics with the integration of the developing technologies in education and teaching in recent years. It is stated that Information and Communication Technologies (ICT) should be utilized in primary school mathematics curriculum. In this respect, it is demanded that game-based applications be included in the teaching of mathematics. [1] Mobile games can be used effectively in teaching mathematical concepts in this context. However, explanations about how a mobile game will be implemented in the teaching process are not included in the programs and they are left to the teachers. The purpose of this study is to teach prospective teacher a number of patterns with an educational mobile game designed in the framework of Theory of Didactical Situations (TDS). A-didactic situation, which is one of the basic components of TDS, was used to design in mobile game design created by researchers. [2] The study design was based on the qualitative study method. Study participants included 21 prospective primary school teachers (8 male and 13 female) attending a public university in Turkey. A pilot study was performed by initially applying the game designed by the researchers to two prospective primary teachers. As a result of the pilot study, it was decided to make changes in game levels, visual design and some technical issues. The actual application lasted 70 minutes. During the application of the mobile game, data were collected by recordings the activities with a video camera and digital voice recorder. Data analysis was performed according to the phases prescribed by the DDT. The analysis results showed that prospective primary school teachers can learn square numbers from mathematical concepts with an educational mobile game designed in the framework of DDT. Teaching mathematical concepts with mobile games has a different teaching experience for prospective teachers and it is thought that they will guide how to design such environments when they are teachers in the future.

MSC 2000: 97D40, 97A90

Keywords: Theory of didactical situations, A-didactical situation, mobile game, prospective teachers

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Mathematical analysis of a two-strain HIV Model with multiple latent stages

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A *two-strain* HIV transmission model incorporating antibiotic-generated HIV resistant strains and long and variable waiting periods within the latently infected class is introduced. The mathematical analysis is carried out when the waiting periods are modeled via parametrically friendly gamma distributions, a reasonable alternative to the use of exponential distributed waiting periods or to integral equations involving “arbitrary” distributions. The model supports a globally-asymptotically stable disease-free equilibrium when the reproduction number is less than one and an endemic equilibrium, shown to be locally asymptotically stable, or l.a.s., whenever the basic reproduction number is greater than one.

MSC 2000: 92D25, 92D30

Keywords: Reproduction number, Stability, Gamma distribution

Moore-Penrose inverse of a conditional type operator

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In this note we investigate some connections and parallelisms between Moore-Penrose inverse and the Aluthge transform of weighted conditional operator $M_w E^{\mathcal{A}} M_u$ on $L^2(\Sigma)$, where $E^{\mathcal{A}}$ is the conditional expectation operator with respect to a sub-sigma algebra $\mathcal{A} \subseteq \Sigma$.

MSC 2000: 47B20, 47B38.

Keywords: Moore-Penrose inverse, Aluthge transform, polar decomposition, conditional expectation.

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Solving an initial-boundary value problem including non-classical case of heat equation by countour integral method

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In this paper, we consider an initial-boundary value problem which contains one-dimensional Heat equation. For this problem, we can not use the classical methods such as Fourier and Laplace transformation and Fourier-Birkhoff methods. Because the eigenvalues of its spectral problem are not strictly and they are repeated. The presentation of solution and also satisfying the solution in given P.D.E and holding the given initial and boundary conditions are established by complex analysis theory and Countour integral method.

MSC 2000: 34B05, 34A08

Keywords: Initial-Boundary Value Problem, Spectral Problem, Countour Integral

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Investigation of a spectral problem for an initial-boundary value problem solving first order two dimensional partial differential equation with general non-local boundary conditions

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In this paper, we will consider an initial- Boundary value problem which consist of first order two dimensional partial differen- tial equation with non-Local general boundary conditions. For this problem we obtain the related spectral problem, and its adjoint problem. Then for the adjoint of spectral problem, fundamental solution is determined. After that the singuralties in its fundamental solution are identified. Finally, necessary condition (comtability condition) are obtained. By making use of these resulted conditions the related spectral problem is converted to the second kind of regularized integral equations asused in some of works of authors.

MSC 2000: 34B05, 34A08

Keywords: Spectral problem, Cauchy-Riemann generalized, Partial differential equation, Singular kernels second order, Fredholm integral equation.

Acknowledgement:

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Numerical method for smooth solution of a system of linear Volterra integral equations

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The present paper, we proposes a fast numerical method a the system of linear Volterra integral equations with regular and weakly singular kernels having smooth solutions. This method is a generalization of the finite difference method proposed in [1] and [2] for scalar linear Volterra integral equations. Error analysis of this method is presented via asymptotic expansion of the absolute error, and Some examples are considered to illustrate the accuracy of the proposed method.

MSC 2000: 65R20, 45D05

Keywords: Volterra integral equation, blocked lower triangular, finite differences method

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Semi-Markov priority closed queuing system with extra-system delays of maintenance server

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In this paper we present a closed single server semi Markov priority queuing system for two maintenance operations replacements and repairs. There is one maintenance server performing both the replacement and the repair operations in the system. We consider the HOL (head of the line) non pre emptive priority discipline, where replacement operations have higher priority than repair operations. It cant interrupt the repair operation in progress, but must wait until the repair is completed. Analytical model is constructed in the form of closed queuing system where maintenance server may be in passive and active states. The durations of both services and of staying in passive state are the random values with arbitrary distributions. Probability characteristics of queue length are received for an important particular case.

MSC 2000: 60K15, 60K20, 60K25, 90B22

Keywords: Renewal, replacement, standby system, priority

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Geometry and kinematics of 2RRS-UPS Stewart manipulator with moving base platform

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In general, parallel mechanisms have a rigid base and a moving platform connected by several identical limbs. However, parallel manipulators which have a moving base and asymmetrical limbs aren't studied widely. In this study, kinematics of 2RRS+UPS parallel manipulator with moving Robert's linkage base is studied.

MSC 2000: 70B15, 70B10, 53A17

Keywords: Parallel manipulator, reconfigurable base, asymmetrical limbs, inverse kinematics, exponential rotation matrices

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A learning algorithm of fuzzy neural networks for solving a system of fuzzy equations

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Fuzzy equations system plays a major role in various areas, therefore a new method for finding a crisp solution for this system is presented. So we have applied an architecture of fuzzy neural network in which, the corresponding connection weights are real numbers. The proposed neural net can get a fuzzy input vector and calculates its corresponding fuzzy output. Next a learning algorithm based on the gradient descent method has been defined for adjusting the connection weights. The given approach has been illustrated by several examples with computer simulations.

MSC 2000: 34B05, 34A08

Keywords: System of fuzzy equations, Fuzzy feed-forward neural networks (FFNNs) , Cost function

Lie group structure on the set of S_r^1

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A ball with one dimension is a circle. Let S be the set of circles with the same center and r-radius. In this article, we prove that the set of S has a group structure, manifold structure and Lie group structure.

MSC 2000: 22E15, 22E20

Keywords: Circle, Lie group, manifold

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Asymptotic behaviour of a nonlinear differential equation with piecewise constant argument

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In this talk, we present sufficient conditions for the oscillation about the positive equilibrium point of a nonlinear differential equation with piecewise constant argument (DEPCA). We introduce the relation between the solutions of DEPCA and corresponding difference equation. We use linearized oscillation theory for difference equations to obtain the main result. Moreover, we investigate the asymptotic behaviour of the nonoscillatory solutions.

MSC 2000: 34K11, 39A10

Keywords: Piecewise constant argument, difference equation, oscillation, nonoscillation.

On sequence spaces $\Lambda_{\hat{p}}(M)$

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Let $\Lambda = \{\lambda_k : k = 0, 1, 2, \dots\}$, be a strictly increasing sequence of positive numbers tending to infinity. Let M be an Orlicz function and $p = (p_n)$ be a bounded sequence of positive reals such that $p_n \geq 1, \forall n \in \mathbb{N}^0$. We define the following sequence space

$$\Lambda_{\hat{p}}(M) = \left\{ x = (x_k) \in \omega : \sum_n \left[M \left(\frac{\frac{1}{\lambda_n} \sum_{k=1}^n \Delta \lambda_k |x_k|}{\rho} \right) \right]^{p_n} < \infty, \rho > 0 \right\}. \quad (1)$$

In the definition (1) and in the sequel, we agree to put $\lambda_{-1} = 0$ and $\Delta \lambda_k = \lambda_k - \lambda_{k-1}, \forall k \in \mathbb{N}^0$.

MSC 2010: 40C05, 46A45, 40A05

Keywords: Sequence spaces, $\Lambda_{\hat{p}}$ - sequence spaces, Orlicz function.

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A novel method for nonlinear systems of higher-order boundary value problems

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In this study, we apply the reproducing kernel method to nonlinear systems of high order boundary value problems. We show the efficiency of the method by some specific examples. Results present that the reproducing kernel method is very impressive method to solve nonlinear systems [1, 2, 3].

MSC 2000: 47B32, 46E22, 35M32, 74S30.

Keywords: Reproducing kernel method, series solutions, nonlinear systems of high order boundary value problems

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The Laplacian Szeged energy of graphs

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In theoretical chemistry, the π -electron energy of a conjugated carbon molecule, computed using the Huckel theory, coincides with the energy. Hence results on graph energy assume special significance. The Laplacian Szeged eigenvalues of a connected graph G are the eigenvalues of its Laplacian Szeged matrix. In this study, the Laplacian Szeged energy of a graph is defined of G . We also give some bounds for the Laplacian Szeged energy of graphs.

MSC 2000: 05C50, 05A20, 05C12

Keywords: Graph Theory, Laplacian Szeged energy, Szeged energy, Szeged index

Eigenvalues of extended adjacency matrix

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The extended vertex- adjacency matrix denoted by $E^v A$, is a square symmetric $V \times V$ matrix defined as,

$$(E^v A)_{ij} = \begin{cases} \frac{1}{2} \left(\frac{d_i}{d_j} + \frac{d_j}{d_i} \right) & ; \quad \text{if } i \sim j \\ 0 & ; \quad \text{otherwise.} \end{cases} \quad (1)$$

where d_i is the degree of a vertex i .

In this study, we find the bounds of eigenvalues for extended vertex-adjacency matrix.

MSC 2000: 05C22, 05C50.

Keywords: Adjancecy matrix, eigenvalues, weighted graph.

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Stability of linear periodic impulsive fractional differential equations

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A stability criterion is obtained for linear periodic impulsive fractional differential equations via Lyapunov type inequality [1] and Floquet theory.

MSC 2000: 26A33, 34D05, 34A37

Keywords: Stability, linear, Lyapunov inequality, periodicity, impulse, fractional differential equations

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Oscillation criteria for second order damped differential equations with deviating argument

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In this talk we discuss the oscillatory behavior of solutions to a class of the second order damped differential equations with deviating argument. Some new oscillation results are obtained that improve and extend a number of related results reported in the literature. Examples are also provided to illustrate the results.

MSC 2010: 34K11, 34C10

Keywords: Oscillation, second order, damping term, deviating argument,

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On endomorphisms of a cotorsion hull

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Endomorphisms of the cotorsion hull of a separable primary group quotient-group of which with respect to a basic subgroup has finite rank are considered. The consideration of endomorphisms of this primary group leads to a conclusion that its cotorsion hull is not fully transitive. This is one more example of a not fully transitive cotorsion group.

MSC 2000: 20K10, 20K21, 20K30

Keywords: Separable primary group, cotorsion hull, full transitivity of a group

Integrated mathematical and computer models of the information warfare

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The possibility of combining of two types of mathematical models of the Information Warfare is considered. In particular, an attempt combining of mathematical models is made: advertising campaign of the academician A. A. Samarskiy, Professor A. P. Mikhaylov [1] and information flows of Professor T. Chilachava [2],[3]. The constructed new mathematical model in the form of sub models includes Samarsky-Mikhaylov's model and model Chilachava. By means of this mathematical model on the computer the computing experiment is made.

MSC 2000: 93A30, 91D10, 91D30

Keywords: mathematical model, Information warfare, computing experiment

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Non-local integrals and derivatives on Smith-Volterra-Cantor set

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The fractional derivatives and integrals have been used as a calculus on fractal curves to models physical process on them. The fractional calculus involves non-local derivatives with arbitrary order but physical problems have local properties in the nature. The non-local derivatives are the mathematical models for the process with memory. The fractional local derivatives are suggested on real-line. Recently, F^α -calculus which is inclusive the fractional local derivatives on fractal sets. More, F^α -calculus is generalized on fractal curves. The new non-local derivatives on fractal set that can be models for the process on fractal sets with memory. As a pursuit, in this paper, we define the Non-Local integrals and derivatives on Smith-Volterra-Cantor sets and present illustrative examples. The non-local derivative of the functions with fractal support is given in Refs.[1, 2, 3, 4, 5, 6, 7, 8].

MSC 2000: 28A80, 81Q35, 26A33, 34K37

Keywords: Fractal calculus, fractional calculus, local fractional derivatives, memory process, staircase functions

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Finite time synchronization of Arneodo and Coulet chaotic systems

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For synchronization of chaotic systems, there are different methods [1-5]. In this paper, we apply the finite-time control scheme for chaos synchronization of Arneodo system as well as Coulet system [1]. Also, we use the finite-time control scheme for synchronization of two different Arneodo and Coulet systems. Sufficient conditions for achieving the synchronization are derived based on Lyapunov stability theory and finite-time control scheme. In this method, we can obtain the settling-time of synchronization. Also, this method is satisfied for any initial condition. Numerical simulations are presented to illustrate the ability and effectiveness of proposed method.

MSC 2000: 34H10, 49J15.

Keywords: Chaos, finite time control, stability, Arneodo system, Coulet system.

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Infinite combinatorial properties of different classes of semigroups

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Throughout this talk, by a graph we mean a directed graph without multiple arcs, but possibly with loops. Let S be a semigroup and let C be a non-empty subset of S . The *Cayley graph* $Cay(S, C)$ of S relative to C is defined as the graph with vertex set S and arc set $E(Cay(S, C))$ consisting of those ordered pairs (s, t) such that $cs = t$, for some $c \in C$.

Let \mathcal{D} be a finite graph. A semigroup S is said to be *Cayley \mathcal{D} -saturated* with respect to a subset C of S if, for all infinite subsets V of S , there exists a subgraph of $Cay(S, C)$ isomorphic to \mathcal{D} with all vertices in V (see [1] or [4]). In this talk, first we present a short survey about Cayley \mathcal{D} -saturated properties of semigroups in different classes of semigroups (see [1]-[4]). Then we show that how we can use these results to build new classes of semigroups with Cayley \mathcal{D} -saturated property. Also we explain that how we can use this approach and operations on semigroups, to prevent repeating similar arguments in the future (see [4]).

MSC 2000: 05C25, 05C20

Keywords: Infinite combinatorial property, Cayley \mathcal{D} -saturated property of semigroups, Cayley graphs of semigroups in special classes of semigroups, Operations on semigroups

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Uniform I -lacunary statistical convergence on time scales

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In this study, we introduce (θ, m) -uniform I -lacunary statistical convergence and (θ, m) -uniform strongly I -lacunary convergence on an arbitrary time scale. Moreover, some inclusion relations about these new concepts are also presented.

MSC 2000: 40A05, 40A35

Keywords: Uniform lacunary statistical convergence, sequence spaces, time scale

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Two asymmetric generalizations of the Filbert matrix

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Two asymmetric generalizations of the Filbert matrix defined by the products of Fibonacci and Lucas numbers are considered, with additional asymmetric parameter settings. Explicit formulæ are derived for the LU-decompositions and their inverses.

MSC 2000: 05A10, 11B37

Keywords: Filbert matrix, Fibonacci and Lucas numbers, q -analogues, LU-decomposition

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Stability and boundedness of solutions of certain nonlinear third order differential equations with delay

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The aim of this paper is to study stability and boundedness certain nonlinear differential equations of the third order with delay. The authors obtain sufficient conditions using Lyapunov functional approach for such behavior.

MSC 2000: 34C11, 34C25, 34D20, 34D23

Keywords: Lyapunov functional, uniform asymptotic stability, differential equations third order with delay

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A new version of Bäcklund transformations by some solutions

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In this paper, we study Bäcklund transformations of integrable geometric curve flows. We consider the some special flows and give new characterizations. Finally, we obtain some new solutions.

MSC 2000: 53C41, 53A10

Keywords: Bäcklund transformations, curve flows , analytic method, curvatures

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Lie group analysis of generalizes the Harry Dym equation

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In this paper, the Lie symmetry analysis is performed on generalizes the Harry Dym equation. On the basis of the point symmetry, the vector fields of these equations are presented. The similarity reductions and exact solutions are obtained based on the optimal system method. Then the exact analytic solutions are considered by using the power series method.

MSC 2000: 35L05, 58Z05

Keywords: Lie symmetry, Harry Dym equation, Group analysis

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Combinatorial aspect for the special words

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The purpose of the present talk is to study and evaluate generating functions corresponding the numbers of the Lyndon words which are representatives of primitive combinatorial necklaces. By using generating functions technique, we investigate some properties of these special words. With the help of the rational functions of some special numbers, we give some formulas for these generating functions. Moreover, we provide identities and combinatorial sums including these special words and some well-known special numbers together with an algorithm computing these generating functions. Finally, by using this algorithm, we provide not only a table including numerical values, but also some plots of these generating functions for some selected intervals and prime numbers in order to simulate our results.

MSC 2000: 03D40, 05A05, 05A15, 11A25, 11B68, 11B83, 11F22, 11M99, 11S40, 65Q20, 65Q30, 68R15, 94B40

Keywords: Lyndon words, Generating functions, Special numbers and polynomials, Combinatorial sums, Algorithms

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Boundary layer analysis of parameterized boundary value problem

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In this study, the parameterized singularly perturbed second order nonlinear boundary value problem is considered (see also[2-5]). The boundary layer behavior of the solution and its first and second derivatives have been established. The obtained results are important for construction and analysis of appropriate approximate methods for such type problems[1]. Examples which are in agreement with the theoretical analysis are presented.

MSC 2000: 34K10, 34K26, 34B08

Keywords: Depending on a parameter, Asymptotic bounds, Singular perturbation, Boundary layer.

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Parallel transport frames of non-degenerated rational Bezier curves in Minkowski space

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A Bezier curve method in Euclidean space is commonly used in Computer Aided Geometric Design to design some computer graphics. Therefore, the purpose of this paper is to construct the parallel transport frames of rational Bezier curves in Minkowski space. Particularly, we study on non-degenerated rational Bezier curves. Firstly we obtain curvatures, torsions and Serret-Frenet frames of the curve, secondly we calculated the parallel transport frames of the non-degenerated rational Bezier curves. Finally, we give some examples for this concept.

MSC 2000: 65D17, 51B20, 14H50

Keywords: Minkowski space, parallel transport frame, rational Bezier curve

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On algorithm for specific problem of scheduling theory

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Many practical problems, for instance, transport or management and running of industry process, require scheduling of tasks at a time. The given system of tasks must be implemented by certain set of resources or by means /devices of services. Such tasks belong to one of the areas of discrete optimization problem (the scheduling theory). considered. As it is known, the problems of scheduling theory are of NP difficulty and only in the certain cases it has been managed to construct the algorithm of polynomial

difficulty. In terms of tasks system and the given properties of resources with certain restrictions to them we have to construct an efficient algorithm of the task implementation sequence, which gives possibility to attain efficiency by certain measure of optimum. Under measure of optimum there may be considered scheduling length in terms of time, average time of being in the tasks system or maximum cost of the system. In the paper it is considered the problem for which the set of additional resources and partially ordered set are not empty, but for implementation of each task the necessary time is constant. On the additional resources special conditions are used. Under such conditions the effective algorithm is constructed to order the sequence of tasks. The schedule length and maximal price of tasks implementation are considered as the measure of the algorithm effectiveness. The constructed algorithm takes into account the construction of tasks implementation schedule. It is possible to construct such schedule, which gives optimal solution for both criteria.

Temporal intuitionistic fuzzy topology in Chang's sense

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In recent years, temporal intuitionistic fuzzy topology in Sostak's sense (ST-TIFS) is defined in [5]. In this study, temporal and overall intuitionistic fuzzy topology in Chang's sense (CT-TIFS) is defined and investigated some properties of them. Also the relation between ST-TIFS and CT-TIFS is examined.

MSC 2000: 47S40, 03E72.

Keywords: Temporal intuitionistic fuzzy sets, Temporal intuitionistic fuzzy topology, continuity. temporal level topology.

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Construction of units in $\mathbb{Z}[C_n \times C_5]$

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Let G be a group. Characterization of units in integral group ring $\mathbb{Z}G$ is a classical open problem for various groups explicitly. In this work, we shall introduce the unit group in the integral group ring of the direct product which is defined as

$$C_n \times C_5 = \langle a, x : a^n = x^5 = 1, ax = xa \rangle$$

MSC 2000: 16S34, 16U60

Keywords: Unit group, integral group ring, group ring, direct product.

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On a partial differential equation with piecewise constant arguments

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In this talk, we consider a partial differential equation with piecewise constant arguments. We investigate formal solution of the partial differential equation and get some results for qualitative properties of the solution of this equation. Also, we give some examples to support the results.

MSC 2000: 35B05, 35B35

Keywords: Partial Differential Equation, Piecewise Constant Argument, Stability, Oscillation

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Symbolic expression for location region of an one-variable polynomials roots and estimation of the minimal distance between them

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Recently we have proposed a methods for accurate symbolic description of an one-variable polynomials roots location, if all roots are real [1], [2]. Based on some results obtained in [3], we obtain recurrence formulae for minimal (for maximal) roots of the polynomial as increasing and bounded above (decreasing and bounded bellow) sequence of rational functions of the polynomials coefficients, and for minimal distance between different roots. Estimations for convergence rate of these sequences are given. As a result, some elaboration of one theorem of V. I. Arnold is made [4]. Results obtained are generalized for any one-variable polynomial from complex ring [5] using some kinds of Tschirnhaus transformations. We symbolically describe the region of the real parts and, separately, of the imaginary parts location of polynomials roots with any accuracy and estimate a minimal distance between real (imaginary) parts of different roots. Correspondent grid was created. In each cell of our grid there is at most one root.

MSC 2010: 12Y99, 47B15

Keywords: Polynomial's roots, Normal operators, symmetric functions

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Caucasus mathematical olympiad

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On 13-18 March 2017, Maykop (Republic of Adygea, Russian Federation) hosted the Second Caucasus Mathematical Olympiad (an International Olympiad for secondary school students)[1]. The first Olympiad was held in the 2015-16 academic year at the Sirius Educational Centre (Sochi, Russia), with students participating from 15 regions of Southern Russia. It was only in 2017 that the Caucasus Mathematical Olympiad accomplished its original intention, bringing together school students and representatives of various regions of Southern Russia and becoming international. From 15 southern regions of Russia and countries of the South Caucasus: Armenia, Abkhazia, and South Ossetia, 110 students took part in the Olympiad [2].

The creators of the Olympiad set the humanistic objective of contributing to the formation of a unified cultural and educational space, which would unite regions of Southern Russia, the Caucasus and countries from the Black Sea region, and strengthening ties between school students keen on mathematics from these regions.

The Olympiad was held in two age groups: Junior League for students of Grades 8-9 and Senior League for students of Grades 10-11 (last two years of high school). The Coordination Council invited the winners of the regional and final rounds of the national Mathematical Olympiads of the participating countries to enter the competition. The Olympiad was held over two rounds in which the participants were asked to solve four problems. The Olympiad events were updated on its website [3].

MSC 2000: 97U40, 97D50

Keywords: Caucasus Mathematical Olympiad, problems, Olympiad

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On stochastic differential equation in a Banach space

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First results concerning to the infinite dimensional stochastic differential equations started to appear in the mid 1960s. The traditional finite dimensional methods gave desired results for Hilbert space case, but these methods does not work in an arbitrary Banach space. Then, it is developed the problem in such Banach spaces, the geometry of which is close to the geometry of Hilbert space (see e.g.[1]). Important results are received in the case, when the Banach space has UMD property (see e. g. [2]). But the class of UMD Banach spaces is very narrow—they are reflexive Banach spaces.

According to our approach we introduce the generalized stochastic integral for a wide class of predictable random functions as a generalized random element (linear random function ore cylindrical random element) and if this generalized random element is decomposable by the Banach space valued random element, then we say that the stochastic integral exists. Thus, the problem of existence of the stochastic integral is reduced to the problem of decomposability of the generalized random element. Afterward, for the main stochastic differential equation in a Banach space, we introduce the corresponding stochastic differential equation for generalized random processes. It is possible to solve this equation by traditional methods and we receive the generalized stochastic process as a solution. If there exists the Banach space valued random process corresponding to this generalized random process, it will be the solution of the main stochastic differential equation. Using this approach we consider the question of existence and uniqueness of the solution [3] and receive the solutions of the linear stochastic differential equations in a general Banach space [4].

MSC 2000: : 60B11, 60H5, 60H10, 37L55.

Keywords: Ito stochastic integrals and stochastic differential equations, Wiener processes, covariance operators in Banach spaces

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Slant semi-Riemannian submersions and some of their fundamental properties

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In this paper we studied slant semi-Riemannian submersion from Lorentzian Sasakian and Para Sasakian manifolds onto semi-Riemannian manifolds and we give some fundamental properties of slant semi-Riemannian submersion.

MSC 2000: 53C43, 53C50, 53C15

Keywords: Slant semi-Riemannian submersio, Lorentzian Sasakian manifolds, Para Sasakian manifolds

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Tight contact structures on Seifert manifolds over S^2 with more than three singular fibers

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If a 3 manifold contains an incompressible torus, then it is known that the Giroux torsion is positive and the 3 manifold admits infinitely many tight contact structures [1]. In a Seifert manifold over S^2 with more than three singular fibers, there exists an incompressible torus and hence one can construct infinitely many tight contact structures with positive Giroux torsion. In this talk, we will discuss the tight contact structures on a Seifert manifold over S^2 with more than three singular fibers when the Giroux torsion is zero.

MSC 2000: 57M50, 57R17

Keywords: contact structures; Seifert manifolds; Giroux torsion

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Nonlocal boundary value problem for fractional telegraph equation by difference scheme

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The following nonlocal boundary value problem for fractional telegraph equation

$$\left\{ \begin{array}{l} \frac{\partial^2 u(t,x)}{\partial t^2} + \frac{\partial^\alpha u(t,x)}{\partial t^\alpha} - \frac{\partial^2 u(t,x)}{\partial x^2} - \frac{\partial u(t,x)}{\partial t} + u(t,x) = f(t,x), \\ 0 < x < L, \quad 0 < t < T, \\ u(0,x) = \lambda u(0,T) + \varphi(x), \quad u_t(0,x) = \mu u(T,x) + \psi(x), \quad 0 \leq t \leq T, \\ u(t, X_L) = u(t, X_R) = 0, \quad X_L < x < X_R. \end{array} \right. \quad (1)$$

is investigated. Stability estimates for the solution of the problem (1) are acquired. The first order of accuracy difference schemes for the approximate solution of the problem (1) are presented. Stability estimates for the solution of difference schemes for nonlocal boundary value problem for fractional telegraph equation are obtained. The theoretical

expressions for the solution of these difference scheme are supported by the results of numerical examples. (See references [1], [2] and [3].)

MSC 2000: 34B05, 34A08

Keywords: Fractional telegraph differential equation, nonlocal boundary value problem, stability, difference schemes.

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Stability of Drygas functional equation in restricted domains

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Let \mathbb{R} and E be the set of real numbers and a Banach space respectively, $f : [0, r) \rightarrow E$ and $g : (-r, r) \rightarrow E$. We prove the Ulam–Hyers stability theorems for the functional equations $f(x + y) + f(x - y) = 2f(x)$ and the Drygas functional equation $g(x + y) + g(x - y) = 2f(x) + g(y) + g(-y)$ in the restricted domains of form $K(r) = \{(x, y) \in \mathbb{R}^2 : 0 \leq y \leq x, x + y < r\}$ and $D(r) = \{(x, y) \in \mathbb{R}^2 : |x + y| < r, |x - y| < r\}$.

MSC 2000: 39B72, 39B82

Keywords: Cauchy functional equation, Drygas functional equation, Ulam-Hyers stability

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A remark on the qualitative criteria in retarded Volterra integro-differential equations

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In this article, the authors obtain new assumptions for the asymptotic stability and boundedness of solutions of non-linear functional Volterra integro-differential equations of first order by constructing a new Lyapunov functional. The results obtained are new and differ from those found in the literature, and they also contain and improve a result found in the literature under more less restrictive conditions. We establish an example and give a discussion to indicate the applicability of the weaker conditions obtained. We also employ MATLAB-Simulink to display the behaviors of the orbits of the (VIDEs) considered.

MSC 2000: 34B05, 34A08

Keywords: Retarded Volterra integro-differential equations, asymptotic stability, boundedness

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Zero Lie preserving maps on some spaces

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Let \mathcal{X} be an algebra over an abelian unital ring R and \mathcal{V} be an R -module. A bilinear map $\Phi : \mathcal{X} \times \mathcal{X} \rightarrow \mathcal{V}$, is said to be zero Lie product preserving if $\Phi(x, y) = 0$ whenever $[x, y] = 0$, ($x, y \in \mathcal{X}$) and if there exists a linear map $T : \mathcal{X} \rightarrow \mathcal{V}$ such that $\Phi(x, y) = T([x, y])$ for all $x, y \in \mathcal{X}$, Φ is said to be proper. An algebra \mathcal{X} is called zero Lie product determined if every zero Lie product preserving map $\Phi : \mathcal{X} \times \mathcal{X} \rightarrow \mathcal{V}$ is proper.

Let \mathcal{A} and \mathcal{B} be two unital algebras and \mathcal{M} be $(\mathcal{A}, \mathcal{B})$ -module and \mathcal{N} be $(\mathcal{B}, \mathcal{A})$ -module. Generalized matrix algebra $\mathcal{G}(\mathcal{A}, \mathcal{M}, \mathcal{N}, \mathcal{B})$ is called trivial whenever $\mathcal{M}\mathcal{N} = 0$ and $\mathcal{N}\mathcal{M} = 0$. The following theorem illustrate the relation between zero Lie product determinacy of \mathcal{A} and \mathcal{B} with $\mathcal{G}(\mathcal{A}, \mathcal{M}, \mathcal{N}, \mathcal{B})$.

Theorem 1 A trivial generalized matrix algebra $\mathcal{G}(A, M, N, B)$ is a zero Lie product determined algebra if and only if A and B are zero Lie product determined algebras.

In the papers [1, 2, 3], we can find more details about zero product preserving maps.

MSC 2000: 47B47, 15A78

Keywords: zero Lie product preserving map, zero Lie product determined algebra, generalized matrix algebra.

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Generalized derivations on semiprime and prime rings

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Let R be a ring. Let $\alpha, \beta : R \rightarrow R$ be onto homomorphisms. An additive mapping $d : R \rightarrow R$ is called an α -derivation if $d(xy) = d(x)y + \alpha(x)d(y)$ holds for all $x, y \in R$. An additive mapping $d : R \rightarrow R$ is called an (α, β) -derivation if $d(xy) = d(x)\alpha(y) + \beta(x)d(y)$ holds for all $x, y \in R$. An additive mapping $f : R \rightarrow R$ is said to be a *generalized α -derivation* associated with an α -derivation d if $f(xy) = f(x)y + \alpha(x)d(y)$ holds for all

$x, y \in R$. An additive mapping $f : R \rightarrow R$ is said to be a *generalized (α, β) -derivation* associated with an (α, β) -derivation d if

$$f(xy) = f(x)\alpha(y) + \beta(x)d(y), \quad (x, y \in R).$$

A mapping $f : R \rightarrow R$ is called skew-commuting on R if $f(x)x + xf(x) = 0$. We study some maps which are skew-commuting on rings and we establish some results concerning generalized derivations in prime and semiprime rings.

MSC 2000: 16W25, 16N60

Keywords: Prime ring, Semiprime ring, Derivation, Generalized derivation

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Amply e-supplemented modules

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In this work, all rings are associative with identity and all modules are unital left modules. Let M be an R -module. If every essential submodule of M has ample supplements in M , then M is called an amply e-supplemented module. In this work, some properties of these modules are investigated.

Results

Lemma 1 Let M be an amply e-supplemented module. Then every factor module of M is amply e-supplemented.

Corollary 2 Every homomorphic image of an amply e-supplemented module is amply e-supplemented.

Lemma 3 If M is a π -projective and e-supplemented module, then M is an amply e-supplemented module.

Corollary 4 If M is a projective and e-supplemented module, then M is an amply e-supplemented module.

Proposition 5 Let R be a ring. The following assertions are equivalent.

- (i) R is e-supplemented
- (ii) R is amply e-supplemented.
- (iii) Every finitely generated R -module is e-supplemented.
- (iv) Every finitely generated R -module is amply e-supplemented.

MSC 2000: 16D10, 16D70

Keywords: Essential submodules, small submodules, supplemented modules, amply supplemented modules

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Weakly e-supplemented lattices

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In this work, all lattices are complete modular lattices. Let L be a lattice. If every essential element of L has a weak supplement in L , then L is called a weakly e-supplemented lattice. In this work, some properties of these lattices are investigated.

Results

Proposition 1 Let L be a weakly e-supplemented lattice. Then $1/r(L)$ have no essential elements with distinct from 1.

Lemma 2 Let L be a lattice, $a_1, a_2 \in L$ and $1 = a_1 \vee a_2$. If $a_1/0$ and $a_2/0$ are weakly e-supplemented, then L is also weakly e-supplemented.

Corollary 3 Let L be a lattice, $a_1, a_2, \dots, a_n \in L$ and $1 = a_1 \vee a_2 \vee \dots \vee a_n$. If $a_i/0$ is weakly e-supplemented for every $i = 1, 2, \dots, n$, then L is also weakly e-supplemented.

MSC 2000: 06C05, 06C15

Key words: Essential Elements, small elements, radical, supplemented lattices

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δ_{ss} -supplemented modules

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In this talk, we introduce δ_{ss} -supplemented modules and provide the various properties of these modules. In particular, we prove that a ring R is δ_{ss} -supplemented as a left module if and only if it is δ -semiperfect and $\delta(R) = Soc({}_R R)$ if and only if every left R -module is δ_{ss} -supplemented.

MSC 2000: 16D10, 16D60, 16D99

Keywords: Semisimple module, δ -supplement, δ_{ss} -supplemented module

The solutions of singular Klein-Gordon equation

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In this paper we find the solutions of the equation

$$y'' + (\lambda - Q(x))^2 y - \frac{n(n+1)}{x^2} y = 0, \quad x \in R_+ \quad (1)$$

using the solutions of the Klein-Gordon equation

$$y'' + (\lambda - Q(x))^2 y = 0, \quad x \in R_+ = [0, \infty) \quad (2)$$

where Q is a real valued function, λ is a spectral parameter and n is a natural number.

MSC 2000: 35BXXB, 35DXX

Keywords: Klein-Gordon equation, spectral parameter, generalized solution

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Solutions of the radial Schrödinger equation in hypergeometric and discrete fractional forms

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Recently, it is possible to see many scientific works related to the discrete fractional calculus (*fractional sum and difference calculus*) and Schrödinger equation that is the main equation of our study [1, 2, 3].

In the x -dimensional space, radial Schrödinger equation is given by

$$g_2(u) + \frac{x-1}{u}g_1(u) + \left[\frac{2\mu}{\hbar^2} \left(E + e^2 \frac{\beta_c}{u^{c-2}} \right) - \frac{y(y-x-2)}{u^2} \right] g(u) = 0, \quad (1)$$

where constant β_c is $\beta_c = \frac{\Gamma(c/2)}{2\pi^{c/2}(c-2)\epsilon_0}$ ($c > 2$), $1 \leq x \leq 3$ and $0 \leq u \leq \infty$.

For Equ. (1), we set

$$v = 2\beta u, \quad g = u^y e^{-\beta u} F, \quad \alpha = \frac{\mu e^2 \beta_c}{\hbar^2}$$

where $\beta^2 = -2\mu E/\hbar^2$. So, Equ. (1) becomes a singular differential equation as follows:

$$vF_2 + (\lambda - v)F_1 + \left(\omega v^{3-c} - \frac{\lambda}{2} \right) F = 0, \quad (2)$$

where $\lambda = 2y + x - 1$, $\omega = \frac{\alpha}{2^{3-c}\beta^{4-c}}$ [4].

The purpose of this present paper is to obtain the hypergeometric and discrete fractional solutions of Equ. (2) by using the nabla discrete fractional calculus operator.

MSC 2000: 26A33, 39A70

Keywords: Fractional calculus, discrete fractional calculus, Leibniz rule, radial Schrödinger equation

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New generalizations of the Filbert and Lilbert matrices

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In this study, we present new generalizations of the well known Filbert and Lilbert matrices with finite product of the consecutive generalized Fibonacci and Lucas numbers. We shall derive explicit formulas for their LU-decompositions and inverses. To prove the claimed results, we first write all identities to be proven in q -form and then use the celebrated Zeilberger algorithm to prove required q -identities.

MSC 2000: 15A23, 05A30, 68-04, 11B39

Keywords: Generalized Filbert matrix, q -analogues, LU-decomposition, Zeilberger's algorithm, Computer Algebra System (CAS)

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A Tauberian theorem for the weighted mean method of improper integrals of fuzzy-number-valued functions

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Let $0 \neq p(x)$ be a nondecreasing real valued function on $[0, \infty)$ such that $p(0) = 0$ and

$$\liminf_{x \rightarrow \infty} \frac{p(\lambda x)}{p(x)} > 1 \text{ for every } \lambda > 1.$$

Given a fuzzy-number-valued continuous function $f(x)$ on $[0, \infty)$, we define

$$s(x) := \int_0^x f(t)dt \text{ and } \sigma(x) := \frac{1}{p(x)} \int_0^x s(t)dp(t), \quad x > 0.$$

It is known that the limit $\lim_{x \rightarrow \infty} s(x) = \mu$ exists, then the limit $\lim_{x \rightarrow \infty} \sigma(x) = \mu$ also exists. But the converse of this implication need not be satisfied in general.

In this paper, our goal is to find a condition under which the existence of $\lim_{x \rightarrow \infty} \sigma(x) = \mu$ follows from that of $\lim_{x \rightarrow \infty} s(x) = \mu$.

As special cases, we obtain some Tauberian conditions of slowly decreasing type and Landau type for the Cesàro summability method of improper integrals of fuzzy-number-valued functions.

MSC 2000: 03E72, 26E50, 40A10, 40E05, 40G99

Keywords: Fuzzy-number-valued functions, fuzzy Riemann-Stieltjes integral, Tauberian theorems, weighted mean method of integrals, slowly decreasing function

The discrete homotopy analysis method for solving fractional partial differential equations

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In this paper, we developed a discrete version HAM(DHAM) to find the solutions of linear and nonlinear fractional partial differential equations. The DHAM contains the auxiliary parameter \hbar , which provides a simple way to control the convergence region of solution series. The efficiency and accuracy of the proposed method is demonstrated by test problems. The obtained results are compared with the exact solutions when $\alpha = 1$. It is shown that they are in good agreement with each other.

MSC 2000: 35R11

Keywords: Discrete homotopy analysis method, Caputo fractional derivative, fractional discrete diffusion equation, fractional discrete Schrödinger equation, fractional discrete Burgers' equation

Mathematics lesson mobile learning scale

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With recent academic studies, many new forms of teaching have been put forward in order to increase the interest and attitudes towards mathematics teaching and students' mathematics instruction. One of them is mobile learning, which is expressed as "learning anytime and anywhere" via mobile devices.

With the increase of technological and economic developments in the coming years, it is envisaged that mobile technologies will be used more effectively in education, especially at high school and junior high school level. Therefore, as an active user in the mobile learning process that can be used in mathematics courses, it is aimed to determine the level of information about high school students about mobile learning, to reveal relevant information about the level of perception and attitudes related to mobile learning and to determine the level of readiness about this new learning style.

For this reason, the purpose of our research is to develop a "Mathematics Course Mobile Learning Scale" in order to measure the perception levels of high school students' use of mobile learning in mathematics lessons.

It has been applied to 450 high school students to test the validity and reliability of the scale developed. The scale consists of two parts. In the first part, there are questions about demographic information to determine the gender, class level, daily internet usage time of the students. The second part of the scale consists of materials aimed to learn the attitudes of the students towards mobile learning in mathematics lesson. As a result of the analyzes made, it was found that the scale had two factorial structure and explained 54.2% of the total variance of the scale. In addition, the internal consistency coefficient (Cronbach

alpha) of the scale was measured as 0.848 as an analysis to determine the reliability of the scale. The KMO value obtained as a result of factor analysis was measured as .876 and the Barlett Test Significance Value as .0. These findings also show that the scale is valid and reliable.

MSC 2000: 97D40, 97A99

Keywords: Mathematics teaching, mobile learning, mathematics lesson mobile learning scale

Constant ratio curves in the four dimensional Galilean space

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In this study, we define constant ratio curves in the four dimensional Galilean Space G_4 . Further, we obtain some characterizations for this curves in terms of their curvature functions.

MSC 2000: 53B30, 53A35.

Keywords: Galilean Space, constant ratio curves, Frenet frame

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Energy decay and blow up of solutions for a nonlinear hyperbolic-type equations with nonlinear damping terms

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In this talk, we consider the global existence, energy decay, and blow up of solutions for a nonlinear hyperbolic equation with nonlinear damping terms. We prove the energy decay estimates of the energy function by using Nakao's inequality. Also, we study the blow up of solutions for the equation with positive and negative initial energy. ([1], [2] and [3]).

MSC 2000: 34B44

Keywords: Hyperbolic equation, decay, blow up

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Blow up of solutions for a system of nonlinear higher-order Kirchhoff-type equations

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This work studies the initial boundary value problem for the Kirchhoff-type equations. We prove the blow up of the solution with negative initial energy by using the technique of [1] with a modification in the energy functional due to the different nature of the problems.

Also, we prove the blow up of the solution with positive initial energy by using the technique of [3] with a modification in the energy functional due to the different nature of problems. This improves earlier results in the literature [2].

MSC 2000: 34B44

Keywords: Blow up, Higher-order Kirchhoff type equations

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Iris recognition based on descriptive proximity

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Based on the concept of descriptive neighborhoods, we present the essential reasoning of the iris recognition system together with the algorithms given in mathematica scripting language.

MSC 2000: 03E75, 03E99

Keywords: Descriptive proximity, iris recognition, descriptive neighborhoods

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Solving fuzzy polynomials using neural nets with a new learning algorithm

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This paper mainly intends to offer a novel method for finding a solution of fuzzy polynomials that supposedly has a real solution. For this scope, we applied an architecture of fuzzy neural networks that corresponding connection weights were real numbers. The suggested neural net can adjust the connection weights using a learning algorithm that based on the gradient descent method. The proposed method is illustrated by several examples with computer simulations.

MSC 2000: 34B05, 34A08

Keywords: Fuzzy polynomial, Fuzzy feed-forward neural network (FFNN), Cost function, Learning algorithm

On projective Ricci Flat Kropina metrics

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In this talk, we study the concept of projective Ricci curvature, an important projective invariant in Finsler geometry, for Kropina metrics $F = \frac{\alpha^2}{\beta}$. We first give the necessary and sufficient conditions of these metrics to be projective Ricci flat. Then we prove that F is projective Ricci flat if and only if it is Ricci-flat.

MSC 2000: 53C60.

Keywords: Finsler metric, Kropina metric, Ricci curvature, projective Ricci curvature.

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On the adjoint of a linear operator on a bilinear space

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A bilinear space of truncated Laurent series has an important role as the underlying space for the study of linear systems using behavioral approach (see [1], [2]). Meanwhile the notion of bilinear spaces can be thought of as generalization of inner product spaces. On a Hilbert space, the existence of the adjoint of a linear operator is guaranteed if it is continue. [3] In this presentation we investigate a similar result for the case linear operators on a bilinear space by using properties of closed subspaces in the space.

MSC 2010: 15A63; 47A05; 47A99

Keywords: Bilinear space, Adjoint operator, Closed subspace

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Topological structures in nonlinear and fluid models

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The goal of this talk is to review the structure that introduced by the author et al in [1] and explain its applications in nonlinear systems e.g., fluid and vortex dynamics.

In the first step, the group of singular cochains restricted to a subgroup with properties similar to the differential forms, then we arrange a new cup product to hold the behaviors of the wedge product and found the related homology and cohomology groups.

We use the above structure to write algebraic cochain equations related to some nonlinear differential equation with physical interest (e.g., $a \wedge da = 0$) on manifolds and compare their solutions to investigate the structural dependency of the solutions of such equations. The isomorphism between de Rham cohomology and singular cohomology (Ref. [2]) which corresponds the kernel of the differential operator d to the kernel of the boundary operator δ and so the solutions of the equations $d\beta = 0$ and $\delta\beta = 0$ is a simple example of this method.

We use the above objects again to redefine some dynamical quantities in ideal fluids (e.g., helicity [3]-[4]) in terms of C^r -independent algebraic terms instead of the differential forms.

The rule of these quantities in bounding energy and studying finite-time singularities will be discussed.

Keywords: Nonlinear Equations, singular cochains, ideal flows

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A new numerical approach for fractional boundary value problems

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In this research, a new numerical approach is proposed for solving fractional linear and nonlinear boundary value problems. Fractional derivative are described in Caputo sense. This approach is based on reproducing kernel Hilbert space theory with shifted Legendre polynomials. Numerical results show that the present approach is efficient for solving fractional boundary value problems.

MSC 2000: 26A33 , 46E22

Keywords: Legendre reproducing kernel method, Caputo, shifted Legendre polynomials, boundary value problem.

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Solution of a optimal control problem for a second order ordinary differential equation

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In this study, a problem of optimization of the function $f(x)$ in the ordinary differential equation

$$-(p(x)y')' + q(x)y = f(x) \quad (1)$$

is investigated. We focus on obtaining a minimizer which converges to the optimal solution. The adjoint problem approach is used to obtain the Frechet derivative of the cost functional. To illustrate efficient of proposed theory, some numerical example is included. The optimal control problems for the ordinary differential equations have been studied by different authors ([1], [2], [3], [4],[5]).

MSC 2000: 93C15, 34H05

Keywords: Ordinary differential equations, Optimization

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On characterizations of the Bäcklund transformations according to Fermi derivative

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In this paper, we study Bäcklund transformations in \mathbb{E}^3 . We give a new theorem Bäcklund transformations with the aid of fermi derivative. Then, we give examples for this transformations in the Euclidean 3-space.

MSC 2000: 53B30

Keywords: Fermi derivative, Bäcklund transformations, Euclidean space

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A constructive approach to the finite wavelet frames over prime fields

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In this article we present a constructive method for computing the frame coefficients of finite wavelet frames over prime fields using tools from linear algebra, computational harmonic analysis, and abstract group theory. In addition, we shall also give a constructive characterization for frame conditions of finite wavelet systems over prime fields using matrix analysis terminology.

MSC 2000: 42C15, 42C40, 65T60, 30E05, 30E10.

Keywords: Finite wavelet frames, finite wavelet group, prime fields.

A new family of numbers and polynomials related to characters of finite abelian group

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The aim of this talk is to give brief history of special numbers and polynomials with their generating functions and also p -adic integrals and their integral equations. By using these integrals and characters of finite abelian group, some fundamental properties of a new family of numbers and polynomials and their generating functions are investigated. p -adic integral representations of these numbers and polynomials are given. By using generating functions and their functional equations, some numerical values of these numbers and polynomials are given. Finally, further remarks and observations on these numbers and polynomials are given.

MSC 2000: 11B68, 05A15, 05A19, 26C05, 40C10

Keywords: Generating function, p -adic integral, characters of finite abelian group, Special numbers and polynomials

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On a new version of the Narumi-Katayama index

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The Narumi-Katayama index is a prominent topological index in graph theory which is equal to the production of vertex degrees of a graph [1]. In the recent two new degree concepts were introduced with named *ve*-degree and *ev*-degree [2]. In this study we show an application of *ve*-degree concept to the Narumi-Katayama index.

MSC 2000: 05C30

Keywords: Narumi-Katayama index, vertex degree, *ve*-degree,

References

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A new graph energy

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Recently, a new eccentricity based topological index was defined with named third Zagreb eccentricity index [1]. In this study we define the third Zagreb eccentricity energy and calculate this energy for some graphs.

MSC 2000: 05C50

Keywords: Eccentricity, energy, graph,

References

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On some sequences of the positive linear operators based on q -calculus

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This talk is concerned with some sequences of the positive linear operators based on q -Calculus. we propose a method based on generating functions for constructing q -analogues of some discrete type positive linear operators. The rate of convergence of these sequences of q -discrete type is established, by means of the modulus of continuity. Moreover we give Voronovskaya-type theorems. Finally we present we have introduced a new type of q -Baskakov operators. Their respective formulae for central moments are thereby obtained. The approximation properties and the rate of convergence of the sequences of q -Baskakov operators which are defined have been established by means of the modulus of continuity.

MSC 2000: 05A30, 41A25, 41A36, 47B38

Keywords: q -Calculus, Positive Linear Operators, Voronovskaya-type Theorems, q -Baskakov Operators

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On the sum range problem

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Let G be a topological abelian group.

We say that a series $\sum_n g_n$ with $g_n \in G$, $n = 1, 2, \dots$:

- *converges in G* if the sequence $(\sum_{k=1}^n g_k)_{n \in \mathbb{N}}$ converges in G ,
- *unconditionally converges in G* if for every permutation $\pi : \mathbb{N} \rightarrow \mathbb{N}$ the rearranged series $\sum_n g_{\pi(n)}$ converges in G .

For a series $\sum_n g_n$ in G :

- The set $\text{SR}(\sum_n g_n)$ is defined as the set of all elements $s \in G$ for which there exist a permutation $\pi : \mathbb{N} \rightarrow \mathbb{N}$ such that the rearranged series $\sum_n g_{\pi(n)}$ converges in G and $s = \lim_n \sum_{k=1}^n g_{\pi(k)}$;
- The set $\text{SR}(\sum_n g_n)$ is called *the sum range of $\sum_n g_n$* (cf. [1, Definiion 2.1.1]);

–It is known that if $\sum_n g_n$ is an unconditionally convergent series in a Hausdorff topological abelian group, then $\text{SR}(\sum_n g_n)$ is a singleton.

A subset A of G we call a **sum range** if there exists a series $\sum_n g_n$ in G such that $\text{SR}(\sum_n g_n) = A$.

If G is a finite-dimensional real normed space with $\dim(G) > 1$, then the Steinitz's theorem implies that a set $A \subset G$ is a sum range iff $A = \emptyset$, A is a singleton or A is an affine subspace of G with $\dim(A) \geq 1$ (cf. [1, Theorem 2.1.1]). The situation is completely different if G is an infinite-dimensional real separable Banach space:

a sum range $A \subset G$ may not be convex (this negative answer on S. Banach's problem 106 from "Scottish book" dues to J. Marcinkiewicz and E. M. Nikishin [1, pp. 30–31]), a sum range $A \subset G$ may not be closed in G (M. I. Ostrovskii, see [1, Example 3.1.3]), an arbitrary finite non-empty subset A of G can be a sum range [2].

In view of these results the following question can be posed (cf. [1, p. 36]):

Question 1. *Let G be an infinite-dimensional real separable Banach space and A an arbitrary infinite subset of G . Is then A a sum range?*

We will discuss the following statement which implies in particular a negative answer to Question 1:

Theorem 2. *Let G be an infinite-dimensional real separable Banach space (or a Polish topological abelian group) and A be a subset of G , which is a sum range. Then A is an analytic subset of G .*

MSC 2010: 46B15, 40A05, 40A30, 40J05.

Keywords: Sum range, analytic set, Borel set.

Acknowledgement: This work was supported by the Shota Rustaveli National Science Foundation grant no. FR/539/5-100/13.

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Local and global existence of solutions for a stochastic wave equation with damping terms

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Wave equation arise in many physical phenomena such as propagation of water waves, the motion of a strand of DNA, propagation of light and sound [1, 2]. For more realistic models, the random fluctuations in the properties of media must be included in the model. Such consideration led to the introduction of stochastic wave equation . In this work, we consider a class of stochastic wave equations [3] with dispersive and dissipative

terms. Existence of local and global solutions are proved by a H^1 -Lipschitz Truncation technique and energy inequality.

MSC 2000: 35A01, 60H15

Keywords: Stochastic wave equation, local and global solutions, energy inequality.

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Some results of Krasnoselskii's theorem on general Banach spaces

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It is well known that the solution of sum of operators may not be solved by the combination of the classic Schauder theorem and Banach fixed point theorem for the weak topology. Especially Krasnoselskii's theorem does not has a solution on weak topology. Because of this reason, we need to the new types of Schauder theorem and Banach fixed point theorem in the weak topology of Banach spaces. This shows that a suitable type of Krasnoselskii theorem is required on general Banach spaces. That's why we aim to give a new type of Krasnoselskii's theorem for the weak topology. For this, we present the new types of Schauder and Banach fixed point theorem in the weak topology.

MSC 2000: 47H10, 47H30.

Keywords: Fixed point theorem, Krasnoselskii theorem, weakly sequentially continuous operator, weakly compact operator.

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Quantitative uncertainty principles

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Uncertainty principles investigate simultaneous concentration of functions and their Fourier transforms and characteristically they put limits on this concentration. In the last twenty years much work has been done to quantify the maximum concentration that is possible. Nazarov proved in his foundational work [2] that, for a function $g \in L^2(\mathbb{R})$, and two sets of finite measure \mathcal{R}, \mathcal{L} we have

$$\int_{\mathbb{R} \setminus \mathcal{R}} |g(x)|^2 dx + \int_{\mathbb{R} \setminus \mathcal{L}} |\widehat{g}(\xi)|^2 d\xi \geq e^{-C|R||L|} \|g\|_{L^2(\mathbb{R})}^2 \quad (1)$$

for an absolute constant $C > 0$. As is clear to any expert this result quantifies the Heisenberg uncertainty principle. It is also possible to quantify the Balian-Low theorem which is an uncertainty statement for Gabor-Riesz bases. Nitzan and Olsen, [3], quantified it by proving for g a generator of a Gabor-Riesz basis, and R, L are two real numbers with $R, L \geq 1$

$$\int_{|x| \geq R} |g(x)|^2 dx + \int_{|\xi| \geq L} |\widehat{g}(\xi)|^2 d\xi \geq \frac{C}{RL}. \quad (2)$$

where C depends only on the Riesz basis bounds for the function g . Obviously these results are of a one-dimensional nature and although there are conjectural statements for higher dimensional analogues, progress has been more limited essentially due to much more complicated geometry higher dimensions. In a recent work [1] we extended to higher dimensions the work of Nitzan and Olsen [3], and investigated the case of rectangles. Let $g \in L^2(\mathbb{R}^d)$ be the generator of a Gabor-Riesz basis. Let $R_i, L_i \geq 1$ be real numbers for each $1 \leq i \leq d$. Let \mathcal{R}, \mathcal{L} be the d -dimensional rectangles $\mathcal{R} := (-R_1, R_1) \times \dots \times (-R_n, R_n)$, and $\mathcal{L} := (-L_1, L_1) \times \dots \times (-L_n, L_n)$. We then have

$$\int_{\mathbb{R}^n \setminus \mathcal{R}} |g(x)|^2 dx + \int_{\mathbb{R}^n \setminus \mathcal{L}} |\widehat{g}(\xi)|^2 d\xi \geq \frac{C}{R_i L_i} \quad (3)$$

for any $1 \leq i \leq d$. The result is sharp, for $C/R_i L_i$ cannot be replaced by $C \log R_i L_i / R_i L_i$.

In this talk we will give an overview of the proof, and also will mention certain alternative approaches to the proof of Nazarov's theorem.

MSC 2000: 42C15, 42A38

Keywords: Fourier analysis, Uncertainty principle, Balian-Low theorem

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A survey on Qi and Bougoffa type inequalities

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There are a lot of types integral inequalities such as Hermite - Hadamard type inequalities, Opial type inequalities and Hardy type inequalities.

In the last 20 years, they have been the focus of attention in many papers. Especially integral inequalities which are called Qi and Bougoffa Inequalities by mathematics community, has been studied by many authors. We survey the literature on those type inequalities.

MSC 2000: 26D15

Keywords: Qi inequalities, Bougoffa inequalities, integral inequalities, inequalities

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Parameter estimation by optimizing for multiple shooting method

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The shooting methods is developed in order to solve boundary value problem (BVP) by reducing initial value problem (IVP). This reducing causes some parameters. By using optimization techniques it is possible to estimate these parameters. In this study, we explain how the optimization problem constitute. The advantage of parameter estimation for Multiple Shooting Method is to overcome instability, singularity and slow convergences of Multiple Shooting Method.

MSC 2000: 65N99, 65K15, 90-08

Keywords: Parameter estimate, shooting method, optimization

The properties of the orbits under Lie group action

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When a Lie group act on manifold, every point of a manifold has an orbit. We known that S^1 is a Lie group and when S^1 acts on R^2 , then every point $p \in R^2$ has an orbit as a circle of radius, $r = \|p\|$. $O(2)$, 2×2 orthogonal matrices set is a Lie group and Lie subgroup of $GL(n, R)$ and the every element of $O(2)$ defines a rotation on R^2 , with fixed point $O(0, 0)$. The set of orthogonal matrices $O(3)$ are Lie subgroup of $GL(3, \mathbb{R})$. Orthogonal matrices $O(3)$ are rotation operators around eigenvector equaled to eigenvalue $\lambda = 1$. When displacement matrices $D = O(3) \times \mathbb{R}^3$ act effectively on a point of manifold \mathbb{R}^3 as Lie group then a point under this Lie group action has an orbit. This orbit is a

vertical cone if eigenvector of orthogonal matrices $O(3)$ are intersected with displacement vector. This orbit is a helix curve if eigenvector of orthogonal matrices $O(3)$ are parallel to displacement vector. In this study, Lie subgroup samples which have some features are discussed and the relations of properties of orbit and Lie group properties are studied. Finally some Matlab applications are given.

Keywords: Lie Group Act, Orthogonal Matrix, Orbit

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On the stability, integrability and boundedness in Volterra integro-differential equations

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The author of this article deals in a non-linear Volterra integro-differential equation of first order. Conditions are obtained which are sufficient for stability, boundedness, and for every solution $x(t)$ of the equation considered is integrable. For properties of solutions of the equation considered three new theorems on stability, boundedness and integrability features of solutions are proved. The methods of the proofs involve constructing a suitable Lyapunov functional which gives meaningful results for the problems to be investigated. The conditions to be given involve nonlinear improvement and extensions of those conditions found in the literature. The results obtained are new and complements that found in the literature.

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A remark on the stability and boundedness of solutions to non-linear differential systems of second order

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In this work, we are concerned with the investigation of the qualitative behaviors of certain systems of non-linear differential equations of second order. We make a comparison between applications of the integral test and the Lyapunovs function approach on some recent stability and boundedness results in the literature. An example is furnished to illustrate the hypotheses and main results in this paper.

MSC 2000: 34C10, 34C11, 34D05, 34D20.

Keywords: Differential system, second order, asymptotically stability, boundedness, solution.

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On some polynomial inequalities for regions with piecewise smooth boundary with zero angles

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Let $G \subset \mathbb{C}$ be a bounded Jordan region with rectifiable boundary $L := \partial G$ such that $0 \in G$. For a fixed system of distinct points $\{z_j\}_{j=1}^m$ given on the curve L , a generalized Jacobi weight function h is defined by

$$h(z) := h_0(z) \prod_{j=1}^m |z - z_j|^{\gamma_j},$$

where $\gamma_j > -1$ for all $j = 1, 2, \dots, m$, and h_0 is uniformly separated from zero on L i.e. there exists a constant $c_0 = c_0(G) > 0$ such that $h_0(z) \geq c_0 > 0$ in a neighbourhood of L . For $0 < p < \infty$, the weighted Lebesgue space $\mathcal{L}_p(h, L)$ consists all analytic functions f in G such that

$$\|f\|_p := \|f\|_{\mathcal{L}_p(h, L)} := \left(\int_L h(z) |f(z)|^p |dz| \right)^{1/p} < \infty.$$

Let \wp_n denotes the class of all algebraic polynomials P_n of degree at most $n \in \mathbb{N}$. For any $P_n \in \wp_n$, let us denote

$$\|P_n\|_{C(\bar{G})} := \max_{z \in \bar{G}} |P_n(z)|.$$

Let $\Omega = \text{ext}L$ and $\Delta := \{w : |w| > 1\}$. Let Φ be the univalent conformal mapping of Ω onto Δ such that $\Phi(\infty) = \infty$ and $\lim_{z \rightarrow \infty} \frac{\Phi(z)}{z} > 0$. $\Psi := \Phi^{-1}$. For $R > 1$, we take $L_R := \{z : |\Phi(z)| = R\}$, $G_R := \text{int}L_R$ and $\Omega_R := \text{ext}L_R$.

The authors in [1] proved the following inequality:

$$\|P_n\|_{\mathcal{L}_p(h, L_R)} \leq R^{n + \frac{1+\gamma^*}{p}} \|P_n\|_p. \quad (1)$$

where $\gamma^* = \max\{0, \gamma_1, \gamma_2, \dots, \gamma_m\}$.

In this study, we investigate the uniform and the point-wise estimates which are similar to the inequality (1) for the case the regions bounded by piecewise smooth curve having zero angles.

MSC 2000: 30A10, 30C10

Keywords: Polynomials, Nikol'skii inequalities, Bernstein inequalities,

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Philos-type oscillation criteria for third-order neutral dynamic equations with distributed deviating arguments

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In this study, we consider a class of third-order nonlinear neutral dynamic equations with distributed deviating arguments on an arbitrary time scale \mathbb{T} . Using a Riccati-type transformation, some new sufficient conditions to ensure that any solution of the considered equation either oscillates or tends to zero are established. Several examples are provided to illustrate the applicability of the results.

MSC 2000: 34K11, 34K40, 34N05

Keywords: Oscillation, asymptotic behavior, third-order, neutral dynamic equation, distributed deviating argument

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Absolutely convergence factors of Fourier series

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The talk is devoted to investigate numerical sequences, for which multiplication with Fourier coefficients of finite variation functions provides absolute convergence of Fourier series in the power p , where $p > 0$.

We present the theorem, which is a criterion for which the above mentioned numerical sequences are absolute convergence factors of Fourier series of finite variation functions.

Moreover, we also consider efficiency of criterion of main results for trigonometric and Walsh systems.

MSC 2000: 42C10, 46B07

Keywords: Fourier coefficients, Fourier series, absolute convergence, finite variation functions.

On small lifting modules

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Let R be an arbitrary ring and M be a left R -module. M said to be *small lifting* if, for any submodule N of M , there exists a decomposition $M = N' \oplus K$ such that $N' \subseteq N$ and $N \cap K$ is a small module. In this work, the basic properties of these modules are investigated. It is shown that; (1) every submodule of a small lifting module is small lifting; (2) a ring R is a left Harada ring if and only if every left R -module is small lifting; (3) a self injective ring R is semiperfect if and only if ${}_R R$ is small lifting; (4) a small lifting module over a local dedekind domain is strongly \oplus -radical supplemented.

MSC 2000: 16D10, 16D99

Keywords: small module, small lifting module, Harada ring

A model for planning (design), development, implementation, and assessment of differential geometry instruction using 3-D visualization applications

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In mathematics education at undergraduate level, learning difficulties arise due to the fact that lessons and topics can not be associated with real life situations or embodied. This problem becomes even more evident in the teaching of advanced mathematical subjects, such as the concepts of Differential Geometry, which require abstract thinking skills, especially in non-Euclidean geometric terms. In this context, teaching models using computer aided teaching materials can help students to learn abstract concepts by making semantic concrete abstract concepts. In this study, it was aimed to design a teaching model with the help of a virtual manipulator prepared in Wolfram Alpha Mathematica program. For this purpose, based on Bergman & Moore and Gerlach & Ely models, a teaching model for differential geometry functions and its 3D representation of the operations performed with these functions has been developed. The stages of development of the model and the integration of the material used in the course are explained in detail. As a result, a teaching model has been achieved. In the next study, the success and retention effect of the model can be investigated.

MSC 2010: 97A30, 97U60, 53Z99.

Keywords: Mathematics teaching, differential geometry, teaching model.

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On timelike surfaces which contain inclined curves as geodesics

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In this study, we study a timelike surface in \mathbb{E}_1^3 whose one of the principal curvatures is identically constant. We give some results about timelike surfaces on which inclined curves lie as geodesic curves.

MSC 2000: 53C45

Keywords: Minkowski space, inclined curves, geodesics

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On surfaces of constant breadth in Minkowski 3-space

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In this study, we introduce surfaces of constant breadth in Minkowski 3-space. Let's take ovaloids into consideration as closed, convex and smooth surfaces, we give some results for ovaloids to be surfaces of constant breadth in Minkowski 3-space. Particularly, we study timelike ovaloids of constant breadth in Minkowski 3-space.

MSC 2000: 53B25, 53C40

Keywords: Classical differential geometry, surfaces of constant breadth, ovaloids, Minkowski space

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Refinements on the Hermite-Hadamard-Fejer-type inequalities via fractional integral operator

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In this paper, with the use of the techniques and the tools in fractional integral operator, we state and prove many refinements on the fractional integral operator of Hermite-Hadamard-Fejer type for co-ordinated convex functions on a rectangle of \mathbb{R}^2 .

MSC 2000: 26A33, 26A5, 26D15

Keywords: Convex function, co-ordinated convex mapping and Hermite-Hadamard-Fejer inequality, fractional integral operator

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Weighted pseudo almost periodic solutions to a class of hyperbolic partial differential equations with delay

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This paper is concerned with the study of weighted pseudo almost periodic solutions to a class of hyperbolic partial differential equations with delay. Upon making some suitable assumptions, the existence and uniqueness of a weighted pseudo almost periodic solution is obtained.

MSC 2000: 35L71, 35B15 (35L70)

Keywords: weighted pseudo almost periodic solutions, hyperbolic partial differential equation, existence and uniqueness

Acknowledgement:

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New construction of normal Fermi-Walker derivative by Ribbon frame

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In this paper, we study normal Fermi-Walker derivative of curve according to Ribbon frame. We characterize this curve and give some examples.

MSC 2000: 53C41, 53A10

Keywords: Fermi-Walker derivative , Ribbon frame, Curvatures

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The properties of strictly convex T_0 -quasi-metric spaces

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In this talk, it is showed that the generalized convexity structures from metric spaces to T_0 -quasi-metric spaces [2], naturally satisfy interesting additional conditions; especially, generalized convexity structures described for T_0 -quasi-metric spaces occur in asymmetrically normed [1] real vector spaces.

According to that, in [3] we introduced with the notion of *strictly convex* for a T_0 -quasi-metric (X, d) space if it satisfies the corresponding conditions given as a system of equations, similar to the metric case and obtained many properties in strictly convex T_0 -quasi-metric spaces. Since any Takahashi convexity structure [4] on (X, d) satisfies the afore-mentioned system of equations, we see that each strictly convex T_0 -quasi-metric space admits at most one convexity structure.

In addition, we showed if a T_0 -quasi-metric space has a unique convexity structure, then it has additional nice properties, through some examples.

MSC 2000: 54E55, 52A01, 54E35, 47H09

Keywords: T_0 -quasi-metric, Strictly convex space, Takahashi convex structure, Isometrically embedding.

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The estimation of the parameters of the Weibull distribution with different parameter estimation methods

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Weibull distribution, is commonly used today in data analysis in relation with lifetime and failure ratios. The popularity of the distribution is attributable to the fact that it provides a useful description for many different kinds of data, especially in emerging areas such as wind speed and finance applications. It is one of the widely used distribution in modeling asymmetric data that comes from the areas of life testing and reliability engineering. In this study, estimation of parameters for the shape parameter and the scale parameter of the Weibull distribution are given by using the methods such as maximum likelihood, L- moment, moment, least square, weighted least square, percentile estimation methods. The performance of different methods in the estimation of the parameters of the Weibull distribution were compared. Furthermore the performances of the obtained estimators are compared with respect to their biases, log-likelihood values, Q-Q plots, the density plots, distribution plots, distribution plots, AIC, BIC and mean square errors through a simulation study. Finally, the procedure is illustrated based on real data. A comparison between different parameter estimation methods are performed.

MSC 2000: 60E05, 62Q05, 62E17

Keywords: : Weibull distribution, L-moment method, Maximum likelihood, Least square, Simulation.

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Counting curves of an integral lamination

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An integral lamination on the n -punctured disk is a non-empty disjoint union of finitely many essential simple closed curves, up to isotopy. A beautiful method of describing such laminations is given by the Dynnikov coordinate system. In the case $n = 3$, the Dynnikov coordinates of an integral lamination consist of a pair of integers, and the number of connected components of the lamination is the greatest common divisor of these integers. No analogous formula is known when $n > 3$. In this talk we describe an efficient algorithm for calculating the number of components of an integral lamination from its Dynnikov coordinates. This resolves, for the n -punctured disk case, a long-standing conjecture regarding the existence of a polynomial algorithm to decide whether an integral lamination, specified in terms of a coordinate system, is connected or not.

MSC 2000: 57M50, 57N05, 20F36

Keywords: Dynnikov coordinates, integral laminations, counting algorithm

Jørgensen's inequality and purely loxodromic 2-generator free Kleinian groups

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Let ξ and η be two non-commuting isometries of the hyperbolic 3-space \mathbb{H}^3 so that $\Gamma = \langle \xi, \eta \rangle$ is a purely loxodromic free Kleinian group. For $\gamma \in \Gamma$ and $z \in \mathbb{H}^3$, let $d_\gamma z$ denote the distance between z and $\gamma \cdot z$. Let z_1 and z_2 be the mid-points of the shortest geodesic segments connecting the axes of ξ , $\eta\xi\eta^{-1}$ and $\eta^{-1}\xi\eta$, respectively. In this manuscript it is proved that if $d_\gamma z_2 < 1.6068\dots$ for every $\gamma \in \{\eta, \xi^{-1}\eta\xi, \xi\eta\xi^{-1}\}$ and $d_{\eta\xi\eta^{-1}}z_2 \leq d_{\eta\xi\eta^{-1}}z_1$, then $|\text{trace}^2(\xi) - 4| + |\text{trace}(\xi\eta\xi^{-1}\eta^{-1}) - 2| \geq 2 \sinh^2\left(\frac{1}{4} \log \alpha\right) = 1.5937\dots$ Above $\alpha = 24.8692\dots$ is the unique real root of the quartic polynomial $21x^4 - 496x^3 - 654x^2 + 24x + 81$ that is greater than 9. Also generalisations of these inequalities for finitely generated purely loxodromic free Kleinian groups are conjectured.

MSC 2000: 54C30, 20E05, 26B25, 26B35

Keywords: Hyperbolic 3-space, loxodromic isometries, hyperbolic displacements, the Log 3 Theorem, Jørgensen's inequality.

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Hilbert-Kirby polynomials in generalized local cohomology

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Let $R = \bigoplus_{n \in \mathbb{N}_0} R_n$ be a Noetherian homogeneous ring with irrelevant ideal $R_+ = \bigoplus_{n \in \mathbb{N}} R_n$ and with local base ring (R_0, \mathfrak{m}_0) . Let M, N be two finitely generated \mathbb{Z} -graded R -modules. We show that, when $\dim(R_0) \leq 1$, the lengths of the graded components of various graded submodules and quotients of the i -th generalized local cohomology $H_{R_+}^i(M, N)$ are anti-polynomial. For R_0 with arbitrary dimension, the Artinian behaviour of $H_{R_+}^i(M, N)$ and the asymptotic behaviour of the R_0 -modules $H_{R_+}^i(M, N)_n$ for $n \rightarrow -\infty$ in the range $i \leq \inf\{i \in \mathbb{N}_0 \mid \#\{\ell_{R_0}(H_{R_+}^i(M, N)_n) = \infty\} = \infty\}$ will be studied. Moreover, it has been proved that, if u is the least integer i for which $H_{R_+}^i(M, N)$ is not Artinian and \mathfrak{q}_0 is an \mathfrak{m}_0 -primary ideal of R_0 , then $H_{R_+}^u(M, N)/\mathfrak{q}_0 H_{R_+}^u(M, N)$ is Artinian with Hilbert-Kirby polynomial of degree less than or equal u . In particular, with $M = R$, we deduce the correspondence result for ordinary local cohomology module $H_{R_+}^i(N)$, [1], [2] and [3].

MSC 2000: 13D45, 14B15, 13D40, 13D07

Keywords: Hilbert-Kirby polynomial, Generalized local cohomology, irrelevant ideal

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Groebner-Shirshov bases for Leibniz algebras and its enveloping dialgebras

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Leibniz (or Loday) algebras, the non-antisymmetric analogue of Lie algebras, were introduced by J.-L. Loday in 1992 (see [?, ?]). Earlier, such algebraic structures had been considered by A. Bloh [?] who called them D -algebras. They are defined by a bilinear bracket which is no longer skew-symmetric. Since the introduction of Leibniz algebras several researchers have tried to find analogs of important theorems in Lie algebras. A Leibniz algebra L is a vector space over a field k with a k -bilinear map $[\cdot, \cdot]: L \rightarrow L$, satisfying

$$[a, [b, c]] = [[a, b], c] + [b, [a, c]], \text{ for all } a, b, c \in L.$$

The concept of an associative dialgebra was introduced by Loday [?]; the generalization of the Lie bracket produces Leibniz algebras. A diassociative algebra is a k -linear space D equipped with two k -linear maps \dashv, \vdash called respectively the left product and the right product such that the products \dashv and \vdash are associative and satisfy the following properties:

- $x \dashv (y \dashv z) = x \dashv (y \dashv z)$,
- $(x \vdash y) \dashv z = x \dashv (y \vdash z)$,
- $(x \dashv y) \vdash z = (x \vdash y) \dashv z$.

It is obvious that if (D, \dashv, \vdash) is a dialgebra then $D^{(-)} = (D, \{ \cdot, \cdot \})$ is a Leibniz algebra, where $\{a, b\} = a \dashv b - b \vdash a$ for $a, b \in D$. Therefore any Leibniz polynomial in variable X can be transformed into dialgebra polynomial by $\{a, b\} \mapsto a \dashv b - b \vdash a$.

Let L be a Leibniz algebra, the universal enveloping dialgebra of L is denoted by $Ud(L)$ and defined as the quotient of the free dialgebra on L :

$$Ud(L) = T(L) \otimes L \otimes T(L) / \langle \{x, y\} - x \dashv y + y \vdash x \rangle.$$

The method of Groebner-Shirshov for Lie algebras invented by Shirshov [?] when he introduced a new basis named Lyndon-Shirshov basis. Several years later, Bokut reformulate Composition-Diamond lemma [?]. For S as a set of Leibniz polynomials such that any composition of polynomials of S is trivial, S is called Groebner-Shirshov basis. Then if $f \in Id(S)$, then $\bar{f} = u\bar{s}v$, where $s \in S$, $u, v \in X^*$ such that X^* is free monoid generated by X . Our aim in this paper is utilizing approach for Leibniz algebras and show that a set of relations of a Leibniz algebra is a Groebner-Shirshov basis if and only if it is a Groebner-Shirshov basis for the relations of the corresponding universal enveloping dialgebra.

MSC 2000: 17A32, 20E99

Keywords: Leibniz algebras, dialgebras, Groebner-Shirshov basis.

Soft measure on soft sets

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In this paper we introduce soft σ -algebras on soft sets and we give some examples. The new notion of soft measures on soft σ -algebras are introduced and relations between various versions of soft measures considered.

MSC 2000: 03E72

Keywords: Soft set, soft σ -algebras, soft measure.

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A study of hypercyclic operators from a different point of view

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So far, several studies have been done on hypercyclic operators. The obtained results has been based on one vector as hypercyclic or non-hypercyclic vector. In this article we study the hypercyclic operators from a different point of view.

For a linear operator $T : X \rightarrow Y$ when X and Y are topological vector space, and $\Omega \subset X$ we define $T(\Omega) = \{T(x) : x \in \Omega\}$ then we define dispersion orbit of T as $\{\Omega, T(\Omega), T^2(\Omega), \dots\}$. We will study a subset $\Omega \subset X$ as a hypersyclic set instead of the hypercyclic vector which has always been taken care of, and about this we will prove some theorems.

MSC 2000: 34B05, 34A08

Keywords: Dispersion orbit, topological spaces subsets, hypercyclic operators

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