International Conference on Applied Mathematics and Analysis (ICAMA2016)

In memory of
Prof. Gusein Sh. GUSEINOV
Hüseyin Şirin HÜSEYİN
(1951-2015)

Abstract Book

Atilim University
Department of Mathematics
Ankara, July 11-13, 2016

Preface

This abstract booklet includes the abstracts of the papers presented at the International Conference on Applied Mathematics and Analysis in memory of Gusein Sh. Guseinov (Hüseyin Şirin Hüseyin) (ICAMA 2016), held at Atılım University during July 11-13, 2016.

The conference is dedicated to the memory of Prof. Guseinov (1951-2015), a former academic staff of the Department of Mathematics, Atılım University.

The main purpose of this conference is to bring together leading experts and young researchers to share new ideas, trends and methods of applied mathematics and analysis. The developments in the field of applied mathematics open new research areas in analysis and vice versa. Therefore, the conference will provide a forum for exchanging ideas and discussing the recent progress in both fields. A special emphasis will be put on Difference, Differential and Dynamic Equations, Fractional calculus since Prof. Hüseyin had significant contributions to these areas.

The conference brings together more than 140 participants from 10 different countries. The presentations are delivered in four different sessions: Advances in Difference, Differential and Dynamic equations and their applications, Fractional calculus and its applications, Fixed point theory and its applications, Others.

We are grateful to the plenary speakers Rawi P. Agarwal, Martin Bohner, Elgiz Bairamov, Metin Gürses and to the session organizers for their valuable contributions. We also appreciate the support of the Chairman of the Board of Trustees Yalçın Zaim, the Rector Prof. Dr. Yıldırım Üçtuğ of Atılım University.

We wish everyone a fruitful conference and pleasant memories from Ankara, Turkey.

Organizing Committee

Gusein Sh. Guseinov (Hüseyin Şirin Hüseyin)

Prof. Dr. Hüseyin Şirin Hüseyin was born on July 17, 1951 in a small city of Agsu, Azerbaijan, which was at that time a republic of the USSR. He was one of the 10 children in the family. His school education had been completed in Agsu, where in 1968 he graduated from a high school with a gold medal. During school years H. Ş. Hüseyin showed great interest and gift in mathematics. Not surprisingly, he chose a carrier of a mathematician and in 1968 was admitted to the Faculty of Mechanics and Mathematics at the Baku State University. He graduated with distinction receiving "red diploma" (the name of a honor certificate in the Soviet university education system). Being a distinguished student, H. Ş. Hüseyin was awarded by a state scholarship to take a PhD course in Moscow State University under supervision of a famous Professor B. M. Levitan. In 1977, he completed his PhD study with a successful defense of PhD thesis related to the inverse problem of the scattering theory. Afterwards, during 1977 - 1993 he was employed by the Institute of Mechanics and Mathematics of the National Academy of Science of Azerbaijan, first as an assistant professor, starting from 1986 as an associate professor, and finally as a full professor. During these years, he published 25 articles on the inverse problem of the scattering theory. In these publications, his name appeared as G. Sh. Guseinov, and all his papers throughout all his academic carrier were signed with this name. These papers are considered as a substantial contribution to the spectral theory of differential operators, inverse problems of the scattering theory, operator theory, nonlinear differential and difference equations, while their author built up a reputation as one of the prominent specialists in the areas.

Starting from 1993, the life and work of Professor Hüseyin has been inextricably connected with Turkey. During 1993-2001 he was working at the department of Mathematics in Ege University, İzmir. In this period, he was teaching a great number of undergraduate and graduate courses, being at the same time a supervisor of 2 MSc and 6 PhD students. All of them succeeded in their studies. That is what one of his former MSc students, nowadays associate professor at Atılım University Ferihe Atalan says: "Prof. Hüseyin was my advisor for both my graduation project and MSc. thesis. I was in his class in many courses. He was always well prepared for his lectures and seminars. He was always careful in his mathematical studies. During his lectures and seminars he had never used notes written on papers, his notes were written in his mind. The way he used the blackboard was always excellent. During his lectures he used to try hard for his student to follow and understand him. He used to love doing mathematics and talking mathematics. He had a strong background in many areas of both abstract and applied mathematics. He was

always sensitive, modest, kind and hardworking. I will miss our conversation on life and mathematics."

In 2001, Prof. H. Ş. Hüseyin moved to Ankara after he was invited to join the newly opened Department of Mathematics in Atılım University. He proved to be a valuable member of the department not only as a teacher and mathematician, but also as a friendly and agreeable person who was respected by all of his colleagues and students. The years of work at Atılım turned out to be very productive. During this time, he made significant contributions in the following academic fields: the spectral geometry of Riemann manifolds, the spectral theory of automorphic functions, direct and inverse spectral problems in differential and difference operators, initial and boundary value problems in impulsive and delay differential and difference equations. Together with Prof. M. Bohner, they developed a new area called "Integral calculus on time scales". On the whole, Prof. H. Ş. Hüseyin published 126 research papers which have been cited by more than 2100 other scholars.

The chair of the Department of Mathematics in Atılım University Prof. Tanıl Ergenç says: "Prof. Hüseyin was not only a distinguished mathematician with highly qualified research experience but also a significant person who played an important role in the development of our department. He taught a great variety of undergraduate and graduate courses without discrimination, some of which have been designed by him and, therefore, are not available in curricula of great majority of other universities. For many years, he was a representative of the department at both the Faculty and University Boards. As the chair of the department, I can say that it was a great opportunity and privilege to work with such a kind and hardworking person. As an educator, Prof. Hüseyin was one of the favorite professors not only for math students but also for the students of other department. He could always notice the incompleteness in the knowledge of the students and made a great effort to fill the gaps. He will be missed very much by anyone who met him." Prof. H. Ş. Hüseyin was a person with a wide scope of interests. He liked and knew Azerbaijan culture, especially music, songs and cinema. Being an amateur boxer as a university student, he enjoyed watching professional boxing matches and commented on techniques and beauty of the fights.

The unexpected death of Prof. Hüseyin on March 20, 2015 was a great shock to all who knew him. Prof. H. Ş. Hüseyin was active till the end. He will be missed by all who knew him and his work will be remembered for years to come. He is survived by his wife Südaba, his two sons Aydın and Adil, and grandchildren Aylin and Nezrin. May him rest in peace.

The present conference is a tribute to his memory.

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PLENARY TALKS

Ravi P. Agarwal

Ravi P. Agarwal is a Professor and also the Chairman of the Department of Mathematics, Texas A&M University-Kingsville, U.S.A. He received his MSc degree in 1969 at Agra University and PhD degree in 1973 at the Indian Institute of Technology, Madras, India. Prof. Agarwal has a research experience of more than 40 years. His research interests include various areas of Applied Mathematics and Analysis such as differential and difference equations, general inequalities, integral equations, fixed point theory and numerical analysis. He is an author of 30 monographs and more than 1000 research papers published in more than 80 different scientific journals. His papers and books have been highly cited. Prof. Agarwal is also an Editor in Chief of 4 journals and a member of the editorial board of more than 40 journals. He supervised 12 PhD students. Prof. Agarwal regularly invites Post Doc researchers from various countries and personally supervises and guides them in their studies.

Boundary value problems for delay differential equations

Ravi P. Agarwal
Texas A&M University-Kingsville

We develop an upper and lower solution method for second order boundary value problems for nonlinear delay differential equations on an infinite interval. Sufficient conditions are imposed on the nonlinear term which guarantee the existence of a solution between a pair of lower and upper solutions, and triple solutions between two pairs of upper and lower solutions. An extra feature of our existence theory is that the obtained solutions may be unbounded. Two examples which show how easily our existence theory can be applied in practice are also illustrated.

Elgiz Bayram

Elgiz Bayram (Bairamov) is a Professor at the Department of Mathematics in Ankara University. He received his BSc degree in 1980 at the Department of Mathematics in Baku State University where he first met Prof. Guseinov at one of his lectures. Prof. Bayram completed his PhD studies in 1985 in the Azerbaijan Science Academy under the supervision of Prof. Guseinov in fact he was the first PhD student of him. Prof. Bayram became an Associate Proffessor in 1987 and Professor in 1992. Prof. Bayram moved to Turkey in 1992 and became a faculty member at the Department of Mathematics in Ankara University. His research interests are spectral anaysis, scattering theory, operator theory and special functions. He has more than sixty papers published in various scientific journals. Prof. Bayram and Prof. Guseinov have published two papers together: one on time scales and one on q-difference equations . They were not only collaborators but also very closed friends.

Spectral analysis of the quadratic pencil of Schrödinger operator with impulsive conditions

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Let L denote the Quadratic Pencil of Schrödinger Operator generated in $L_2(\mathbb{R})$ by the differential equation

$$-y'' + [q(x) + 2\lambda p(x) - \lambda^2]y = 0, x \in \mathbb{R}^- \cup \mathbb{R}^+$$

with impulsive conditions $y(0^+) = \gamma_1 y(0^-)$ and $y'(0^+) = \gamma_2 y'(0^-)$, where p, q are complex valued functions and $\gamma_1, \gamma_2 \in \mathbb{C}$. Using the uniqueness theorems of analytic functions, we investigate to the dependence of the structure of eigenvalues and spectral singularities of L on the behaviour of p and q at infinity. We obtain the conditions on p and q under which the operator L has a finite number of eigenvalues and spectral singularities with finite multiplicities. We also study the properties of the principal functions of L corresponding to eigenvalues and spectral singularities. The results about eigenvalues and spectral singularities of L are applied to the Klein-Gordon S-wave equation with impulsive. Note that the spectral theory of L without impulsive conditions was investigated in detail in [1–4].

References:

[1] E. Bairamov, Ö. Çakar, A. O. Çelebi, *Quadratic Pencil of Schrödinger Operators with Spectral Singularities*, J. Math. Anal. Appl. **216** (1997), 303-320.

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Martin Bohner

Martin Bohner is the Curators' Professor of Mathematics and Statistics at Missouri University of Science and Technology in Rolla, Missouri, USA. He received the BS (1989) and MS (1993) in Econo-mathematics and PhD (1995) from University Ulm, Germany, and MS (1992) in Applied Mathematics from San Diego State University. He was a Postdoc, sponsored by the Alexander von Humboldt-Foundation, at National University of Singapore (1997) and at San Diego State University (1998). Martin Bohner is the current Vice President of and former President of ISDE, the International Society of Difference Equations. His research interests center around differential, difference, and dynamic equations as well as their applications to economics, finance, biology, physics, and engineering. He is the author of five textbooks and around 250 publications, Editor-in-Chief of three international journals and Associate Editor for more than 50 international journals. His work has been cited almost 12000 times in the literature, including more than 3000 citations of his book "Dynamic Equations on Time Scales: An Introduction with Applications", co-authored with Professor Allan Peterson. Professor Bohner's honors at Missouri S&T include five Faculty Excellence Awards, one Faculty Research Award, and eight Teaching Awards.

Professor Bohner was first introduced to Professor Guseinov by Professor Kaymakçalan on July 26, 2000. Shortly after meeting each other, Professor Guseinov moved from İzmir to Ankara and started working at Atilim University. Being introduced to the theory of dynamic equations on time scales, Professor Guseinov became very interested in this topic, and both Gusein and Martin met usually twice a year in Ankara and have completed 15 papers on time scales over the course of these 15 years. The papers were usually written always in the same restaurant in Ankara, called Yeni Piknik. All 15 papers are highly cited in the literature. Five of them are related to the Laplace transform on time scales, the topic of Martin Bohner's talk at this conference, dedicated to the memory of his friend, teacher, and collaborator, Gusein Guseinov.

The Laplace transform on time scales

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We introduce the Laplace transform on time scales, hence unifying the classical Laplace transform and the Z-transform. We present many properties of the Laplace transform, give examples, and also cover the convolution on time scales, together with the convolution theorem on time scales. Special attention is paid to the two important cases of h-calculus and q-calculus as well as to, more generally, the case of isolated time scales. Results from the following three papers are covered in this talk.

References:

[**1**] M. Bohner, G. Sh. Guseinov, *The convolution on time scales*, Abstr. Appl. Anal. 2007:24, Art. ID 54989, 2007.

[**2**] M. Bohner, G. Sh. Guseinov, *The h-Laplace and q-Laplace transforms*, J. Math. Anal. Appl. **365(1)** (2010), 75-92.

[**3**] M. Bohner, G. Sh. Guseinov, *The Laplace transform on isolated time scales*, Comput. Math. Appl. **60(6)** (2010), 1536-1547.

Metin Gürses

Metin Gürses recevied his BSc degree in Physics at Middle East Technical University (METU) in 1969 and his PhD degree at the same department in 1975 under the supervision of Feza Gürsey. In his dissertation, the linearity of Einstein equations was investigated for a special type of metric tensor for general relativity, called Kerr-Schild metric with an intrinsic solution for Kerr metric. After completing his PhD studies he became a faculty member at METU. In 1979 Prof. Gürses joined the General relativitiy research group in Garching (Germany) with a Alexander von Humbold research scholarship. He worked as a faculty member at the Department of Mathematics in TÜBİTAK Gebze Marmara Research Center, Physics department in Çukurova University and at present at the Department of Mathematics in Bilkent University. His research interests focus on applied mathematics and mathematical physics. Prof. Gürses supervised more than 10 graduate students and published over 100 papers in various scientific journals.

Prof. Gürses and Prof. Guseinov first met at a conference in Çukurova University. Their collaboration started in 2001 when Guseinov moved to Ankara. Prof. Guseinov regularly visited Bilkent Applied Mathematics Seminars and presented many talks on time scales. They have two joint works: one on integrable systems on time scales published in 2005 and the other in 2009 on multiple Poisson structure on dynamical systems.

Functionals on Toroidal Surfaces

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We show that the 2-torus in $\mathbb{R}^3$ is a critical point of a sequence of functionals F_n $(n = 1, 2, 3, ...)$ defined over compact 2-surfaces (closed membranes) in $\mathbb{R}^3$. When the Lagrange function ϵ is a polynomial of degree n of the mean curvature H of the 2-torus, the radii $(a; r)$ of the 2-torus are constrained to satisfy $\frac{a^2}{r^2} = \frac{n^2-n}{n^2-n-1}$, $n \geq 2$. A simple generalization of 2-torus in $\mathbb{R}^3$ is a tube of radius r along a curve α which we call it toroidal surface (TS). We show that toroidal surfaces with non-circular curve α do not provide minimal energy surfaces of the functionals $F_n(n = 2, 3)$ on closed surfaces. We discuss possible applications of the functionals discussed in this work on cell membranes.

CONTRIBUTED TALKS

A note on the stationary acceleration curves on a timelike surface in R_1^3 and a hypersurface in R_1^4

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In this work, the ideas of Zefran, Kumar [4] and Selig [3] are revisited. By using the Serret-Frenet frame in the Minkowski space R_1^3, the stationary acceleration of a curve on the timelike surface is studied. Also we study the normal curvature, geodesic curvature and geodesic torsion functions of the unit speed timelike or spacelike normal stationary acceleration curve with non-lightlike vector fields on a hypersurface in R_1^4.

References:

[**1**] O. Bottema, B. Roth, Kinematics, New York, Dover Publications, 1990.

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Session: *Others*

Some new integral inequalities for $(\beta, \alpha; n, m)$-convex functions in the second sense

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By using the identity for differentiable functions given in [5], we obtained some new estimates on generalizations of trapezoid, midpoint, Bullen and Simpson type inequalities for $(\beta, \alpha; n, m)$-convex functions in the second sense.

References:

[1] S. S. Dragomir, R. P. Agarwal, P.Cerone, *On Simpson's inequality and applications*, J. Inequal. Appl. **5(6)** (2000), 533-579, Available online at

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[4] M. Tunç, *On some new inequalities for convex functions*, Turk. J. Math. **36** (2012), 245–251.

[5] M. Tunç, A. Acem, *Some integral inequalities for h-convex functions and applications*, preprint.

Session: *Others*

Some generalized integral inequalities for $(\beta, \alpha; n, m)$-logarithmically convex functions in the second sense

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In this paper, we obtained some new general inequalities for $(\beta, \alpha; n, m)$-logarithmically convex functions in the second sense by using the identity for differentiable functions given in [5].

References:

[1] A. O. Akdemir, M. Tunç, *Ostrowski type inequalities for s-logaritmically convex functions in the second sense with applications*, Georgian Mathematical Journal. **22 (1)** (2015), 1–7. Doi: 10.1515/gmj-2014-0061.

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[3] S. S. Dragomir, B. Mond, *Integral inequalities of Hadamard type for log-convex functions*, Demonstratio Mathematica **31 (2)** (1998), 354–364.

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[5] M. Tunç, A. Acem, *Some integral inequalities for h-convex functions and applications*, preprint

Session: *Others*

Dynamic operators for surfaces on time scales

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The geometry of surfaces parameterized by time scales is relatively new subject and can be useful to mimetic discretization processes. Recent studies have shown that defining tangential spaces by symmetric differentiation on time scales is more efficient way. In this study, we present geometric operators such as Beltrami, Laplace, and Gradient on surfaces parameterized by time scales by using the symmetric differentiation. Our results are also supported by the examples of point clouds which can be locally seen as the discrete surface patches.

Session: *Advances in Difference, Differential and Dynamic equations and their applications*

Homotopy perturbation solution for a fractional virus epidemic model on financial networks

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Afterwards the global financial crisis of 2008, the view that the financial networks and their vulnerability play a key role in shaping systemic risk has become common sense. In this study, we present an epidemic model that characterize the behavior of a financial network of Turkish and world currencies. Since the long time series have a global memory effect, we first give our model by using the fractional calculus. This model operates on a network, where nodes are the currencies and edges are constructed by the correlation distances. Thereafter, we use the well-known Homotopy Perturbation Method to obtain the solution of this system of fractional differential equations. Our findings are confirmed and complemented by the data set of the relevant Turkish and world currencies during the Turkey's financial crisis of 2001 and the global financial crisis of 2008. Rather than the hypothetical values, we use the Hurst Exponent of each time series to approximate the fraction size and graph theoretical concepts to obtain the variables.

Session: *Fractional Calculus and its Applications*

Fractional order weighted mixed modulus of smoothness

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Main properties of the fractional order mixed modulus of smoothness with Muckenhoupt weights are obtained. Its applications in angular trigonometric approximation problems are considered.

References:

[**1**] R. Akgün, *Mixed modulus of continuity in Lebesgue spaces with Muckenhoupt weights*, Turk. J. Math. **40 (5)**, In Press, 2016.

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Session: *Fractional Calculus and its Applications*

Limit behavior of nonoscillatory solutions of two dimensional time-scale systems

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In this talk, we consider nonlinear two dimensional systems of first order dynamic equations on time scales and obtain necessary and sufficient conditions to show the existence of nonoscillatory solutions. Our approach is based on the sign of components of solutions and we use Knaster and Schauder fixed point theorems. Examples will be given to illustrate some of our results as well.

References:

[**1**] D. R. Anderson, *Oscillation and Nonoscillation Criteria for Two-dimensional Time-Scale Systems of First Order Nonlinear Dynamic Equations*, Electronic Journal of Differential Equations **24** (2009), 1-13.

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[**4**] Ö. Öztürk, E. Akın. *Nonoscillation Criteria for Two Dimensional Time Scale Systems*, Nonauton. Dyn. Syst. **3** (2016), 1-13.

Session: *Advances in Difference Differential and Dynamic Equations and Applications*

A priori bound for positive solutions of N-Laplacian with critical exponential nonlinearity

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In the present study we establish a priori bound for positive solutions without using Moser-Trudinger inequality of the Neumann problem for the N-Laplace equation with critical exponential nonlinearity. In other words, we show that if the $\{u_\varepsilon\} \subset W_0^{1,N}(\Omega)$ sequence is solutions to Neumann problem for the N-Laplace equation, then there exists $M > 0$, independent of $\varepsilon > 0$, such that $\|u_\varepsilon\|_{L^\infty(\Omega)} \leq M$.

References:

[**1**] J. Giacomoni, S. Prashanth, K. Sreenadh, *Multiple positive solutions for N-Laplace equation with nonlinear Neumann boundary condition*, Differential Integral Equations **23(34)** (2010), 201-222.

[**2**] O. A. Ladyzhenskaya, N. Uraltseva, Linear and Quasilinear Elliptic Equations, Academic Press, New York, 1968.

[**3**] S. Lorca, B. Ruf, P. Ubilla, *A priori bounds for superlinear problems involving the N-Laplacian*, J. Differential Equations (2009), 2039–2054.

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Session: *Advances in Difference Differential and Dynamic Equations and Applications*

Convergence theorems in CAT(0) space and an application

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The aim of present paper is to introduce a new iterative process involving a finite family of multivalued nonexpansive mappings in CAT(0) spaces. We prove some Δ-convergence and strong convergence theorems for the proposed scheme with and without end point conditions. The newly defined iteration scheme is also utilized to an application in image recovery problem. In process, our results generalize and extend the corresponding results of Uddin et al., Abbas et al., Eslamian and Abkar, Bunyawat and Suantai, Khan, Khan and Fukhar-ud-din and Fukhar-uddin and Khan and references cited therein.

Session: *Fixed Point Theory and Applications*

Common fixed point theorems by (CLR) property on partial metric space

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The aim of this paper is to get the common fixed point results for two pair of weakly compatible mapping by using common (CLR) property in partial metric space. We extend the very recent results as well.

Session: *Fixed Point Theory and Applications*

Set of solutions of split quaternionic polynomial equations

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We study the set of the solutions of any split quaternionic equation of the form $ax + xb = c$. Moreover we investigate the set of the solution s of a split quaternionic equation of the form $ax^2 + x^2b = c$ by the method of sections by hyperplanes perpendicular to the real axis. This sections are linear manifold a necessary and sufficient conditions are given.

References:

[**1**] D. Mierzejewski, *Linear Manifolds in Sets of Solutions of Quaternionic Polynomial Equations of Several Types*, Appl. Clifford Algebra **21** (2011), 417-428.

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[**3**] W. K. Clifford, *Preliminary Skecth of biquaternions*, Proc. London Math. Soc. **4** (1873), 361-395.

Session: *Others*

Spectral properties of a matrix quantum difference equation with spectral singularities

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In this paper, we investigate the Jost solution, continuous spectrum, eigenvalues and spectral singularities of a nonselfadjoint matrix q-difference equation with spectral singularities.

References:

[**1**] M. Adıvar, E. Bairamov, *Spectral properties of nonselfadjoint difference operators*, J. Math. Anal. Appl. **261** (2001), 461–478.

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Session: *Advances in Difference, Differential and Dynamic Equations and Their Applications*

Numerical solution of higher order linear differential equation and Pantograph equations using Lagrange polynomials

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In this study, a numerical matrix method is developed for numerically solving high-order linear differential, pantograph and delay equations under initial conditions. The technique we have used is essentially based on Taylor matrix method using Lagrange polynomial. The method consists of expanding the required approximate solution as the elements of Lagrange polynomial. The operational matrices for the integration, product and delay of the Lagrange polynomials are presented. General procedure for forming these matrices is given. These matrices play an important role in modelling of problems.by using these operational matrices together, a pantograph equation can be transformed to a system of algebraic equations. An efficient error estimation for the Lagrange polynomials method is also introduced. Some examples are given to demonstrate the validity and applicability of the method and a comparison is made with existing results.For error we use residel function

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Session: *Advances in Difference Differential and Dynamic Equations and Applications*

New fractional derivatives and integrals and their applications

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Fractional calculus is a field in continuous developing. The applications of this type of calculus can be seen in more than 100 branches of various fields. Recently, new fractional derivatives and integrals were proposed. In this talk I will present some new applications of these newly introduces concepts.

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Session: *Fractional Calculus and its Applications*

Randic index of a graph using some graph operations

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In this study we found bounds for Randic Index of a graph with using graph operations, such as (cartesian) product and union of two graphs, ie. $G_1 \times G_2$, $G_1 \cup G_2$, respectively.

References:

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Session: *Others*

Regarding complex and exponential behaviours to the nonlinear space-time fractional telegraph equation

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In this manuscript, we study on the travelling complex wave structures for the nonlinear space-time fractional Telegraph equation which plays an important role in mathematical physics. For obtaining such structures, we use the modified trial equation method. After then, two- and three- dimensional surfaces of travelling complex wave structures are plotted by using Wolfram Mathematica 9 programming language.

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Session: *Fractional Calculus and its Applications*

A glance into the stabilizing of chaotic dynamical systems through fixed point iterative methods

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Stabilizing unstable dynamical systems through feedback adjustment methods have dominated the recent research in the field off chaos control, see Huang [5] and references therein. This method has been shown theoretically and by numerical simulations to be effective in stabilizing unstable periodic points of chaotic discrete systems. In this paper, a simple growth-rate type mechanism for controlling chaos in discrete systems, similar to that in Huang [6] but originating in iterative approximation of fixed points [1], is developed. We show in theory and by numerical simulations that our technique of stabilizing unstable periodic points of chaotic discrete systems is effective and, moreover, compared to other stabilizing methods, has a extremely high speed. The main idea of the new method is inspired from recent and classical methods in the iterative approximation of fixed points, see [1-4].

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Session: *Fixed Point Theory and Applications*

A new aspect to Picard operators with simulation functions

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In this paper, considering the simulation function, we give a new class of Picard operators on complete metric spaces. We also provide a nontrivial example that shows the aforementioned class properly contains some earlier such classes.

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[**1**] I. Altun, H. A. Hancer, G. Mınak, *On a general class of weakly Picard operators*, Miskolc Mathematical Notes **16** (2015), 25-32.

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Session: *Fixed Point Theory and Applications*

Spectral criteria for the convergence of averages of a contraction

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We use spectral tools and a theorem of Rademacher-Menchov on the convergence of orthogonal series to study the mean and the pointwise convergence of arithmetic means of a randomly generated contraction on a Hilbert space. We give sufficient conditions for the pointwise convergence by involving the spectral measure, we also show that these conditions are optimal in the one dimensional setting and produce a rate of convergence in this case.

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Session: *Others*

On some common fixed point theorems for (α, β) −admissable pairs in metric space

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In this paper, we establish some common fixed point theorems for cyclic (α, β) -admissible pairs on a complete metric space, which are generalized some results in the existing literature.

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Session: *Fixed Point Theory and its Applications*

Terminal control processes governed by nonlinear sequential dynamic system with particular parameter

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This paper is devoted to the optimal control processes represented by nonlinear sequential dynamic system with special parameter. It is supposed that the considered parameter depending on initial and other necessary states in the proof of optimality condition, satisfies the condition of unique solution for fixed input value. All important operations of the above-mentioned optimal processes are characterized by the pseudo Boolean objective functional and Boolean transfer function on Galois field GF(2). Then uniqueness theorem and principle of optimality are proven. Finally Bellman equation is established by applying dynamic programming method which is the one of the solution method of optimal control problem for multi-step stochastic discrete processes.

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Session: *Others*

A note on the existence of optimal control for stochastic binary dynamic systems

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In this talk, processes given by stochastic binary dynamic systems are discussed and a particular accessible set is defined to show existence of optimal control. Then the existence theorem is proven for considered problem.

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Session: *Others*

Spectrum and symmetries of the impulsive difference equations

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We consider the second order difference equation

$$y_{n-1} + y_{n+1} = \lambda y_n,\ n \in \mathbb{Z} \setminus \{-1, 0, 1\} \tag{1}$$

with impulsive condition

$$\begin{pmatrix} y_1 \\ \Delta y_1 \end{pmatrix} = \begin{pmatrix} a & b \\ c & d \end{pmatrix} \begin{pmatrix} y_{-1} \\ \nabla y_{-1} \end{pmatrix} \tag{2}$$

where a, b, c, d are complex numbers,

$$\begin{aligned} \Delta y_n &: = y_{n+1} - y_n \\ \nabla y_n &: = y_n - y_{n-1} \end{aligned}$$

and λ is a spectral parameter. Let L denote the operator generated by $(1) - (2)$ in $l_2(\mathbb{Z})$. In this study, we investigate eigenvalues and spectral singularities of L depending on the choice of coupling constants a, b, c, d. We also examine the P, T and PT symmetries of L. Note that, the spectral singularities of general second order difference operators were investigated in detail in $[1 - 4]$.

References:

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Session: *Advances in Difference Differential and Dynamic Equations and Applications*

Fractional derivatives: An application for score functions

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In classical case, while deriving the score functions, the known derivative is used. The different fractional derivatives are proposed in the literature. In this study, the new score functions based on the fractional derivatives are derived. The combination score functions of normal (Gaussian) and Laplace distributions were also considered. This kind of functions are in the class of Huber M-estimate. We observed that the mean squared errors of estimates for the score functions derived with the fractional derivatives have smaller than that of ones derived with the known derivative.

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Session: *Fractional Calculus and its Applications*

On determination of the class of saturation for a method (M, λ)

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One of the main problem in aproximation theory is determination a saturation class for given method. This problem has been considered by Zamanski [1], Sunouchi and Watari [2] and others for methods as Cesaro, Nrlund, Riesz and some others. In this talk we considered with this problem for a method (M, λ) which was given by Natarjan in [3].

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Session: *Others*

Integral representation formulas in polydomains and applications to boundary value problems

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Integral representation formulas are important in the theory of boundary value problems. In this study, we give some second-order Cauchy-Pompeiu integral representations of several complex variables in polydomains. Such representations are derived by iterating respective first-order representation formulas of one variable and they are used in solving boundary value problems.

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Session: *Advances in Difference, Differential and Dynamic equations and their applications*

Existence of solutions for fourth order boundary value problems on an infinite interval

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In this study, we consider fourth-order three-point nonlinear differential equations on an infinite interval. We present sufficient conditions for the existence of a solution between a pair of lower and upper solutions by using Schauder's fixed point theorem. Also, we establish the existence of three solutions between two pairs of lower and upper solutions by using topological degree theory. To demonstrate how easily our theory can be applied in practice, we illustrate two examples.

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Session: *Advances in Difference, Differential and Dynamic equations and their applications*

Randic index of a weighted graph using graph operations

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Let G be a simple connected graph and n nodes weighted graph. Let each edge of G is weighted with positive real numbers. Weighted Randic index $R_w = R_w(G)$ of is defined as follows:

$$R_w = R_w(G) = \sum_{uv \in G} \frac{1}{\sqrt{w(u)w(v)}}$$

where $w(u)$ is the sum of the weights on u and $w(v)$ is the sum of the weights on v that is;

$$w(u) = \sum_{i \sim u} t_i \qquad w(v) = \sum_{j \sim v} c_j$$

In this study we found bounds for Randic index of a weighted graph operations, such as Cartesian product and union of two weighted graphs, i.e. $G_1 \times G_2, G_1 \cup G_2$, respectively.

References:

[**1**] C. Vasudev, Graph theory with applications, New Age International Publishers, New Delhi, Indian, 2006.

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Session: *Others*

Trigonometric cubic B-spline collocation method for solitons of the Klein-Gordon equation

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A collocation method based on trigonometric B-spline functions is set up for the numerical solution for an initial boundary value problem modeling motion of a single solitary for the Klein-Gordon Equation. Since the equation contains a term with second order time derivative, we reduce the order of the time derivative by converting the equation to a coupled system of two first order equations. Then, the time discretization of the system is carried out by using Crank-Nicolson method due to its strong stability properties. After linearization of the time discretized system, the trigonometric cubic B-spline approximate solutions are substituted into the system. The iteration algorithm becomes ready to run after adapting the initial state. The numerical results obtained by the proposed algorithm are compared with the exact solutions in order to check the validity of the method.

References:

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Session: *Advances in Difference Differential and Dynamic Equations and Applications*

Fractional variational principles and its applications

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In my talk, I will present some applications of the fractional variational principles in the area of optimal control theory. Illustrative examples will be given in order to show the accuracy and performance of the method. New insights will be introduced for further extended formulations and applications.

References:

[**1**] O. P. Agrawal, D. Baleanu, *A Hamiltonian formulation and a direct numerical scheme for fractional optimal control problems*, Journal of Vibration and Control **13(9-10)** (2007), 1269–1281.

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Session: *Fractional Calculus and its Applications*

Long time behaviour of discontinuous impulsive differential equations via principal and nonprincipal solutions

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The notion of principal and nonprincipal solutions for the ordinary differential equation

$$(p(t)x')' + q(t)x = 0$$

was introduced by Leighton and Morse in 1936. After a long time it was proven by Özbekler and Zafer that such solutions exist for impulsive differential equations of the form

$$\begin{aligned} &(p(t)x')' + q(t)x = 0, \quad t \neq \theta_i, \\ &\Delta p(t)x' + q_i x = 0, \quad t = \theta_i \end{aligned}$$

whose solutions are continuous. In this work we are concerned with two types of impulsive differential equations with discontinuous solutions. We first prove the existence of principal and nonprincipal solutions for discontinuous impulsive differential equations, then we give some applications as $t \to \infty$.

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Session: *Advances in Difference Differential and Dynamic Equations and Applications*

On α-admissible F-contractions on quasi metric spaces

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In this talk, by taking into account the effect of α-admissibility and F-contractivity of a self mapping of a quasi metric space we present some fixed point results on Hausdorff left (right) K-complete quasi metric spaces. Also, without Hausdorffness condition of the space, we present similar fixed point results on left (right) Smyth complete T_1-quasi metric spaces. Finally, we give some illustrative examples to show the significant of the presented fixed point results.

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Session: *Fixed Point Theory and Applications*

On linear algebra of adjacency matrices for one type of graph

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At this study, we consider one type of graph, then we investigated some linear algebraic properties of them.

References:

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Session: *Others*

Differential SEIS epidemic model for computer viruses

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"Virus" as common word is a kind of computer program that shows how it behaves and which is similar to the spread of infectious disease. Due to continuous improvement on software / hardware technology and very common using computer networks, computer viruses are continually evolving and their structures increasingly becoming more complex and transmission capabilities are becoming more powerful. In this paper, we proposed a new epidemiological model for computer viruses. A virus can corrupt a computer and also we thought that user could recover the computer by formatting or using system restore. System restore helps restore computer's system files to an earlier point in time. It's a way to undo system changes to computer without affecting personal files. Also we have investigated the global behavior of the endemic equilibrium and we have supported our results with numerical simulation.

References:

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Session: *Advances in Difference Differential and Dynamic Equations and Applications*

On a general class of α-admissible rational type contractive mappings

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Recently, various studies related with generalized contractive conditions involving inequalities of rational type have been introduced in the context of partially ordered metric spaces. The existence and uniqueness of fixed points for these types of contractions have been discussed under different conditions. In this talk we present a class of contraction mappings of rational type which generalizes the results of the studies mentioned above. Moreover, there is no need for any extra restrictions.

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Session: *Fixed Point Theory and its Applications*

RBF-DQ solution of natural convection under the effect of a magnetic field in a tilted cavity

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In this study, radial basis function based differential quadrature (RBF-DQ) method is applied to the natural convection in an inclined unit square cavity under the effect of an applied magnetic field in different angles. The stream function-vorticity form of the dimensionless governing equations is concentrated on. The change in different Hartmann numbers and inclination angles of the cavity are investigated both in terms of streamlines, isotherms, vorticity contours and the average Nusselt number through the heated wall. The increase in Hartmann number causes heat transfer to be conductive due to the Lorentz force, and the inclination angle of the cavity has a remarkable effect on heat transfer at a small Hartmann number. The proposed method is a global method and provides to use small number of grid points as a result of DQ method.

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Session: *Others*

Volterra integral equations on time scales

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In this talk are considered Volterra integral equations of the first and second kind on time scales. They are proved existence and uniqueness of the solutions. They are defined resolvent kernels and they are deducted some of their properties. The results are provided with some applications to dynamic equations.

References:

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Session: *Advances in Difference Differential and Dynamic Equations and Applications*

(p,q)-Integral inequalities

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In this study, we establish (p,q)-analogue of some of the most important integral inequalities as trapezoid, Ostrowski, Cauchy-Bunyakowski-Schwarz, Grüss and Grüss-Chebyshev integral inequalities by using (p,q)-derivative and (p,q)-integral on finite intervals.

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Session: *Others*

New Hermite-Hadamard type integral inequalities for tgs-convex functions

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In this study, the authors prove some integral inequalities of Hermite-Hadamard type for functions whose derivatives of absolute values are tgs-convex. Some new estimations are obtained.

References:

[**1**] S. S. Dragomir, C. E. M. Pearce, Selected topics on Hermite-Hadamard inequalities and applications, Victoria University, Australia, 2000.

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Session: *Others*

Further results on fibre products of Kummer covers

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We study fibre products of an arbitrary number of Kummer covers of the projective line over $\mathbb{F}_q$ under suitable weak assumptions. If $q-1=r^a$ for some prime r, then we completely determine the number of rational points over a rational point of the projective line. Using this result we obtain explicit examples of fibre products of three Kummer covers supplying new entries for the current table of curves with many points (http://www.manypoints.org).

References:

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Session: *Others*

Deferred statistical equivalence of sequences of sets

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The concept of wijsman deferred statistical convergence of sequences of sets has been defined in [**1**]. In this study, by considering this notation asymptotically wisjman deferred statistical equivalence of sequences of sets is defined. Besides main properties of this new concept, some inclusion results are given under strict restrictions.

References:

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Session: *Others*

On some properties of Balance-binomial graphs

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Recently, graph theory has huge amount of interest by scientists. Due to graphs are visual objects, to analyze them, their matrix representation helps us. At this work, we introduce balance-binomial graphs, whose entries of adjacency matrix are balance-binomial numbers. Besides computation of their energy, we investigated some of their linear algebraic properties.

References:

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Session: *Others*

A Galerkin-like method to obtain approximate solutions of an epidemiological computer virus model

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One of the most common approaches to study the spread of infectious diseases is considering the related population as composed of disjoint parts in terms of relation to the disease. This approach from epidemiology, known as the "compartmental approach" has inspired the modelling of the spread of computer viruses in computer networks. In this study, we consider such a computer virus model and obtain its approximate solutions by using a Galerkin-like method based on ordinary polynomials. In order to demonstrate the effectiveness of the method, it has been tested on an example problem.

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Session: *Advances in Difference Differential and Dynamic Equations and Applications*

A new theorem on $\varphi - |A, p_n|_k$ summability method

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In this paper, we have generalized a known theorem to the $\varphi - |A, p_n|_k$ summability factors of infinite series, under weaker conditions by using an almost increasing sequence. This new theorem also includes several known and new results.

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Session: *Others*

A short talk on the development of distance functions

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It is an indispensable fact that the fixed point theory is the most dynamic research subject in not only nonlinear analysis but also in all quantitative sciences. In particular, fixed point theory in the setting of abstract metric spaces has been investigated by a number of researchers since the theory has a wide application potential to the several applied science besides its own interest. According to needs of the application problems, the researchers in this fields have proposed several fixed point results and also extend the standard frame, complete metric space, to the more general abstract spaces, like, quasi-metric space, b-metric space, dislocated metric space and so on. The aim of this talk is to indicate the improvement of distance functions starting from the standard metric.

Session: *Fixed Point Theory and its Applications*

Basis properties of root functions of a fourth order boundary value problem

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In this work we consider the problem:

$$\begin{aligned} &y^{(4)} + q\,(x)\,y = \lambda y, \quad 0 < x < 1 \\ &y'''\,(1) - (-1)^{\sigma}\,y'''\,(0) + \alpha y\,(0) = 0, \\ &y''\,(1) - (-1)^{\sigma}\,y''\,(0) = 0, \\ &y'\,(1) - (-1)^{\sigma}\,y'\,(0) = 0, \\ &y\,(1) - (-1)^{\sigma}\,y\,(0) = 0, \end{aligned}$$

where λ is a spectral parameter, $q(x) \in L_1(0,1)$ is a complex valued function, α is an arbitrary nonzero complex constant and $\sigma = 0, 1$. The boundary conditions of this problem are regular, but not strongly regular. Asymptotic formulae for eigenvalues and eigenfunctions of the considered boundary value problem are established. It is proved that the system of root functions of this spectral problem forms an unconditional basis in the space $L_2(0,1)$. Moreover, under the condition $q(x) \in W_1^1(0,1)$, this system of root functions forms a basis in $L_p(0,1), 1 < p < \infty$.

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Session: *Advances in Difference Differential and Dynamic Equations and Applications*

A generalized Lyapunov type inequality for fractional 2nx2n Hamiltonian systems

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In this talk Lyapunov inequality is generalized to fractional $2n \times 2n$ Hamiltonian systems special cases of which include sequential fractional system, fractional self adjoint differential equation, $2n \times 2n$ Hamiltonian systems and second order linear ordinary differential equations. By means of applications of this new inequality, disconjugacy of solutions of such systems, existence and uniqueness of related boundary value problems and lower bounds for the eigenvalues of associated eigenvalue problems are discussed. This inequality is the extension and improvement of the results obtained for ordinary differential equations and systems and for fractional differential equations and systems, respectively.

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Session: *Fractional Calculus and its Applications*

On k-Hessenberg Toeplitz matrices

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One of the basic branch of mathematics, matrix theory is in the intersection of linear algebra, graph theory, algebra, combinatorics and statistics. To solve problems easily, it has been neccessary to define some special type of matrices. In this study, we examine lower k-Hessenberg Toeplitz matrices and give some properties of the matrix family.

References:

[**1**] C. M. Fonseca, T. Sogabe, F. Yilmaz, *Lower k-Hessenberg matrices and k-Fibonacci, Fibonacci-p and Pell (p; i) numbers*, Gen. Math. Notes **31** (2015), 10–17.

Session: *Others*

Monotone approximation in Orlicz spaces by using averaged modulus of smoothness

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In this presentation, firstly we give basic properties of averaged modulus of smoothness in Orlicz spaces. Then we prove some direct and converse one sided approximation problems in Orlicz spaces.

References:

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Session: *Others*

A collocation method based on extended cubic B-splines for numerical solutions of the Klein-Gordon equation

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An extension of classical cubic polynomial B-splines has been used to derive a finite element collocation method for numerical solution of the Klein-Gordon equation. The time order of the equation is reduced by converting it to a coupled system of two first order equations. The space discretization of the equation is completed by the extended cubic B-spline approach as the equation is integrated in time by using Crank-Nicolson implicit method. Some initial boundary value problems covering the travel of a single wave are solved numerically by the proposed method. The simulations are depicted in three dimensional plots. The error between the analytical solutions, if exist, and the numerical solutions is measured by using various norms.

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Session: *Advances in Difference Differential and Dynamic Equations and Applications*

New exact solutions for some nonlinear conformable PDEs Using Exp-Function method

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Modeling the many physical systems mathematically arises to nonlinear evolution equations by reason of most physical systems are intrinsically nonlinear in nature. To search for the travelling wave solutions of nonlinear partial differential equations (NPDEs) has an important role in the study of nonlinear physical phenomena. As a result of this important role, this article is written with an aim of finding the travelling wave solutions of some conformable NPDEs such as Nizhnik-Novikov-Veselov and Klein-Gordon equations. For this aim the Exp-Function method which based on series of exponential functions is used as a tool. It is seen that Exp-Function method is a useful and suitable tool for obtaining analytical solutions of considerable number of nonlinear FDEs where the derivatives denoted by newly defined "Conformable Derivative".

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Session: *Fractional Calculus and its Applications*

Porosity convergence and porosity limit points

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Porosity appeared in the papers of Denjoy [2], [3], Khintchine [5] and, independently, Dolzenko [4]. In [1] we define right upper porosity at infinity for subsets of natural numbers by using right upper porosity at 0 for subsets of real numbers and a function $\mu : \mathbb{N} \to \mathbb{R}^+$. In this study we define porosity convergence for real valued sequences by using right upper porosity at infinity for subsets of natural numbers. Then we give some properties of porosity convergence. Also we define porosity limit points for real valued sequences and investigate the relationship between porosity convergence and porosity limit points.

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Session: *Others*

Comparison theorems for fractional Sturm-Liouville problem

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Main idea of this study is to prove first and second comparison theorems for fractional Sturm-Liouville problems which plays an important role in mathematical physics.

References:

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Session: *Fractional Calculus and its Applications*

Recent progress on M-metric spaces

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In this talk, we establish Matkowski's fixed point theorem and Boyd and Wong's fixed point theorem with covered Ciric-contractions for M-metric spaces and our results improve very recent results in the literature.

Session: *Fixed Point Theory and its Applications*

Some bounds for the weighted distance energy

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Let G be a simple connected matrix weighted graph on n vertices. The weighted distance energy $DE_w(G)$ of G is defined as

$$DE_w(G) = \sum_{i=1}^{nt} |\mu_i|,$$

where $\mu_1, \mu_2, ..., \mu_{nt}$ are eigenvalues of weighted distance matrix of G. In this study, the weighted distance energy for simple connected matrix weighted graphs is considered and some bounds for the weighted distance energy are found. Moreover, some results on number weighted and unweighted graphs are obtained by means of these bounds.

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Session: *Others*

A Non-integer variable order dynamic equations on time scales

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This work deals with the concept of a Capuoto-Fabrizio type non-integer variable order fractional differential operator on time scales which involves a non-singular kernel. A measure theoretic discussion on the limit cases for the order of differentiation is presented. Corresponding to the fractional derivative, we discuss on an integral for constant and variable orders. Then solutions to some dynamic problems on time scales involving the proposed derivative is obtained.

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Session: *Advances in Difference Differential and Dynamic Equations and Applications*

On a foundation of fractional derivative on time scales

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The present work discusses on a possible foundation for the non-integer order derivative on time scales which involves a singular kernel. Introducing some limited approaches on the fractional counterpart of the power law based kernel, a suitable singular kernel for the fractional derivative on time scales is proposed. Then, implementing the Taylor's expansion on time scales, the non-integer order derivative is introduced. It has been illustrated that, assuming the singular kernel based differential operators such as Riemann-Liouville or Caputo, it is not possible to generalize the definitions to include the delta calculus. Indeed, there exists a proper subclass of all time scales possessing the same left-density property, which is analytically eligible for the non-integer order extended theory.

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Session: *Advances in Difference Differential and Dynamic Equations and Applications*

Approximation of discontinuous functions by q-Bernstein polynomials with $q > 1$

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The q-Bernstein polynomials, introduced by G. M. Phillips ([1]) in 1997, originally were used only for the approximation of continuous functions. Recently, a number of results on the q-Bernstein polynomials with $q¿1$ attached to discontinuous functions on [0,1] have been published. See, for example, [2] and [3]. These results reveal some new phenomena which do not ocur for the classical Bernstein polynomials ([4]). To be specific, consider the time scale $\mathbf{J}_q = \{0, 1, q^{-1}, q^{-2}, \ldots, q^{-m}, \ldots\}$. It has been proved that the singularities of dicontinuous functions located on the time scale $\mathbf{J}_q$ are definitive for the investigation of the convergence properties of the corresponding q-Bernstein polynomials.

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Session: *Others*

Discrete Sturm-Liouville problem via Bessel potential type

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In this paper, discrete Sturm-Liouville problem via Bessel potential type is considered. The sum representation of solution are obtained. It is proved that this solution satisfies the equation by applying summation by parts. Estimation of asymptotic expansion of eigenfunction are found.

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Session: *Advances in Difference Differential and Dynamic Equations and Applications*

Sturmian theory for second-order differential equations with mixed nonlinearities

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In the talk, Sturmian comparison theory is developed for the pair of second-order differential equations; first of which is the nonlinear differential equations

$$(m(t)y')' + s(t)y' + \sum_{i=1}^{n} q_i(t)|y|^{\alpha_i - 1}y = 0, \qquad (\mathbf{A})$$

with mixed non-linearities $\alpha_1 > \cdots > \alpha_m > 1 > \alpha_{m+1} > \cdots > \alpha_n$, and the second is the non-self-adjoint differential equations

$$(k(t)x')' + r(t)x' + p(t)x = 0. \qquad (\mathbf{B})$$

Under the assumption that the solution of Eq. (**B**) has two consecutive zeros, we obtain Sturm-Picone type and Leighton type comparison theorems for Eq. (**A**) by employing the new nonlinear version of Picone's formula that we derive. Wirtinger type inequalities and several oscillation criteria are also attained for Eq. (**A**). Examples are given to illustrate the relevance of the results.

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Session: *Advances in Difference Differential and Dynamic Equations and Applications*

A survey on modular metric spaces

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Caristi's fixed point theorem is considered as a significant extensions of the Banach contraction principle for maps of a complete metric space into itself. It is guarantee that a functional equation has a bounded solution. In the current study, we generalize Caristi's fixed point theorem by introducing lower semi-continuous for modular metric spaces which can be considered as more general a notion than metric spaces. On the other hand, we express some special results which are obtained from Caristi's fixed point theorem. Finally, with Caristi's fixed point theorem, we also characterize completeness in modular metric spaces.

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Session: *Fixed Point Theory and its Applications*

Structural stability for g-Bénard problem

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Rayleigh - Bénard convection is one of the most commonly studied convection phenomena. We consider the Bénard problem with an upper boundary prescribed by a smooth function g. The concept of structural stability in which the study of continuous dependence or stability, is on changes in the model itself rather than the initial data. The object of this talk is to present some estimates of structural stability for the g-Bénard problem.

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Session: *Advances in Difference Differential and Dynamic Equations and Applications*

Laplace transform of fractional derivation under CTIT transformation

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We propose an adapted Laplace transform method that gives the solution of a linear fractional differential equation with constant coefficients in terms of corresponding integer order differential equation. After we mention what the CTIT transformation is based on, we explain how it can reduce the solution in fractional domain to integer domain when it is used with Laplace transformation via some examples for $0 < \alpha < 2$ where α; is the order of fractional derivative so that comparisons with the solutions of Kilbas et al. are made via simulations.

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Session: *Fractional Calculus and its Applications*

On the dynamics of predator-prey dynamic systems with generalized functional response

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Here two dimensional predator-prey system with generalized functional response is considered. The main problem for this study is to find the necessary and sufficient conditions for the periodic solution of the considered system. Additionally, global attractivity of the system also investigated and some important results were found. This study is mainly based on continuation theorem in coincidence degree theory and some results from semi-group theory.

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Session: *Advances in Difference Differential and Dynamic Equations and Applications*

Some common coupled fixed point theorems for weakly compatible mappings in complex valued metric spaces

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In this paper, we introduce the concept of a weakly compatible mappings to obtain coupled coincidence points and coupled point of coincidence for nonlinear contractive mappings in complex valued metric space. Coupled common fixed point theorems for such mappings are also proved. Results are supported by some examples.

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Session: *Fixed Point Theory and its Applications*

Recurrence relations for the hypergeometric type functions on the q-quadratic lattices

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The main idea of this talk is to introduce the difference analogues of solutions of the second order linear difference equation of hypergeometric type defined on the q-quadratic lattices. We give some difference-recurrence relations for such solutions.

References:

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Session: *Others*

Oscillation of a second order impulsive delay differential equation with a piecewise constant argument

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This paper concerns with the existence of the solutions of a second order impulsive delay differential equation with a piecewise constant argument. Moreover, oscillation, nonoscillation and periodicity of the solutions are investigated.

Session: *Advances in Difference Differential and Dynamic Equations and Applications*

Spectral analysis of the Dirac system with a general point interaction

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Let L denote the operator generated in $L_2(\mathbb{R}, \mathbb{C}^2)$ by the equation

$$i\sigma_2(d\psi/dx) + m\sigma_3\psi = \lambda\psi \quad , \quad \psi(x) = \begin{pmatrix} \psi_1(x) \\ \psi_2(x) \end{pmatrix} \quad , \quad x \in \mathbb{R}\setminus\{0\} \tag{3}$$

and a general point interaction

$$\begin{pmatrix} \psi_1(0^+) \\ \psi_2(0^+) \end{pmatrix} = \begin{pmatrix} a & , & b \\ c & , & d \end{pmatrix} \begin{pmatrix} \psi_1(0^-) \\ \psi_2(0^-) \end{pmatrix} \quad , \quad a, b, c, d \in \mathbb{C}$$

where

$$\sigma_2 = \begin{pmatrix} 0 & -i \\ i & 0 \end{pmatrix}, \ \sigma_3 = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$$

and λ is a complex spectral parameter. In relativistic quantum theory, the equation (1) is called a one-dimensional stationary Dirac system with a mass m. The purpose of this study is to generalize the results obtained for the Schrödinger operator with a general point interaction in [1-2].

References:

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Session: *Advances in Difference Differential and Dynamic Equations and Applications*

On a faster iterative scheme in hyperbolic spaces

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We consider a new faster iterative scheme due to Sintunavarat and Pitea (J. Nonlinear Sci. Appl. 9:2553-2562, 2016) for further investigation. We study its strong and Δ-convergence, stability and data dependence in hyperbolic spaces. Our results are extension, improvement and generalization of several recent results in CAT(0) and uniformly convex Banach spaces.

References:

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Session: *Fixed Point Theory and its Applications*

Generalized perturbed trapezoid inequalities for convex function and applications

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In this paper, the Authors establish a new general identity for twice differentiable functions. Afterwards some new inequalities are presented related to general perturbed trapezoid inequality for the classes of functions whose second derivatives of absolute values are convex. Last of all, applications to special means have also been presented.

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Session: *Others*

Numerical solutions of reaction-diffusion equation systems with trigonometric quintic B-spline collocation algorithm

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In this study, the numerical solutions of the reaction-diffusion systems are investigated via the trigonometric quintic B-spline finite element collocation method. These equations are appeared in various disciplines in order to describe some physical facts such as pattern formation, autocalytic chemical reaction and population dynamics. Schnakenberg, Gray-Scott and Brusselator models are several special cases of the reaction diffusion systems and they are considered as numerical examples in this paper. For the numerical purpose, Crank-Nicolson formulas are used for the time discretization and the resulted system is linearized by Taylor expansion. In finite element method, a uniform partition of the solution domain is constructed for the space discretization. Over the mentioned mesh, dirac-delta function and trigonometric quintic B-spline functions are chosen as the weighted function and the basis functions respectively. Thus the reaction-diffusion system turns into an algebraic system which can be represented by a matrix equation so that the coefficients are bloc matrices containing certain number of non-zero elements in each row. The method is tested on different problems. To illustrate the accuracy, error norms are calculated in the linear problem whereas the relative error is given in the other nonlinear problems. Subject to the character of the nonlinear problems, the occurring spatial patterns are formed by the trajectories of the dependent variables.

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Session: *Advances in Difference Differential and Dynamic Equations and Applications*

Translation hypersurfaces in Euclidean space with zero scalar curvature

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We study translation hypersurfaces in Euclidean n-space that can locally be written as the sum of function of one variable are parametrized. We obtain parametrizations all these hypersurfaces with zero scalar curvature. Finally we give examples of these hypersurfaces.

References:

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Session: *Others*

On the dynamics of the non-linear difference equation $x_{n+1} = \alpha + \beta x_{n-1} + x_{n-1}/x_n$

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In this talk, a certain second order fractional difference equation containing two arbitrary parameters is handled. The issue equation is investigated with aspects of some dynamics structures: the boundedness character and semi-cycle analysis of positive solutions are examined; existence of periodic solutions is studied; local and global stability analysis of the fixed point are performed. Numerical examples are provided to illustrate the theory.

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Session: *Advances in Difference Differential and Dynamic Equations and Applications*

Some Belluce-Kirk type fixed point theorems in CAT(0) Spaces

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In 1967, Belluce and Kirk (Proc. Amer. Math. Soc. 20, (1969), 141-146) proved some core results for nonexpansive mappings with a diminishing orbital diameter in Banach spaces. In this paper, we extend these results (due to Belleuce and Kirk) to CAT(0) spaces wherein we also utilize the concept of normal structure to prove some existence results on fixed points in CAT(0) spaces. In process, results of Belluce and Kirk (Proc. Amer. Math. Soc. 20, (1969), 141-146) as well as R. DeMarr (Pacific J. Math. 13, (1963), 1139-1141) are generalized and improved.

Session: *Fixed Point Theory and its Applications*

Multiparameter second order Sturm-Liouville equations

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In this talk, the nested circles will be introduced for the multiparameter second order Sturm-Liouville equations defined on time scales. Then squarely integrable solutions will be investigated.

References:

[**1**] G. Sh. Guseinov, *An expansion theorem for a Sturm-Liouville operator on semi-unbounded time scale*, Adv. Dyn. Syst. Appl. **3** (2008), 147-160.

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Session: *Advances in Difference Differential and Dynamic Equations and Applications*

Some summability results concerning the sequences of random elements in Banach spaces

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In this talk we introduce a new type of uniform integrability for sequences of Banach valued measurable functions (random elements) by using Bochner integral so that we generalize the concept of A-compactly uniform integrability. Furthermore, we study the concepts of A-strong convergence and A-statistical convergence, which are some of the main concepts of the summability theory, for sequences of random elements and we investigate the relationship among these concepts by using this new type of uniform integrability.

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Session: *Others*

The combinatorial representation of Jacobsthal and Jacobsthal Lucas sequences

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In this study, by using Jacobsthal and Jacobsthal Lucas matrix sequences we define k-Jacobsthal, k-Jacobsthal Lucas matrix sequences de- pending on one parameter k: After that by using two parameters $(s;t)$ we define $(s;t)$ Jacobsthal and $(s;t)$-Jacobsthal Lucas matrix sequences. And then, we establish combinatoric represantations of all of these matrices.

Session: *Others*

On nonlinear multidimensional singular integral operators

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In this study, we present three theorems on approximation by nonlinear multiple integral operators having suitable singularity assumptions. In the first theorem, we prove existence of the operators. In other words, the operators are well defined in the space $L_p(D)$. Here, the symbol D stands for an arbitrary bounded box in R^n. In the next, main theorem of this study, the pointwise approximation at generalized Lebesgue points of the functions $f \in L_p(D)$ is obtained. In the last theorem, rate of pointwise convergence is established.

References:

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Session: *Others*

Chaos synchronization of fractional chaotic maps

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This work discusses chaos and chaos synchronization of a class of fractional chaotic maps. Discrete fractional calculus is used to introduce memory effects into discrete maps. General Chaotic behaviors are shown. Image encryption of fractional order is illustrated as one of the possible applications. Furthermore, chaos synchronization is designed according to stability conditions.

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Session: *Fractional Calculus and its Applications*

Some Pólya-Szegö and Chebyshev types inequalities for the fractional q, ρ-integral operator

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In this talk, we prove certain new Pólya-Szeg types q-intgeral inequalities including the fractional q, ρ-integral operator introduced in [1]. Also, we establish some Chebyshev types fractional q-integral inequalities using these inequalities.

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Session: *Fractional Calculus and its Applications*

Classification of nonoscillatory solutions of four-dimensional dynamic systems on time scales

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There are a number of cases in which the theory of time scales can be applicable. Therefore, it is of great significance that we study the properties of nonoscillatory solutions of four-dimensional time-scale systems in order to unify these discrete and continuous cases. In this study, nonoscillatory solutions of four-dimensional time-scale systems of first order dynamic equations on time scales are investigated.

Session: *Advances in Difference Differential and Dynamic Equations and Applications*

Some monotonicity results on k-Gamma and q,k-Gamma functions

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Diaz and Pariguan introduced k-analogue of Pochhammer symbol and by aid of this definition they give k-analogues of gamma function $\Gamma(x)$ and beta function $B(x,y)$ with their properties in [1]. Authors in [2] define q,k generalized Pochhammer symbol in order to construct the q,k-generalized gamma $\Gamma_{q,k}(x)$ and beta $B_{q,k}(x,y)$ functions. They show some properties of these functions, these are the generalizations of classical gamma and beta functions. They also obtain commutative relation between gamma, q-gamma, k-gamma and q,k-gamma functions. In this presentation, we give some monotonicity results for these new generalized k-gamma $\Gamma_k(x)$ and q,k-gamma $\Gamma_{q,k}(x)$ functions and by the help of them we obtain some related inequalities.

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Session: *Others*

Graph-Directed IFS with Condensation

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Graph-directed iterated function systems (GIFS) can be considered as a generalization of the notion of classical (hyperbolic) iterated function systems (IFS) (see [1, 2]). On the other hand, an IFS with condensation consists of finite contractions on a complete metric space and a condensation map which is a constant map on the Hausdorff space of the complete metric space. In this work, we define GIFS with condensation as a generalization of the classical notion of IFS with condensation to the graph-directed case and prove the existence of the attractor of the system as a fixed point of the corresponding operator.

(This work is supported by the Anadolu University Research Fund Under Contract 1605F473.)

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Session: *Fixed Point Theory and its Applications*

Solvability of an inverse problem for a transport equation

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In this work we deal with solvability of a two-dimensional integral geometry problem for a family of curves of given curvature. Solvability of the problem is proved via solvability of a two-space-dimensional inverse problem for a transport-like equation by using the Galerkin method. The main difficulty in studying the integral geometry problems lies in their overdeterminacy. Therefore, the initial data for these problems cannot be arbitrary; they should satisfy some solvability conditions which are difficult to establish. On using some extension of the class of unknown functions the overdetermined problem is replaced by the determined problem. This is achieved by assuming that the unknown function depends not only upon the space variable (as in the case of the classical integral geometry problem), but also upon the direction in some special manner.

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Session: *Others*

Generalized Feynman-Kac formula on time scales and Black Scholes model

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In this study, we give a general form of Feynman-Kac formula, which is widely used in mathematical finance, stochastic control and related fields. This general formula provides a stochastic representation for the solutions of partial integro-differential equation which can be used in option pricing in a Lévy market model. Indeed, these results can be considered as a unification and generalization of the random difference equation and stochastic dynamic results. We first review Itô's formula and a formulation of martingale problem on time scales. Then, a general ∇-stochastic dynamic equation under square integrable martingale processes will be studied with existence and uniqueness of solution. The results are employed in the discussion of infinitesimal generator and generalized Feynman-Kac formula on time scales.

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Session: *Advances in Difference, Differential and Dynamic equations and their applications*

Approximation in Smirnov spaces on Dini-smooth curves

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Approximation of complex functions were researched by several authors. Especially, there are sufficiently wide investigations relating to approximation problems in simply connected domains. But approximation problems do not investigated sufficiently wide in the doubly connected domains. Meanwhile, some approximation problems were studied in the literature (for example, see [2], [3] and [5]) for doubly connected domains. In this work, we present a Jackson-type direct theorem approximation theory in the Smirnov spaces, defined doubly-connected domain on Dini-smooth curves.

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Session: *Others*

Trigonometric approximation in Lebesgue spaces with variable exponent

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The approximation of trigonometric polynomials were widely researched by many mathematicians. For example, some results can be found in [**1-5**]. In this talk, we give a theorem concerning trigonometric approximation. In particular, the degree of approximation by matrix transforms of Fourier series are investigated in Lebesgue spaces with variable exponent.

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Session: *Others*

First order differential operators associated to Cauchy-Riemann operator in several elliptic complex numbers

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In this article we consider the initial value problem $u(0,x,y) = u_0(x,y)$, $v(0,x,y) = v_0(x,y)$ for a linear first order system

$$\begin{aligned} \partial_t u &= \mathcal{L}_1\left(\partial_{x_j} u \partial_{y_j} u, \partial_{x_j} v, \partial_{y_j} v, u, v\right), \\ \partial_t v &= \mathcal{L}_2\left(\partial_{x_j} u, \partial_{y_j} u, \partial_{x_j} v, \partial_{y_j} v, u, v\right) \end{aligned}$$

of partial differential equations. Here u and v are real-valued functions of t, x and y; t means the time, $x = (x_1, \ldots, x_n)$ and $y = (y_1, \ldots, y_n)$ run in a bounded domain in $\mathbb{R}^n$, and the initial functions u_0 and v_0 are holomorphic with respect to the structure polynomial $X^2 + \beta X + \alpha$. First we rewrite the system in elliptic complex form for several elliptic complex numbers $(z_1, \ldots, z_n)$ with $z_j = x_j + iy_j$, $j = 1, \cdots, n$, and $i^2 = -\beta i - \alpha$. Then we solve the initial value problem with holomorphic initial functions in several elliptic complex numbers by applying the method of associated operators.

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Session: *Advances in Difference Differential and Dynamic Equations and Applications*

On hyperbolic type semi-discrete equations with finite dimensional characteristic x-ring.

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We consider integrable semi-discrete equations of hyperbolic type. To study such equations it is convenient to use the notion of characteristic ring. In particular a semi-discrete equation of hyperbolic type is Darboux integrable if and only if its characteristic x- and n-rings are finite dimensional. In the present work we give necessary and sufficient conditions for characteristic x-ring to have dimension four and five.

Session: *Advances in Difference Differential and Dynamic Equations and Applications*

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