International Conference on Mathematics and Computer Science
4th Edition - MACOS 2022

Braşov, September 15-17, 2022

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September 17, 2022

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And ... other participants of MACOS 2022:
Nicoleta Enache-David
Olivia Florea
Andreea Fulga
Gabriela Petruşel
Gabriel Stan

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PENTALOG

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Abstracts

Combinatorial optimization interdiction problems with linear costs

September 15
16:00-16:50
Transilvania
University Hall

Javad Tayyebi[1]

[1]Department of Industrial Engineering, Birjand University of Technology, Iran

Abstract: A most important category of optimization problems is the class of combinatorial optimization (CO) problems. A CO problem constitutes two sets: a set E as well as a subset P of the power set of E. The elements of P are called objects and have a common structure depended on the problem. There is a decision maker, called the user, whose aim is to find an object which optimizes an objective function among all objects of P. Two types of objective functions are studied in the literature: (I) sum type (II) bottleneck type. Here, we investigate an extension of CO problems in which there is another decision maker except the user, called the attacker. Two decision makers have conflicting goals. The user wants to solve the CO problem while the attacker enables to change the coefficients of its objective function under some restrictions so as to worsen the optimal value of the user as much as possible. This problem is referred to as the combinatorial optimization interdiction (COI) problem. It is supposed that the attacker faces with two types of constraints: a linear budget constraint and bound constraints. We develop algorithms to show that the COI problem with linear interdiction costs can be solved in polynomial time for both the types of objective functions under some special circumstances.

Semilocal Approximation an some popular Diophantine equations

September 15
17:10-18:40
Transilvania
University Hall

Preda Mihăilescu[1]

[1] Mathematisches Institut, Georg-August-University,
Goettingen, Germany

Abstract: We present new techniques of semilocal approximation of algebraic numbers emerging from the assumed solutions to some popular ternary exponential Diophantine equations.

September 16
9:00-9:50
Transilvania
University Hall

Inevitable remarks on some recent results in metric fixed point theory

Erdal Karapınar[1]

[1] Cankaya University, Ankara, Turkey.

Abstract: The main goal of this talk is to express the dilemmas of the metric fixed point theorems that was initiated by Banach in 1922. It is quite possible to Express many of the real-world problems in the context of the fixed point theorems. It indicates that how the fixed point theory is useful and how huge application potential it has. But, a lot of results are repeated in this theory, which is of great interest. A substantial part of the new results suggested overlaps with the already existing results.

To support this observation, I shall share a few examples from the current literature.

September 16
10:00-10:20

Successive coefficients of close-to-convex functions

Paweł Zaprawa[1]

[1] Lublin University of Technology, Poland

Abstract: Let $\mathcal{C}$ denote the class of univalent functions which are close-to-convex in the unit disk Δ. A function f belongs to $\mathcal{C}$ if there exist a number $\beta \in (-\pi/2, \pi/2)$ and a function $g \in \mathcal{S}^*$, starlike in Δ, such that

$$\left\{ \frac{e^{i\beta} z f'(z)}{g(z)} \right\} > 0, \quad z \in \Delta \ .$$

We consider a subclass $\mathcal{C}_0(k)$ of $\mathcal{C}$, for which $\beta = 0$ and a starlike function g is of the form $k(z) = \frac{z}{(1-z)^2}$. Functions in $\mathcal{C}_0(k)$ satisfy the following geometric condition

$$w \in f(\Delta) \Rightarrow \{w + t : t \geq 0\} \subset f(\Delta) \ .$$

This means that each function in $\mathcal{C}_0(k)$ is convex in the positive direction of the real axis.

Let $F_n = a_{n+1} - a_n$ and $G_n = |a_{n+1}| - |a_n|$. We obtain the estimates of $|F_n|$ and G_n, $n \in \mathbb{N}$ while $f \in \mathcal{C}_0(k)$.

On Marx-Strohhäcker type results for multivalent functions and their n^{th} root

September 16
10:20-10:40
UI6 Room

Dorina Răducanu [1]

[1]Transilvania University of Brasov, Romania

Abstract: Two Marx-Strohhäcker type results for multivalent functions and their n^{th} root are given. Both results provide a lower bound, over the unit disc, of $\Re \sqrt[n]{\frac{f(z)}{z^p}}$ for functions that are p-valent starlike of a given order and uniformly p-valent starlike of a given order, respectively. Connections with previous results are indicated.

Logarithmic coefficients for a class of analytic functions defined by subordination

September 16
10:40-11:00
UI6 Room

Andreea Nistor-Şerban[1] and Dorina Răducanu [2]

[1]Transilvania University of Brasov, Romania
[2]Transilvania University of Brasov, Romania

Abstract: In this paper we consider a class of functions $\mathcal{M}_\alpha(\varphi)$ defined by subordination, consisting of functions $f \in \mathcal{A}$ satisfying the condition

$$(1-\alpha)\frac{zf'(z)}{f(z)} + \alpha\left(1 + \frac{zf''(z)}{f'(z)}\right) \prec \varphi(z),\ z \in U.$$

In the study of univalent functions, estimates on the Taylor coefficients are usually given. Another significant problem deals with the estimates of logarithmic coefficients. For the class $\mathcal{S}$ of univalent functions no sharp bounds for the modulus of the individual logarithmic coefficients are known if $n \geq 3$. For different subclasses of $\mathcal{S}$ the results are not better and in most cases only the first three initial coefficients of $\log \frac{f(z)}{z}$ are considered. For the class $\mathcal{M}_\alpha(\varphi)$ we obtain upper bounds for the logarithmic coefficients $\gamma_n,\ n \in \{1,2,3\}$ and also for $\Gamma_n,\ n \in \{1,2,3\}$, the logarithmic coefficients of the inverse of $\mathcal{M}_\alpha(\varphi)$. Connections with previous known results are pointed out.

September 16
11:00-11:20
UI6 Room

Some new characterizations of inner product spaces regarding the p-angular distance

Mario Krnić (joint work with Nicusor Minculete)[1]
[1]University of Zagreb, Croatia

Abstract: In this talk we derive some new bounds for the p-angular distance

$$\alpha_p[x,y] = \big\| \|x\|^{p-1}x - \|y\|^{p-1}y \big\|$$

in a normed linear space X and consequently, we establish the corresponding new characterizations of inner product spaces. Our first goal is to prove a characterization of an inner space which looks familiar to the Hile inequality, although it shows significantly different behavior since the Hile inequality holds in every normed space. More precisely, we prove that if $|p| \geq |q|$, $p \neq q$, then X is an inner product space if and only if for every $x, y \in X \setminus \{0\}$,

$$\alpha_p[x,y] \geq \frac{\|x\|^p + \|y\|^p}{\|x\|^q + \|y\|^q}\alpha_q[x,y].$$

Next, we establish several new characterizations of an inner space based on the Maligranda bounds for the angular distance. Finally, our results are compared with some previously known results from the literature.

September 16
11:30-11:50
UI6 Room

Asymptotic expansions of stable means

Lenka Mihoković[1]
[1]University of Zgreb, Croatia

Abstract: Consider *bivariate mean* M, i.e. function $M\colon \mathbb{R}^+ \times \mathbb{R}^+ \to \mathbb{R}^+$ such that

$$\min(a,b) \leq M(a,b) \leq \max(a,b).$$

M. Raissouli introduced a notion of *stable mean* with the following condition imposed

$$M(a,b) = M\big(M(a,M(a,b)), M(M(a,b),b)\big).$$

It can easily be seen that the arithmetic mean is stable and more general, the binomial power mean is also stable. The logarithmic and identric means are known not to be stable. The open problem of finding all pairs (p,q) such that Gini means $G_{p,q}$ and Stolarsky means $E_{p,q}$ are stable was stated by the same author.

The series $\sum_{n=0}^{\infty} a_n\varphi_n(x)$ is said to be an *asymptotic expansion* of a function $f(x)$ as $x \to x_0$ if for each $N \in_0$

$$f(x) = \sum_{n=0}^{N} a_n\varphi_n(x) + o(\varphi_N(x)).$$

Approximation of the function to a given accuracy is achieved by approaching the variable to a certain fixed point or a point at infinity. A small number of members of this series ensures a good approximation.

For a symmetric homogeneous stable mean we find asymptotic power series expansion of a form

$$M(x-t,x+t)=\sum_{n=0}^{\infty}a_n t^{2n}x^{-2n+1},\ \text{as } x\to\infty,$$

where coefficients a_n are given by recursive relation. By including known asymptotic expansions of parametric means it is shown how the obtained coefficients are used to solve the problem of identifying stable means within classes of parametric means under consideration.

Comparison of exact and heuristic method for numerical approximation of functions

September 16
11:50-12:10
UI6 Room

Tomislav Burić[1]

[1]University of Zagreb,Croatia

Abstract: We analyse and compare exact and heuristic methods for numerical evaluation of elementary functions in terms of polynomial and rational approximations. The results are presented together with advantages and disadvantages of exact methods in regard to heuristic methods considering function behaviour within interval for which approximation is obtained.

Redistributing algorithms and Shannon's Entropy: how to redistribute the ties?

September 16
12:10-12:30
UI6 Room

Flavia-Corina Mitroi-Symeonidis[1] and Eleutherius Symeonidis[2]

[1]Academy of Economic Studies, Department of Applied Mathematics,
Calea Dorobanţi 15-17, sector 1, Bucharest RO-010552, Romania
[2]Mathematisch-Geographische Fakultät, Katholische Universität Eichstätt-Ingolstadt,
85071 Eichstätt, Germany

Abstract: The mathematical problems discussed in our talk arise in the framework of time series analysis. The permutation entropy is used, and the underlying probabilities are established by redistributing the tuples with ties. We point out the changes of Shannon's entropy due to modifications of the distribution probability by means of various redistributing algorithms.

September 16
12:30-12:50
UI6 Room

On the Space of Homogeneous Modified Harmonic Polynomials

Eleutherius Symeonidis[1]

[1]Mathematisch-Geographische Fakultät, Katholische Universität Eichstätt-Ingolstadt, 85071 Eichstätt, Germany

Abstract: The solutions $u : \Omega \to \mathbb{R}$ (Ω a domain in $\mathbb{R}^d$, $d \geq 3$) of the equation

$$x_d \cdot \left(\frac{\partial^2 u}{\partial x_1^2} + \ldots + \frac{\partial^2 u}{\partial x_d^2} \right) + (d-2) \cdot \frac{\partial u}{\partial x_d} = 0$$

are called *modified harmonic functions*. Let $r := \sqrt{x_1^2 + \ldots + x_d^2}$. In his article entitled "Modified Spherical Harmonics in Several Dimensions" (Adv. Appl. Clifford Algebr., 29 (2019)), Heinz Leutwiler conjectures that the set

$$\left\{ r^{2n+2d-4} \cdot \frac{\partial^n r^{4-2d}}{\partial x_1^{\alpha_1} \ldots \partial x_{d-1}^{\alpha_{d-1}}} \mid \alpha_1, \ldots \alpha_{d-1} \in \cup\{0\};\ \alpha_1 + \ldots + \alpha_{d-1} = n \right\}$$

is linearly independent, thus forming a basis of the space of homogeneous modified harmonic polynomials of degree n on $\mathbb{R}^d$. In our talk we present a proof of this conjecture.

September 16
12:50-13:10
UI6 Room

Estimates of approximation using higher order moduli of continuity

Radu Păltănea[1]

[1]Faculty of Mathematics and Computer Science, Transilvania University of Braşov, Romania

Abstract: For a function $f \in B[a,b]$, for an integer $k \geq 2$ and for a number $h > 0$, we consider the following modulus of continuity of order k:

$$\begin{aligned} \tilde{\omega}_k(f,h) &= k! \sup \Big\{ \prod_{i=1}^{k} (x_{i+1} - x_i) |[f; x_1, x_2, \ldots, x_{k+1}]|, \\ &\qquad a \leq x_1 < x_2 < \ldots < x_{k+1} \leq b,\ x_{k+1} - x_1 \leq kh \Big\}, \end{aligned}$$

where $[f; x_1, x_2, \ldots, x_{k+1}]$ is the divided difference of function f on the points $x_1 < x_2 < \ldots < x_{k+1}$. Also denote by

$$\omega_j(f,h) = \sup\{|\Delta_\rho f(x)|,\ x, x+\rho \in [a,b],\ 0 < \rho \leq h\},$$

the usual moduli of continuity of order $j \geq 1$.

Let $L : C[a,b] \to C[a,b]$ be an arbitrary positive linear operator. We obtain a general estimate of the difference $|L(f,x) - f(x)|$, $x \in [a,b]$, using modulus $\tilde{\omega}_k(f,h)$ in combinations with the moduli of continuity $\omega_j(f,h)$, $1 \leq j \leq k-1$ in terms of the moments of operator L.

In the second part it is obtained a general estimate of the degree of approximation for arbitrary positive linear operators using a double weighted second order modulus of continuity.

Several inequalities related to the numerical radius

September 16
13:10-13:30
UI6 Room

Nicuşor Minculete[1]

[1]Faculty of Mathematics and Computer Science,
Transilvania University of Braşov, Romania

Abstract: The aim of this presentation is to give new upper bounds of $\omega(T)$, which denotes the numerical radius of an operator T on a Hilbert space $(H, \langle \cdot, \cdot \rangle)$. Next, we give certain inequalities about radius $\omega(S^*T)$.

Energy drift and stochastic process in the three-body problem

September 16
15:30-16:20
Transilvaniay
University Hall

Marian Gîdea[1]

[1]Yeshiva University, New York, USA

Abstract: We consider the three-body problem as a model for the motion of a small body (e.g., asteroid or spacecraft) under the gravitational influence of two massive bodies (e.g., Sun and Jupiter). We study the effect of the eccentricity of the orbits of the massive bodies on the motion of the small body. We show that for all small eccentricity values we can find trajectories of the asteroid along which the energy can grow significantly. Also, we can find trajectories which make chaotic jumps in energy. We show that the distributions of energies along such trajectories converge to a Brownian motion with drift as the eccentricity value tends to zero. Our results solve some conjectures made by V.I. Arnold and B. Chirikov. We use a methodology that combines geometric and topological methods with computer assisted proofs.

About some speeds of convergence to the the constant of Euler

September 16
16:30-16:50
UI6 Room

Andrei Vernescu[1]

[1]Valahia University of Târgoviște,Romania

Abstract: The speed of convergence of the classical sequence which defines the constant of Euler (or Euler- Mascheroni), $\gamma = \lim_{n\to\infty} \gamma_n = 0.5777\ldots$, where $\gamma_n = \sum_{k=1}^{n} \left(\frac{1}{k}\right) - \ln n$, was intensively studied.

In 1983, I established one of the first two sided estimates of this speed, namely $\frac{1}{2n+1} < \gamma_n - \gamma < \frac{1}{2n}$ Further several new sequences with a faster convergence are defined either by modifying the argument of the logarithm (De Temple, 1993, Negoi 1997, Ivan 2002) or by modifying the last term 1/n of the harmonic sum (Vernescu 1999). Now we give a systematic study of these speeds of convergence and especially of the last ones.

On approximation properties of some non-positive Bernstein-Durrmeyer type operators modified in the Bezier-King sense

September 16
16:50-17:10
UI6 Room

Bianca Vasian[1]

[1]Faculty of Mathematics and Computer Science,
Transilvania University of Braşov, Romania

Abstract: In this paper we will propose some new Bernstein-Durrmeyer type operators modified in Bezier-King sense, which are not positive on the entire interval $[0,1]$. Firstly we will show that these operators approximate all continuous functions on an interval $[0,\xi]$ on which they are positive, using the Ditzian-Totik modulus of continuity. Further, we will prove that, even though the operators are not positive on the entire $[0,1]$, they can approximate all continuous functions on $[0,1]$, first, by using the first order modulus of continuity, and then the second order one, with the aproppiate K-functionals

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On the convergence of power series of positive linear operators

September 16
17:10-17:30
UI6 Room

Ştefan Garoiu[1] and Radu Păltănea[2]

[1,2]Faculty of Mathematics and Computer Science,
Transilvania University of Braşov, Romania

Abstract: In this paper we will introduce a more general series of Bernstein operators which will be an extension of geometric series of Bernstein operators introduced by R. Păltănea. Namely, we will introduce the operators $A_n^s : \psi C[0,1] \to \psi C[0,1]$, given by $A_n^s = \frac{1}{s!n^{s+1}} \sum_{k=s}^{\infty} (k)_s (B_n)^{k-s}$, where $(k)_s = k(k-1)\dots(k-s+1)$ and we will study their approximation properties. In this sense, we have obtained a convergence result and a generalized Voronovskaja theorem. On the other hand, following the work of Raşa, we will prove that our operator approximate the integral of the C_0-semigroup approximated by Bernstein operators, mentioning that our proof relies on applying Nachbin's theorem instead of using the eigenvalues of Bernstein operators. We mention that these results can be extended to a more general class of operators on the space $C_0[0,1]$, but this would require too many additional conditions, therefore we will restrict ourselves only to Bernstein operators.

The 3-convexity flavor of the Hornich-Hlawka inequality

September 16
17:30-17:50
UI6 Room

Constantin P. Niculescu[1,2]

[1]University of Craiova, Department of Mathematics, Craiova 200585, Romania
[2]Academy of Romanian Scientists, Bucharest, Romania

Abstract: The following result is proved:

Suppose that E is an ordered Banach space and $f : \mathbb{R}_+ \to E$ is a continuous 3-convex function. Then f verifies the functional inequality

$$f(x) + f(y) + f(z) + f(x+y+z) \geq f(x+y) + f(y+z) + f(z+x) + f(0)$$

for all $x, y, z \in \mathbb{R}$.

If, in addition, f is nondecreasing and concave, then

$$f(|x|) + f(|y|) + f(|z|) + f(|x+y+z|) \geq f(|x+y|) + f(|y+z|) + f(|z+x|) + f(0)$$

for all $x, y, z \in \mathbb{R}$.

This extends a result previously obtained by Ressel by a different method.

End-to-end data privacy using homomorphic encryption models

September 16
18:00-18:20
UI6 Room

Răzvan Bocu[1] and Delia Monica Duca Iliescu[2]

[1,2]Faculty of Mathematics and Computer Science,
Transilvania University of Braşov, Romania

Abstract: The integrated collection of personal health data represents a relevant research topic, which is enhanced further by the development of next-generation mobile networks that can be used in order to transport the acquired medical data. The gathering of personal health data has become recently feasible using relevant wearable personal devices. Nevertheless, these devices do not possess sufficient computational power, and do not offer proper local data storage capabilities. This paper presents an integrated personal health metrics data management system, which considers a virtualized symmetric 5G data transportation system. The personal health data are acquired using a client application component, which is normally deployed on the user's mobile device, regardless if it is a smartphone, smartwatch, or another kind of personal mobile device. The collected data are securely transported to the cloud data processing components, using a virtualized 5G infrastructure and homomorphically encrypted data packages. The system has been comprehensively assessed through the consideration of a real-world use case, which is presented.

Mammographic texture analysis in the diagnosis of breast cancer

September 16
18:20-18:40
UI6 Room

Andreea-Bianca Lixandru[1], Laura Dioșan [2] and Mircea-Lucian Sasu[3]

[1] Transilvania University of Brasov, Romania
[2] University Babeș-Bolyai, Cluj-Napoca, Romania
[3] Transilvania University of Brasov, Romania

Abstract: Worldwide, the incidence of breast cancer is expanding. Although population-based screening is accessible in many nations, it may not be the best use of digitalization resources. The adoption of a solution based on automatic processing of mammographies is a crucial component of risk-based screening. In this paper we investigate multiple models for classification of textures on a medical dataset which contains mammography scans. For extracting the features, in this article we will present two different approaches: one will use the Local Binary Pattern feature and the other one will use the Gray Level Co-ocurrence Matrix feature, to make possible a texture classification for MIAS dataset. More than this, the models are validated on Kylberg dataset and we observed that the classification using texture features is working very promising also on the medical dataset. The research will present in detail the implementation, the scores obtained for both approaches and a comparison between the models.

Advances in CUDA for Computational Physics

September 16
18:40-19:00
UI6 Room

Delia Spridon[1]

[1]Faculty of Mathematics and Computer Science,
Transilvania University of Braşov, Romania

Abstract: Advances in the GPU development led to the opportunity for software developers to increase the execution speed for their programs by massive parallelization of the algorithms by using GPU programming. CUDA is a parallel computing architecture developed by NVIDIA and it includes a set of CUDA instructions and the hardware part for parallel computing. Computational Physics is an interdisciplinary field in continuous development that studies, develops and optimizes numerical algorithms and computational techniques for their application in solving various physics problems. Computational Physics has applicability in all sub-branches of physics or similar fields: biophysics, astrophysics, plasma physics, biomechanics, fluid physics, etc. Moreover, with the evolution of technology in the last few decades, this relatively new field has helped to quickly obtain results in these fields, facilitating the connection between theoretical and experimental physics. In this paper, the latest researches and results obtained in computational physics, especially in plasma domain by using GPU computing with CUDA architecture are presented.

Image processing in medicine: the algorithms and datasets for searcing the spatial location of brain intracranial aneurysms

September 16
19:00-19:20
UI6 Room

Sergey Sinitsa[1]

[1]Kuban State University, Krasnodar, Russia

Abstract: This presentation is about the current results of solving the problem of cerebral aneurysms spatial location according to computer tomography and magnetic resonance imaging angiography data. It also gives a review of algorithms and datasets that can be used to perform this search.

Fixed Point Theory for Abstract Volterra Operators

September 16
10:00-10:20
UI3 Room

Adrian Petruşel[1]

[1]Babeş-Bolyai University, Department of Mathematics, Cluj-Napoca, Romania

Abstract: Several notions of abstract Volterra operators on spaces of functions of one variable are well known (C. Corduneanu, Abstract Volterra equations: a survey, Math. Comput. Modeling, 32(2000), 1503-1528; E.S. Zhukovskii, M.J. Alves, Abstract Volterra operators, Russian Math., 52(2008), 1-14; I.A. Rus, Some variants of contraction principle in the case of operators with Volterra property: step by step contraction principle, Adv. Theory of Nonlinear Anal. Appl., 3(2019), No. 3, 111-120). In this paper, we introduce a notion of abstract Volterra operators in spaces of functions of several variables. Some fixed point equations with such abstract Volterra operators are also studied. The talk is based on a recent joint work with I.A. Rus.

Interpolation type iterated function systems

September 16
10:20-10:40
UI3 Room

Radu Miculescu[1]

[1]Transilvania University of Braşov,
Faculty of Mathematics and Computer Science, Braşov, Romania

Abstract: By scrutinizing the crucial features of the iterated function systems used in the construction of fractal interpolation functions we introduce the concept of interpolation type iterated function system and prove that such a system has attractor and that it admits canonical projection.

September 16
10:40-11:00
UI3 Room

Fixed points of interpolative contractions

Isa Yildirim[1], Y. Serdar Sahin[2]

[1]Atatürk University, Turkey
[2]Atatürk University, Turkey

Abstract: The purpose of this paper is to give some results for classes of interpolative Kannan type contraction and interpolative Reich–Rus–Cirić type contraction in complete convex $b-$metric spaces (in short ccbms).

September 16
11:00-11:20
UI3 Room

A countable fractal interpolation scheme involving Rakotch contractions

Cristina Păcurar[1]

[1]Faculty of Mathematics and Computer Science,
Transilvania University of Braşov, Romania

Abstract: The main result of this paper states that for a given countable system of data Δ, there exists a countable iterated function system consisting of Rakotch contractions, such that its attractor is the graph of a fractal interpolation function corresponding to Δ. In this way, on the one hand, we generalize a result due to N. Secelean (see *The fractal interpolation for countable systems of data*, Univ. Beograd. Publ. Elektrotehn. Fak. Ser. Mat., **14** (2003), 11–19) by considering countable systems consisting of Rakotch contractions rather than Banach contractions. On the other hand, we generalize a result due to S. Ri (see *A new idea to construct the fractal interpolation function*, Indag. Math., **29** (2018), 962-971) by considering countable (rather than finite) systems consisting of Rakotch contractions. Some exemplifications are provided.

September 16
11:30-11:50
UI3 Room

Some remarks on convex orbital operators

Ovidiu Popescu[1]

[1]Transilvania University of Braşov, Department of Mathematics and Computer Sciences,
Braşov, Romania

Abstract: The aim of this paper is to clarify the notion of orbital convex Lipschitz operator and prove some fixed point theorems which generalize and complement several results in the theory of nonlinear operators.

The approximation of controls using moment problems

September 16
11:50-12:10
UI3 Room

Ionel Rovenţa[1] and József Kolumbán[2]

[1]Department of Mathematics, University of Craiova, Romania

Abstract: We consider a finite-difference semi-discrete scheme for the approximation of boundary controls for wave equation. The continuous problem is controllable but the high frequency numerical spurious oscillations lead to a loss of the uniform (with respect to the mesh size) controllability property of the semi-discrete model in the natural setting.

Basically, this difficulty can be treated using an appropriate filtering technique to eliminate the short wave length components of the solutions/initial data of the discrete system, i.e. the large frequencies of the discretized problem. Our aim consists of filtering the initial data in an optimal range in order to restore the uniform controllability property. Moreover, we obtain a relation between the range of filtration and the minimal time of control. The technique used here is based on solving a moment problem.

A study on the Research Directions of some Cesàro and Rhaly Operators

September 16
12:10-12:30
UI3 Room

Amelia Bucur [1], María del Carmen Listán - García[2] and María del Pilar Romero-De La Rosa[3]

[1]Lucian Blaga University of Sibiu, Romania
[2]University of Cádiz, Spain
[3]University of Cádiz, Spain

Abstract: In this article, we present a study on the research directions for Cesàro operators and their generalizations, with details for two different directions, namely (A) extended eigenvalues and extended eigenoperators, and (B) statistical convergence and strong Rhaly convergence. Thus, one of the purposes of this paper is to give an observation of the extended eigenvalues to the third power of the discrete Cesàro operator C_0 defined on the complex Banach spaces l^2 by the expression $(C_0 f)(n) = \frac{1}{n+1}\sum_{k=0}^{n} f(k)$. For a bounded linear operator T on a complex Banach space, a complex scalar λ is said to be an extended eigenvalue, if there is a non-zero operator X and $TX = \lambda XT$. Such an operator X is called an extended eigenoperator of T corresponding to the extended eigenvalue λ. In this work it is shown that the set of extended eigenvalues for the operator $C_0^3 : l^2 \to l^2$, is the interval $[1, \infty)$. Also, for one of the generalizations of the discrete operator Cesàro, namely a type of Rhaly operators, $(R_a f)(n) = \frac{1}{a_n}\sum_{k=0}^{n} f(k)$, we presented details about statistical convergence and strong Rhaly convergence by moduli for double sequences. Given a modulus function f, we established that a double sequence that is f-strong Rhaly convergent is always f-statistically convergent. The results of this paper adapt the

results obtained in (Fernando León-Saavedra, María del Carmen Listán-García and María del Pilar Romero de la Rosa in J. Inequal. Appl.2022:62) to Rhaly concepts.

Fixed point theory for multi-valued nonlinear graph contractions in complete metric spaces

September 16
12:30-12:50
UI3 Room

Mădălina Moga [1], Adrian Petruşel[2], Radu Truşcă[3]
[1]Babeş-Bolyai University Cluj-Napoca, Romania
[2]Academy of Romanian Scientists, Romania
[3]Babeş-Bolyai University Cluj-Napoca, Romania

Abstract: Let (M,d) be a metric space and $P(M)$ be the set of all nonempty subsets of M. We also denote by $P_{cl}(M)$ the set of all nonempty closed subsets of M. We denote by H the generalized Pompeiu-Hausdorff metric on $P_{cl}(M)$.

A function $\varphi : [0,\infty[\to [0,\infty[$ is called a strong comparison function if φ is increasing and the series $\sum_{k=0}^{\infty}\varphi^k(t)$ is convergent for any $t>0$.

If $F : M \to P(M)$ is a multi-valued operator, then $m \in M$ is called a fixed point for F if $m \in F(m)$. Then, $Fix(F) := \{m \in M : m \in F(m)\}$ is the fixed point set of f, while the symbol $SFix(F) := \{m \in M : F(m) = \{m\}\}$ denotes the set of all strict fixed points of F. The symbol $Graph(F) := \{(m,p) \in M \times M : p \in F(m)\}$ is the graph of the multi-valued operator F.

Definition. *Let (M,d) be a metric space. Then, an operator $F : M \to P(M)$ is called a multi-valued graph φ-contraction if there exists a strong comparison function $\varphi : [0,\infty[\to [0,\infty[$ such that*

$$H(F(m),F(p)) \leq \varphi(d(m,p)), \text{ for every } (m,p) \in Graph(F).$$

The purpose of this paper is to give several results, concerning existence, approximation and localization of the fixed point/strict fixed points, for the fixed point inclusion $m \in F(m)$ where $F : M \to P_{cl}(M)$ is a multi-valued nonlinear graph φ-contraction.

Some fixed point theorems in the framework of f-metric spaces

September 16
12:50-13:10
UI3 Room

Bogdan-Cristian Anghelina[1]
[1]Faculty of Mathematics and Computer Science,
Transilvania University of Braşov, Romania

Abstract: This presentation is concerned with the notion of f-metric space, a genuine generalization of the concept of b-metric space. We extend Matkowski, Kannan and Chatterjea type fixed point theorems in the context of f-metric spaces.

$\varphi-$ Contractive Orbital Affine Iterated Function Systems

September 16
13:10-13:30
UI3 Room

Irina Savu[1]

[1]University Politehnica of Bucharest, Faculty of Applied Sciences, Bucharest, Romania

Abstract: In this paper we introduce the notion of $\varphi-$contractive orbital affine iterated function system (oAIFS for short), which is based on the notions of affine iterated function system and $\varphi-$contractive orbital iterated function system. We present two results which give a description of the functions of an oAIFS and establish sufficient conditions to exist a norm with specific properties on the linear space where the functions are defined. Two examples are provided.

An application of Edelstein's contraction principle: the attractor of a graph-directed generalized iterated function system

September 16
16:30-16:50
UI3 Room

Radu Miculescu[1], Alexandru Mihail[2] and Silviu-Aurelian Urziceanu

[1]Transilvania University of Brasov, Romania
[2]University of Bucharest, Romania
[3]Polytechnic University of Bucharest, Romania

Abstract: This paper gathers two generalizations of iterated function systems, namely the one introduced by the first two authors under the name of generalized iterated function systems and the one introduced by D. MauldinS. Williams and G. Boore K. Falconer under the label of graph-directed iterated function systems. By combining them we introduce the concept of a graph-directed Generalized iterated function system. We prove that, under suitable contractivity assumptions on the constitutive functions of such a system and structural assumptions on the underlying metric space, it generates, via Edelstein's contraction principle, a unique attractor. The result is illustrated by two examples.

About the B-concavity of functions with many variables

September 16
16:50-17:10
UI3 Room

Alexandra-Diana Melesteu[1]

[1]Transilvania University of Brasov, Faculty of Mathematics and Informatics, Romania

Abstract: The paper deals with the study of the property of B-concavity and BB-concavity in the multi-dimensional case and with the relation between these properties and the Bernstein operators defined on a simplex.

September 16
17:10-17:30
UI3 Room

Fixed point theorems on product of b-metric spaces

Izabella Abraham[1]

[1]Faculty of Mathematics and Computer Science,
Transilvania University of Braşov, Romania

Abstract: The aim of this paper is to extend some fixed point results from [Şerban, M. A., *Teoria punctului fix pentru operatori definiţi pe produs cartezian*, Presa Universitară Clujeană, Cluj–Napoca, 2002] and [Prešić, S. B., *Sur une classe d' inéquations aux différences finite et sur la convergence de certaines suites*, Publ. Inst. Math. (Beograd) (N. S.). **5(19)** (1965), 75-78] in the framework of b-metric spaces.

September 16
10:00-10:20
UI2 Room

On the solutions of several coupled systems of fractional differential inclusions

Aurelian Cernea[1]

[1]Faculty of Mathematics and Informatics, University of Bucharest, Romania

Abstract: We present a short survey of some recent results concerning the existence of solutions for several classes of coupled systems of fractional differential inclusions. Such kinds of coupled systems seem to be very useful in the research of several physical phenomena.

We consider systems with integro-multistrip-multipoint boundary conditions, with nonlocal non-separeted boundary conditions, with mixed order fractional order differential inclusions and with nonlocal integral boundary conditions

Our approach use Filippov's technique, avoids the applications of fixed point theorems and takes into account the case when the values of the set-valued maps are not convex; instead the set-valued maps are assumed to be Lipschitz in the second and third variable..

September 16
10:20-10:40
UI2 Room

Fractional q-difference Schrödinger equations with integral and multi-point boundary conditions

Umit Aksoy[1]

[1]Atılım University, Turkey

Abstract: In this talk, we study the existence and uniqueness of the solution of a class of nonlinear fractional q-difference Schrödinger equations with integral and multi-point boundary conditions. We introduce the Green's function for the associated linear problem which is used to transform the nonlinear problem into an integral equation. Conditions for the existence-uniqueness of the solution of the problem are discussed and an example is provided to demonstrate the application of our result.

Nonlinear Diffusion-based Image Edge Detection Solutions

September 16
10:40-11:00
UI2 Room

Tudor Barbu[1]

[1]Faculty of Mathematics and Computer Science,
Transilvania University of Braşov, Romania

Abstract: Edge detection, which has the purpose of detecting sharp changes in image brightness, represents a fundamental tool in image processing and analysis, and computer vision. It includes a variety of mathematicalapproaches that aim at identifying the edges in digital images. Here, the state of the art edge detection techniques based on partial differential equations (PDE) are surveyed. Our own contributions in this image analysis domain are also presented in this work. The anisotropic diffusion-based edge detection techniques inspired by the influential Perona – Malik diffusion model are disscused first. Nonlinear reaction-diffusion models for edge detectionare then presented here. One of them uses a modified version of thePerona – Malik scheme with edge indicators, while anotherone is based on a modified version of the FitzHugh-Nagumo reaction-diffusion equations.Another image edge detection solution described here combines succesfully anisotropic diffusion and total variation-based models.Other variational edge detection algorithms based on the total variation (TV) regularization are also described. A nonlineardiffusion-based edge detection approach using the mean curvature motion and a local scale controlled piecewise linear diffusion model for edge detection aredisscused next. Fuzzy anisotropic diffusion-based edge detection algorithms arealso presented.Nonlinear PDE-based detection techniques using higher order partial differential equations, such as the fourth-order You-Kaveh model, or combinations between secondand fourth order PDEs, are then described. Finally, the edge detection techniques developed by us are presented in this work. While the most of the anisotropic diffusion-based edge detection schemes have a variational character, the nonlinear PDE-based models proposed by us are non-variational, since they cannot be derived from some energy functional minimizations. Such an effective automatic edge detection method that is described here performs a nonlinear anisotropic diffusion-based multi-scale image analysis by using a non-variational well-posed second-order PDE model. The edges are detected at each scale of this PDE-based scale-space by determiningthe zero-crossings and applying some gradient magnitude thresholding operationsand morphologicalprocesses. The edges identified at multiple scales are then combined using a fine-to-coarse edgetracking approach. Method comparison results are also provided. .

September 16
11:00-11:20
UI2 Room

On the existence and uniqueness of solutions of fractional dynamic equations on time scales

Inci Erhan[1]

[1]Atılım University, Turkey

Abstract: In this talk, we discuss the existence and uniqueness of solutions of a Cauchy problem associated with a nonlinear Caputo fractional dynamic equation of arbitrary order $\alpha > 0$, defined on a time scale. After detailed introduction on the fractional integral and derivatives on time scales, we state the problem and formulate it as a fixed point problem posed on a b-metric space. Finally, we present a numerical example to support our theoretical results.

September 16
11:30-11:50
UI2 Room

On the Mersenne Hybrinomial Quaternions

Engin Özkan[1], Bahar Kuloğlu[2] and Engin Eser[3]

[1,2,3]Erzincan Binali Yıldırım University,Turkey

Abstract: In this paper, we introduce Mersenne hybrinomial quaternions and present some of their properties. Some identities are derived for these polynomials. Furthermore, we give the Binet formulas, Catalan, Cassini, d'Ocagne identity and generating and exponential generating function of these hybrinomial quaternions.

September 16
11:50-12:10
UI2 Room

On Mersenne Hybrid Quaternions

Engin Özkan[1] and Mine Uysal[2]

[1,2]Erzincan Binali Yıldırım University,Turkey

Abstract: We define Mersenne, Mersenne-Lucas hybrid quaternion. We give the Binet's formula, the generating functions, exponential generating functions and sum formula of these numbers. We find some relations among Mersenne-Lucas hybrid quaternion, Jacobsthal hybrid quaternion, Jacobsthal-Lucas hybrid quaternion and Mersenne hybrid quaternion. Then we present some important identities such as Cassini identities for Mersenne, Mersenne-Lucas hybrid quaternion.

Division quaternion algebras over extensions of degree l^n (where l is an odd prime integer) of quadratic number fields

September 16
12:10-12:30
UI2 Room

Diana Savin (joint work with Vincenzo Acciaro, Mohammed Taous and Abdelkader Zekhnini) [1]

[1] Transilvania University of Brasov, Romania

Abstract: Let F be a quadratic number field and let p and q are positive prime integers. We obtain a complete characterization of division quaternion algebras $H_L(p,q)$, where L is an extension of F of degree l such that L is a dihedral extension of $\mathbb{Q}$, or else L is an abelian l-extension of F, unramified over F whenever l divides the class number of F.
Keywords: quaternion algebras; ramification theory in algebraic number fields.
MSC 2020: Primary: 11R04; 11R11; 11R21; 11R32: 11R52 ; 11S15; Secondary: 11R37; 11R29; 11A41; 11F85.

Surfaces associated with Pascal and Catalan triangles

September 16
12:30-12:50
UI2 Room

Adela Mihai[1,2]

[1]Technical University of Civil Engineering Bucharest, Romania
[2]Transilvania University of Braşov, Romania

Abstract: An open problem in reliability theory is that of finding all the coefficients of the reliability polynomial associated with particular networks. Because reliability polynomials can be expressed in Bernstein form (hence linked to binomial coefficients), it is clear that an extension of the classical discrete Pascal's triangle (comprising all the binomial coefficients) to a continuous version (exhibiting infinitely many values in between the binomial coefficients) might be geometrically helpful and revealing. We investigated some geometric properties of a continuous extension of Pascal's triangle: Gauss curvature, mean curvatures, geodesics and level curves, as well as their symmetries. These results have been published in [V. Beiu, L. Daus, M. Jianu, A. Mihai, I. Mihai, On a surfaces associated with Pascal's triangle, Symmetry 14(2) (2022), art. 411.]. As a further study, we investigate surfaces associated with Catalan triangles [S. Achimescu, L. Daus, M. Jianu, I. Mierlus-Mazilu, A. Mihai, D. Tudor, O.-A. Roman, On a surface associated to Catalan triangle, preprint].

September 16
12:50-13:10
UI2 Room

Cosmological Finsler Spacetimes

Nicoleta Voicu[1], Manuel Hohmann[2] and Christian Pfeifer[3]

[1]Transilvania University of Braşov, Romania
[2]University of Tartu, Estonia
[3]Center of Applied Space Technology and Microgravity (ZARM),University of Bremen, Germany

Abstract: We first introduce the notion of Finsler spacetime manifold. Then, for Finsler spacetimes equipped with a global time function, we iden- tify the Lie Algebra of symmetry generators of spatially homogeneous and isotropic Finsler geometries, thus generalizing Friedmann-Lemaître-Robertson- Walker geometry. In particular, we find the most general spatially homogeneous and isotropic Berwald spacetimes, which are Finsler spacetimes that can be re- garded as closest to pseudo-Riemannian geometry.

September 16
16:30-16:50
UI2 Room

Methods Used to Extract the Photovoltaic Cells and Panel Parameters

Adrian-Marius Deaconu[1]

[1]Faculty of Mathematics and Computer Science,
Transilvania University of Braşov, Romania

Abstract: The methods to estimate the parameters of the photovoltaic cells and panels have been developed since 1963. In time, the researchers developed methods to calculate one, two, and all parameters of the photovoltaic cells and panels, under different conditions, such as laboratory or natural sunlight conditions, under light or in the dark, in normal light, or in concentrated light. More recently, the metaheuristic algorithms started to be used to extract the parameters of the photovoltaic cells and panels with very good accuracy. Nowadays, these algorithms surpass the other methods developed to calculate the photovoltaic cells parameters. This paper briefly presents the main methods introduced in time, and tested for photovoltaic parameters extraction. The algorithms' results for known datasets from literature are compared and ranked by different error formulae.

Credentials are the holy grail for hackers

September 16
16:50-17:10
UI2 Room

Cristina-Alexandra Caldarea[1], Silviu-Razvan Dumitrescu [2]

[1] Atos, Romania
[2] Transilvania University of Brasov, Romania

Abstract: Identity and Access Management is that module of Cyber Security domain which transforms identities into accounts. With an account you can authenticate to an application (ex: account provides credentials). To manage access on various features of the application you must have rights (permissions). This presentation will cover the general concept, some experienced good practices and what means innovation in IAM.

An Incremental Minimum Flow Algorithm

September 16
17:10-17:30
UI2 Room

Luciana Majercsik [1]

[1]Transilvania University of Brasov, Romania

Abstract: There are certain problems, that occur in economy, in the design of the electrical or water supply networks or in other various situations, that can be modelled and solved as minimum flow problems. When changes occur in the networks, either by the modification of the capacity or of the lower bound of an arc, the recalculation of the minimum flow in the modified network can be highly time consuming. This paper proposes an incremental minimum flow algorithm, based on a data structure that produces decreasing paths without complex computations.

Bottleneck spanning tree interdiction problem with fixed and linear costs

September 16
17:30-17:50
UI2 Room

Abolfazl Abdolahzadeh[1], Massoud Aman[2], Javad Tayyebi[3]

[1,2,3]Department of Industrial Engineering, Birjand University of Technology, Iran

Abstract: This paper investigates the bottleneck spanning tree interdiction problem. This is a game containing two players with conflicting goals. The first player, called the user, wants to find a bottleneck (min-max or max-min) spanning tree in a weighted network. The other player, called the attacker, increases edge weights under a budget constraint as well as bound constraints so that the user does not achieve his/her goal. This game has a hierarchy structure. It means that the attacker first perturbates the network and then, the user chooses his/her strategy after observing the attacker's action. This paper considers the problem in two cases that there are fixed and linear costs for the attacker. Two divide-and-conquer algorithms are developed to solve the problem under both the costs in polynomial time.

September 16
18:00-18:20
UI2 Room

Spatial behaviour in the coupled theory of viscoelasticity of porous materials

Adina Chirilă[1]

[1]Transilvania University of Brasov, Faculty of Mathematics and Informatics, Romania

Abstract: We analyse a right cylinder made of a viscoelastic material with pores. The mathematical model is represented by a system of equations of steady vibrations for the displacement vector, the changes of the volume fraction and the pressure. The spatial behaviour is characterised in terms of some cross-sectional functional.

September 16
18:20-18:40
UI2 Room

Existence of solutions for a variational relation promblem

Mircea Balaj[1] and Dan Florin Serac[2]

[1,2] University of Oradea, Romania

Abstract: Let X be a nonempty compact and convex subset of a topological vector space and Z be a topological vector space. Let $T : X \rightrightarrows Z$ be a set-valued mapping with nonempty, compact and convex values and $\rho(x, y, z)$ be a relation linking elements $x \in X$, $y \in X$ and $z \in T(X)$. Assume that:

(i) ρ is T-convex in the variable z and closed.

(ii) ρ^c is convex in the variable y;

(iii) ρ is T-KKM;

Then, there exists an $x_0 \in X$ and $z_0 \in T(x_0)$ such that $\rho(x_0, y, z_0)$ holds for all $y \in X$.

September 16
18:40-19:00
UI2 Room

Some results for isotropic micropolar bodies with pores

Iana M. Fudulu[1] and Marin Marin[2]

[1,2]Faculty of Mathematics and Computer Science,
Transilvania University of Braşov, Romania

Abstract: This paper is concerned with the theory of isotropic micropolar media, and its purpose is defined by obtaining both the variational principle and the continuous dependence in the case of the mentioned theory. An new presentation of our mixed problem is defined by the corresponding basic equations of the present theory and the initial and boundary conditions. With respect to this alternative characterization, the convolutional variational principle is obtained, followed by the obtaining of the continuous dependence of the solutions over the initial data and the terms of external supply in the present context.

Inside Neural Networks

Detlef Streitferdt[1]

[1]Technische Universität Ilmenau, Germany

September 17
9:00-9:50
PIII1 Room

Abstract: Machine learning became a prominent technology with artificial neural networks as its current and highly discussed model. Although the results of image analysis / recognition or speech detection are very promising, the analysis of neural networks itself and their behavior is still a very hard task due to the complexity of the models. Even a single software neuron puts high demands on the assessment of software quality aspects. Current models with thousands of interconnected neurons require by far more elaborated software tools and methods. This talk gives a software engineering overview of the current state in analyzing neural networks within the software development life-cycle. It addresses the limits of using neural networks and emphasizes the corresponding pitfalls a software engineer has to cope with.

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