Third Romanian Itinerant Seminar on Mathematical Analysis and its Applications

Alba Iulia, September 10-12, 2021

Edited by:

- Ioan-Lucian Popa ("1 Decembrie 1918" University of Alba Iulia)
- Daniel Breaz ("1 Decembrie 1918" University of Alba Iulia)

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Opening Speech

by Professor Gheorghe Morosanu
(Babes-Bolyai University)

Dear Colleagues,

Welcome to the third meeting of the Romanian Itinerant Seminar on Mathematical Analysis and Its Applications (RISMAA) that I launched myself in 2017.

As you know, the first meeting took place in 2018 at Babes-Bolyai University, the organizers being then Professors Adrian Petrusel, Marcel Serban and myself. It was a very successful conference, which strengthened our hope for a remarkable future evolution of this scientific project.

The second edition of RISMAA took place in 2019 at the Ovidius University of Constanta, under the coordination of the late Professor Constantin Popa. It was also a great success which confirmed the need for these periodic meetings of researchers who love mathematical analysis. I myself participated then, with great enthusiasm, and I gave a plenary lecture on that occasion. At the end of that conference, our colleague Lucian Popa came to me, on his own initiative, and told me that he wanted to organize the third meeting, in 2020, at the University of Alba Iulia. Unfortunately, the covid pandemic strongly influenced his plan from bad to worse. I recall that when I launched RISMAA (in 2017), I stated that *although there are nowadays excellent means of communication, face-to-face conversations cannot be replaced by anything else, so periodic meetings are strongly needed.*

By meetings I then meant meetings in person. Under the present circumstances we cannot completely follow this idea. It was decided to postpone the third edition of RISMAA for 2021, and replace the live format with the hybrid format.

I apologize that I myself cannot participate in person at this edition of RISMAA. Part of my family lives in the US and I have not been able to get there in the last 2 years. My grandchildren's invitation was stronger than my desire to meet you. But I am with you from afar and I will try to follow online what is going to happen in Alba Iulia.

I wish you all Good Luck! See you at the next edition of RISMAA!

Conference via Zoom:

Time: Sep 10, 2021 17:00 PM Bucharest
Join Zoom Meeting:
https: https://zoom.us/j/4103568066?pwd=d2hOQkJ4STdkL0NEUkFBWEhiaUNrUT09
Meeting ID: 410 356 8066
Passcode: RISMAA-21

Time: Sep 11, 2021 9:00 AM Bucharest
Join Zoom Meeting:
https: https://zoom.us/j/4103568066?pwd=d2hOQkJ4STdkL0NEUkFBWEhiaUNrUT09
Meeting ID: 410 356 8066
Passcode: RISMAA-21

Technical Program

September 10, 2021

16:00 - 17:00 Registration. Venue: Apor Palace
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Opening Address
Prof. Dr. Daniel Breaz
Rector of "1 Decembrie 1918" University of Alba Iulia

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17:20-18:00 Some New Trends in Fractional Calculus and its Applications
Dumitru Băleanu

18:00-18:40 Fixed Point Equations with Abstract Volterra Operators on Spaces of Functions of Several Variables
Adrian Petruşel

18:40-19:00 On Some Concepts of Uniform Dichotomy for Evolution Operators in Banach Spaces
Rovana Boruga(Toma), Mihail Megan, Daniela Maria-Magdalena Toth

19:00-21:00 Welcome Reception (University Restaurant)

September 11, 2021

9:00-11:00 Session 2 (Council Hall) Chair: Dorin Andrica

9:00-9:40 Recent Trends in Geometric Function Theory
Daniel Breaz

9:40-10:00 Convergence Estimates for Some Two Parameters Singularly Perturbed Problems for Sine-Gordon Type Equations
Andrei Perjan, Galina Rusu

10:00-10:20 On Well-posedness Associated with a New Class of Constrained Optimization Problems
Savin Treanţă

10:20-10:40 A Spectral Criterion for the Existence of the Stabilizing Solution of a Class of Riccati Type Differential Equations with Periodic Coeficients
Vasile Drăgan, Ioan-Lucian Popa

10:40-11:00 On A_n-Bounded Operator Valued Analytic Functions
Ilie Valuşescu

11:00-11:30 Coffee Break

11:30-12:40 Session 3 (Council Hall) Chair: Ilie Valuşescu

11:30-11:50 Adaptive Gradient Descent and Slow Manifolds
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11:50-12:10 Cauchy's Integral Formula with Applications to Polynomial Coefficients and Partitions
Ovidiu Bagdasar

12:10-12:30 The Determinant Formulae for the Rodrigues General Problem When the Eigenvalues Have Double Multiplicity
Dorin Andrica, Oana-Liliana Chender

12:30-12:50 A Fractional Differential Inclusion with Mixed Boundary Conditions
Aurelian Cernea

12:50 - 14:00 Lunch (University Restaurant)

14:00-17:20 Session 4 (Council Hall) Chair: Aurelian Cernea

14:00-14:40 The Hardy-Littlewood-Pólya Inequality of Majorization in the Context of Ordered Banach Spaces
Constantin P. Niculescu

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Vicente Bevia, Juan Carlos Cortés

15:00-15:20 On Uniform Stability of Linear Discrete-time Systems in Banach Spaces
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15:20-15:40 Maia's Fixed Point Theorems for Discontinuous Mappings
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15:40-16:00	Torsional Creep Problems Involving Grushin p-Laplacian *Denisa Stancu-Dumitru*
16:00-16:20	On Coupled Nonlinear Oscillators of a Mechanical System of Vibration Reduction *Gheorghe Moroşanu, Cristian Vladimirescu*
16:20-16:40	Dynamics of the Infection by SARS-CoV-2 *Carla M.A. Pinto*
16:40-17:20	Unbounded Solutions of Third Order Three-point Boundary Value Problems on a Half-line *Ravi P. Agarwal*

17:20-19:00 Tour of Alba Iulia Citadel

19:00-21:00 Dinner (University Restaurant)

September 12, 2021

Departure of participants

Abstracts

Some new trends in fractional calculus and its applications

Sep 10
17:20-18:00

Dumitru Băleanu[1]

[1]Department of Mathematics, Faculty of Art and Sciences,Cankaya University, Ankara, Turkey

[2]Institute of Space Sciences, Magurele-Bucharest,Romania

Abstract: Fractional calculus deals with the study of the fractional-order integral and derivative operators over real or complex domains, and their applications. In my talk, I will present some new trends from both theoretical and experimental viewpoints.

Fixed Point Equations with Abstract Volterra Operators on Spaces of Functions of Several Variables

Sep 10
18:00-18:40

Adrian Petruşel[1]

[1]Babeş-Bolyai University 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), No. 3, 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 various notions of abstract Volterra operators in spaces of functions of several variables. Some fixed point equations with such abstract Volterra operators are also studied. The basic ingredient in the theory of step by step contraction is the notion of G-contraction (I.A. Rus, Cyclic representations and fixed points, Annals T. Popoviciu Seminar, 3(2005), 171-178). The relevance of step by step contraction principle is illustrated by applications in the theory of Darboux-Ionescu problem.
The talk is based on some recent joint works with I.A. Rus and M.A. Şerban.

References:

[1] T.A. Burton: *A note on existence and uniqueness for integral equations with sum of two operators: progressive contractions*, Fixed Point Theory, **20**(2019), no. 1, 107-113.

[2] C. Corduneanu: *Abstract Volterra equations: a survey*, Math. Comput. Modeling, **32**(2000), 1503-1528.

[3] V. Ilea, D. Otrocol: *On the Burton method of progressive contractions for Volterra integral equations*, Fixed Point Theory, **21**(2020), no. 2, 585-594.

[4] A. Petruşel, I.A. Rus: *On some classes of Fredholm-Volterra integral equations on spaces of functions on several variables*, Montes Taurus J. Pure Appl. Math. (in press).

[5] A. Petruşel, I.A. Rus, M.A. Şerban: *Some variants of fibre contraction principle and applications: from existence to the convergence of successive approximations*, Fixed Point Theory, **22**(2021), no. 2, 795-808.

[6] 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.

[7] E.S. Zhukovskii, M.J. Alves: *Abstract Volterra operators*, Russian Math. (Iz. VUZ), **52**(2008), no. 3, 1-14.

Sep 10
18:40-19:00

On Some Concepts of Uniform Dichotomy for Evolution Operators in Banach Spaces

Rovana Boruga(Toma)[1], Mihail Megan[2], Daniela Maria-Magdalena Toth[1]

[1]West University of Timisoara/Department of Mathematics, Faculty of Mathematics and Computer Science, Timisoara, Romania

[2]Academy of Romanian Scientists, 050094 Bucharest, Romania,
West University of Timisoara/Departament of Mathematics, Faculty of Mathematics and Computes Science, Timisoara, Romania

Abstract: The paper presents three concepts of uniform dichotomy: uniform exponential dichotomy, uniform polynomial dichotomy and uniform dichotomy with growth rates for dynamical systems described by evolution operators in Banach spaces. Characterizations and conections between these concepts are given.
Keywords: evolution operators, uniform exponential dichotomy, uniform polynomial dichotomy, uniform dichotomy with growth rates.
MSC2010: 34D05, 93D20.

Sep 11
9:00-9:40

Recent Trends in Geometric Function Theory

Daniel Breaz[1]

[1]"1 Decembrie 1918" University of Alba Iulia, Romania

Abstract: We consider some new general integral operators which extend integral classical operators in geometric functions theory. Also, we prove some properties of univalence, starlike, convexity and other results for this operators.

Convergence Estimates for Some Two Parameters Singularly Perturbed Problems for Sine-Gordon Type Equations

Sep 11
9:40-10:00

Andrei Perjan[1], Galina Rusu[1]

[1]Department of Mathematics, Moldova State University, Chisinau, Republic of Moldova

Abstract: In the real Sobolev space $H_0^1(\Omega)$ we consider the Cauchy-Dirichlet problem for sine-Gordon type equation with strongly elliptic operators and two small parameters. Using some a priori estimates of solutions to the perturbed problem and a relationship between solutions in the linear case, we establish convergence estimates for the difference of solutions to the perturbed and corresponding unperturbed problems. We obtain that the solution to the perturbed problem has a singular behavior, relative to the parameters, in the neighbourhood of $t = 0$.

Keywords: Sine-Gordon type equation, singular perturbation, boundary layer function, a priory estimate.

MSC2010: 35B25, 35K15, 35L15, 34G10.

Acknowledgements. Researches supported by the Project 20.80009.5007.25.

References:

[1] T.A. Burton: *A note on existence and uniqueness for integral equations with sum of two operators: progressive contractions*, Fixed Point Theory, **20**(2019), no. 1, 107-113.

[2] C. Corduneanu: *Abstract Volterra equations: a survey*, Math. Comput. Modeling, **32**(2000), 1503-1528.

[3] V. Ilea, D. Otrocol: *On the Burton method of progressive contractions for Volterra integral equations*, Fixed Point Theory, **21**(2020), no. 2, 585-594.

[4] A. Petruşel, I.A. Rus: *On some classes of Fredholm-Volterra integral equations on spaces of functions on several variables*, Montes Taurus J. Pure Appl. Math. (in press).

[5] A. Petruşel, I.A. Rus, M.A. Şerban: *Some variants of fibre contraction principle and applications: from existence to the convergence of successive approximations*, Fixed Point Theory, **22**(2021), no. 2, 795-808.

[6] 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.

[7] E.S. Zhukovskii, M.J. Alves: *Abstract Volterra operators*, Russian Math. (Iz. VUZ), **52**(2008), no. 3, 1-14.

Sep 11
10:00-10:20

On Well-posedness Associated With a New Class of Constrained Optimization Problems

Savin Treanţă[1]

[1]University Politehnica of Bucharest, Department of Applied Mathematics, Bucharest, Romania

Abstract: In this paper, by using the notions of monotonicity, lower semicontinuity, pseudomonotonicity and hemicontinuity associated with the considered scalar multiple integral functional, we investigate well-posedness for a new class of control problems with variational inequality constraints. More precisely, by introducing the approximating solution set of the considered class of variational control problems, we formulate and prove several characterization results on well-posedness. Also, in order to highlight the theoretical results and tools derived in the paper, some illustrative examples are provided.

Keywords: well-posedness; well-posedness in the generalized sense; variational control problem; monotonicity; pseudomonotonicity; hemicontinuity; multiple integral functional.

MSC2010: 49K40; 65K10.

Sep 11
10:20-10:40

A Spectral Criterion for the Existence of the Stabilizing Solution of a Class of Riccati Type Differential Equations with Periodic Coefficients

Vasile Drăgan[1], Ioan-Lucian Popa[2]

[1]Institute of Mathematics "Simion Stoilow" of the Romanian Academy, P.O.Box 1-764, RO-014700, Bucharest, Romania
and the Academy of the Romanian Scientists
[2]Department of Computing, Mathematics and Electronics, "1 Decembrie 1918" University of Alba Iulia, 510009 - Alba Iulia, Romania

Abstract: This talk is devoted to show the existence and uniqueness of a stabilizing solution to a periodic backward nonlinear differential equation. This class of nonlinear equations includes as special cases many of the continuous-time Riccati equations arising both in deterministic and stochastic linear quadratic type control problems.

Keywords: generalized Riccati equations; stabilizing solution; the periodic case; characteristic multipliers.

MSC2010: 49N10; 93E20

On A_n-bounded Operator Valued Analytic Functions

Sep 11
10:40-11:00

Ilie Valuşescu[1]

[1]Institute of Mathematics "Simion Stoilow" of the Romanian Academy (IMAR), Bucharest, Romania

Abstract: For various purposes, scalar valued analytic functions was extended to vector valued, or operator valued analytic functions. Such a way, bounded operator valued analytic functions was extended to the class of L^2-bounded operator valued analytic functions, to find a model for infinite variate prediction. In this paper the class of L^2-bounded operator valued analytic functions, which generalized the class of bounded operator valued analytic functions $\{\mathcal{E}, \mathcal{F}, \Theta(z)\}$, is extended to the class of A_n-bounded operator valued analytic functions, or Bergman bounded analytic functions, to the aim of modeling the structure of n-hypercontractions in a similar mode which was made for contraction functional model in $C_{0\cdot}$ case. The functional model of a contraction in $C_{0\cdot}$ class given by the maximal function of the contraction is remembered, and a similar model for the case of n-hypercontractions is given with an attached maximal function which is actually an A_n-bounded operator valued analytic function on the unit disc $\mathbb{D}$.

Adaptive Gradient Descent and Slow Manifolds

Sep 11
11:30-11:50

Adrian Viorel[1]

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

Abstract: Recently, Y. Malitsky and K. Mishchenko have reignited the interest in classical gradient descent, albeit with variable step size, by proving that convergence rates cand be obtained without assuming the global Lipschitz continuity of the objective function's gradient and thus, without an a priori condition on the step size. We build upon their ideas and show that the true power of adaptive step size gradient descent manifests itself in the presence of so called slow manifolds, along which the local flatness allows for larger and larger steps.
Keywords: gradient flows, gradient descent, slow manifolds, convex optimization.
MSC2010: 90C26, 90C30, 65K10.

Sep 11
11:50-12:10

On Some Exact Integral Formulae for Polynomial Coefficients and Enumeration of Multipartitions

Ovidiu Bagdasar[1]

[1]University of Derby, College of Science and Engineering, Derby, United Kingdom

Abstract: The Cauchy integral formula has numerous applications in various mathematics fields, including complex analysis, combinatorics, or number theory. Here we show how it can be used to derive exact formulae for the coefficients of cyclotomic polynomials and other classes of special polynomials. We also discuss applications to the enumeration of ordered multi-partitions with equal sum for multisets, where we present some recent additions to the Online Encyclopedia of Integer Sequences (OEIS).

MSC2010: 11B83, 05A15, 05A16, 05A18, 11B75.

References:

[1] Andrica, D., Bagdasar, O., *On some results concerning the polygonal polynomials*, Carpathian J. Math., **35** (2019), 1–12.

[2] Andrica, D., Bagdasar, O., *A new formula for the coefficients of Gaussian polynomials*, An. Şt. Univ. Ovidius Constanţa **27**(3) (2019), 25–36.

[3] Andrica, D., Bagdasar, O., *Remarks on a family of complex polynomials*, Appl. Anal. Discr. Math., **13** (2019), 605–618.

[4] Andrica, D., Bagdasar, O.: Recurrent Sequences: Key Results, Applications and Problems. Springer (2020)

[5] Andrica, D., Bagdasar, O., *On k-partitions of multisets with equal sums* The Ramanujan Journal, **55** (2021), 421–435.

Sep 11
12:10-12:30

The Determinant Formulae for the Rodrigues General Problem when the Eigenvalues Have Double Multiplicity

Dorin Andrica[1], Oana-Liliana Chender[1]

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

Abstract:

Consider the analitic function f defined on the domain $D \subseteq \mathbb{C}$. If $X \in M_n(\mathbb{C})$ and $\sigma(X) \subset D$, then according to the Hamilton-Cayley-Frobenius theorem, we have the Rodrigues formula for the matrix $f(X)$

$$f(X) = \sum_{k=0}^{n-1} a_k^{(f)}(X) X^k,$$

where the numbers $a_0^{(f)}(X), \ldots, a_{n-1}^{(f)}(X)$ are the Rodrigues coefficients of f with respect to the matrix X. The determination of the Rodrigues coefficients for a given analytic function is called *the Rodrigues general problem* (see [1]).

In the paper [2, Theorem 5] the Rodrigues general problem is completely solved when the eigenvalues $\lambda_1, \ldots, \lambda_s$ of the matrix $X \in M_{2s}(\mathbb{C})$ are distinct and have double multiplicity. The main purpose of this present paper is to present, in this

case, a closed form for the Rodrigues coefficients by involving suitable determinants of order $n = 2s$.

References:

[1] D. Andrica, O.L. Chender (Broaina), *A New Way to Compute the Rodrigues Coefficients of Functions of the Lie Groups of Matrices* in "Essays in Mathematics and its Applications" in the Honor of Vladimir Arnold, Springer, 2016, 1-24.

[2] O.L. Chender (Broaina), *Computational Aspects of the General Rodrigues Problem* in "Mathematical Analisys in Interdisciplinary Research", I.N. Parasidis, E. Providas, Th. M. Rasias, Eds., Springer Nature, 14 pp, to appear.

A Fractional Differential Inclusion with Mixed Boundary Conditions

Sep 11
12:30-12:50

Aurelian Cernea[1]

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

Abstract: A Caputo type fractional derivative of a function with respect to another function ([3]) that extends and unifies several fractional derivatives existing in the literature like Caputo, Caputo-Hadamard, Erdélyi-Kober was intensively studied in recent years. In particular, existence results and qualitative properties of the solutions for fractional differential equations defined by this fractional derivative are obtained in [1,2].

We extend the study to the set-valued framework and we consider the following problem

$$D_C^{\alpha,\psi}x(t) \in F(t,x(t)) \quad a.e.\ ([a,b]), \quad x(a) = x_0, \quad x'(0) = x_1, \quad x(b) = kI^{\alpha,\psi}x(c), \tag{1}$$

where $D_C^{\alpha,\psi}$ is the fractional derivative mentioned above, $\alpha \in (2,3)$, $x_0, x_1, k \in \mathbf{R}$, $c \in (a,b]$ and $F : [a,b] \times \mathbf{R} \to \mathcal{P}(\mathbf{R})$ is a set-valued map which is Lipschitz in the state variable.

Our aim is twofold. On one hand, we show that Filippov's ideas can be suitably adapted in order to obtain the existence of solutions for problem (1) and on the other hand, we prove the arcwise connectedness of the solution set of problem (1).

Keywords: differential inclusion, selection, boundary value problem.

MSC2010: 34A60, 26A33, 34A08.

References:

[1] R. Almeida, *Fractional differential equations with mixed boundary conditions*, Bull. Malays. Math. Sci. Soc. 42 (2019), 1687-1697.

[2] R. Almeida, A.B. Malinowska, M.T.T. Monteiro, *Fractional differential equations with a Caputo derivative with respect to a kernel function and their applications*, Math. Meth. Appl. Sci 41 (2018), 336-352

[3] A.A. Kilbas, H.M. Srivastava, J.J. Trujillo, *Theory and Applications of Fractional Differential Equations*, Elsevier, Amsterdam, 2006.

Sep 11
14:00-14:40

The Hardy-Littlewood-Pólya Inequality of Majorization in the Context of Ordered Banach Spaces

Constantin P. Niculescu[1]

[1]University of Craiova, Romania

Abstract: The Hardy-Littlewood-Pólya inequality of majorization is extended to the framework of ordered Banach spaces. Our main result deals with Gâteaux differentiable convex functions whose differentials are isotone (that is, order preserving). Then the conclusion is extended to a nondifferentiable framework involving convex functions defined on open N-dimensional intervals of $\mathbb{R}^N$, which verify a condition of monotonicity à la Popoviciu (called by us 2-box monotonicity). Several applications illustrating our findings are also included.

Sep 11
14:40-15:00

Numerical Probabilistic Analysis of a Generalized Random Logistic Model

Vicente Bevia[1], Juan Carlos Cortés[1]

[1]Instituto de Matemática Multidisciplinar, UPV, Valencia, Spain

Abstract: Consider the following initial value problem (IVP) based on a non-autonomous ordinary differential equation

$$\dot{N}(t) = \alpha(t)\, r\, N(t) \left(1 - \left(\frac{N(t)}{K}\right)^{\nu}\right), \quad t > 0, \tag{1}$$

$$N(0) = N_0. \tag{2}$$

This type of equation can model a great variety of growth processes [1] due to the fact that it can account for a time-dependent lag phase ($0 \leq \alpha(\cdot) \leq 1$, [2]) after which it has has a logistic-type growth, as well as a deceleration parameter (ν) which affects the time at which growth speed begins to decay. The remaining parameters have the same meaning as in the usual logistic model: $r > 0$ is the initial growth rate, $K > 0$ is the asymptotic state of the system, $N(t)$ is the state at time $t \geq 0$ and N_0 is the initial state of the model.
In this contribution we will give a density-based probabilistic analysis of the IVP (1)–(2) with random initial condition and random parameters. The probability density function is obtained by solving the Liouville-Gibbs partial differential equation [3] using numerical simulation techniques such as Lagrangian methods and Adaptive Mesh Refinement. Finally, all the aforementioned theoretical results will be applied to a real data-set of a biological culture growth [4].
Keywords: Randomness, Density Function, Numerical methods, Optimization.
MSC2010: 34D09.
References:

[1] Tjørve KMC and Tjørve E, The use of Gompertz models in growth analyses, and new Gompertz-model approach: An addition to the Unified-Richards family. *PLOS ONE* 12(6): e0178691, 2017

[2] Baranyi, J., and Roberts, T. A., A dynamic approach to predicting bacterial growth in food. *International journal of food microbiology*, 23(3-4), 277-294, 1994.

[3] Soong, T.T., Random Differential Equations in Science and Engineering. New York and London, Academic Press, 1974.

[4] Ram, Y., Dellus-Gur, E., Bibi, M., Karkare, K., Obolski, U., Feldman, M.W., Cooper, T.F., Berman, J. and Hadany, L., Predicting microbial growth in a mixed culture from growth curve data. *Proceedings of the National Academy of Sciences*, 116(29), 14698–14707, 2019.

On Some Concepts of Uniform Dichotomy for Evolution Operators in Banach Spaces

Sep 11
15:00-15:20

Timea Melinda Szemely Fülöp[1], Ariana Găină[2], Carmen Florinela Popa[1]

[1]West University of Timisoara/Department of Mathematics, Faculty of Mathematics and Computer Science, Timisoara, Romania

Abstract: In this paper, we investigate a more general concept of uniform stability for linear discrete-time systems in Banach spaces. This concept includes as particular cases the concepts of uniform expopnential stability and uniform polynomial stability. For these concepts we obtain five characterization-types.
Keywords: Linear discrete-time stability, uniform h-stability, uniform exponential stability, uniform polynomial stability.
MSC2010: 34D05.

Maia's Fixed Point Theorems for Discontinuous Mappings

Sep 11
15:20-15:40

Paula Mihaela Tamara Homorodan[1]

[1]Technical University of Cluj-Napoca North University Center at Baia Mare, Romania

Abstract: We establish new fixed point theorems for Maia's fixed point theorem in the setting of a space with a distance, more precisely when both metrics are replaced with two distance. We also indicate some particular cases of our main results and present some examples to illustrate the theoretical results and show that our generalizations are effective.
Keywords: Space with distance, H-distance space, partially ordered, Kannan type mappings, Bianchini type mappings.
MSC2010: 47H10; 47H09.

Sep 11
15:40-16:00

Torsional Creep Problems Involving Grushin p-Laplacian

Denisa Stancu-Dumitru[1]

[1]Department of Mathematics and Computer Sciences, University Politehnica of Bucharest, Romania

Abstract: The asymptotic behaviour of solutions for a family of torsional creep problems involving the Grushin p-Laplace operator is analyzed. In particular, our results complement some earlier works on the topic by L. E. Payne & G. A. Philippin [3], B. Kawohl [2] and T. Bhattacharya, E. DiBenedetto and J. Manfredi [1]. This is based on a joint work with Mihai Mihăilescu. This presentation is partially supported by CNCS-UEFISCDI Grant No. PN-III-P1-1.1-TE-2019-0456.
Keywords: Torsional creep problems; Grushin p-Laplacian; weak solutions; compact embeddings; Γ-convergence.
MSC2010: 35D30; 46E30; 46E35; 49J45; 49S99.
References:

[1] T. Bhattacharya, E. DiBenedetto, & J. Manfredi: Limits as $p \to \infty$ of $\Delta_p u_p = f$ and related extremal problems, *Rend. Sem. Mat. Univ. Politec. Torino*, special issue (1991), 15-68.

[2] B. Kawohl: On a family of torsional creep problems, *J. Reine Angew. Math.* **410** (1990), 1-22.

[3] L. E. Payne & G. A. Philippin: Some applications of the maximum principle in the problem of torsional creep, *SIAM J. Appl. Math.* **33** (1977), 446-455.

Sep 11
16:00-16:20

On Coupled Nonlinear Oscillators of a Mechanical System of Vibration Reduction

Gheorghe Moroşanu[1], Cristian Vladimirescu[2]

[1]Academy of Romanian Scientists, Bucharest, Romania
Faculty of Mathematics and Computer Science, Babeş-Bolyai University, Cluj-Napoca, Romania
[2]Department of Applied Mathematics, University of Craiova, Romania

Abstract: We investigate nonlinear systems of second order ODEs describing the dynamics of two coupled nonlinear oscillators of a mechanical system of vibration reduction. We obtain, under certain assumptions, some stability results for the null solution. Also, we show that, in the presence of a time dependent external force, every solution starting from initial data small enough is bounded or goes to zero as time tends to infinity, provided that suitable conditions are satisfied. Our theoretical results are illustrated with numerical simulations.
Keywords: coupled oscillators, uniform stability, asymptotic stability, uniform asymptotic stability, vibration reduction.
MSC2010: 34D20.

Dynamics of the Infection by SARS-CoV-2

Sep 11
16:20-16:40

Carla M.A. Pinto[1]

[1]School of Engineering, Polytechnic of Porto

Abstract: This paper adapts the Susceptible-Infected-Quarantined-Recovered model (aSIQR) for describing the dynamics of the SARS-CoV-2 virus propagation, responsible for the COVID-19 pandemic. Numerical results are shown for Portugal (PT), United States (US), and France (FR). There is a good agreement of the simulations and the data available for these countries.

Unbounded Solutions of Third Order Three-point Boundary Value Problems on a Half-line

Sep 11
16:40-17:20

Ravi P. Agarwal[1]

[1]Texas A& M University-Kingsville, USA

Abstract: We consider the following third order three-point boundary value problem on a half-line

$$x^{'''}(t) + q(t)f(t, x^{'}(t), x^{''}(t)) = 0, \;\; t \in (0, \infty),$$
$$x^{'}(0) = A, \;\; x(\eta) = B. \;\; x^{''}(+\infty) = C,$$

where $\eta \in (0, +\infty)$, but fixed, and $f : [0, +\infty) \times \mathbb{R}^3 \to \mathbb{R}$ satisfies Nagano's condition. We apply Sch "auder's fixed point theorem, the upper and lower solution method, and topological degree theory, to establish the existence theory for at least one unbounded solution, and at least three unbounded solutions. To demonstrate the usefulness of our results we illustrate two examples.

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