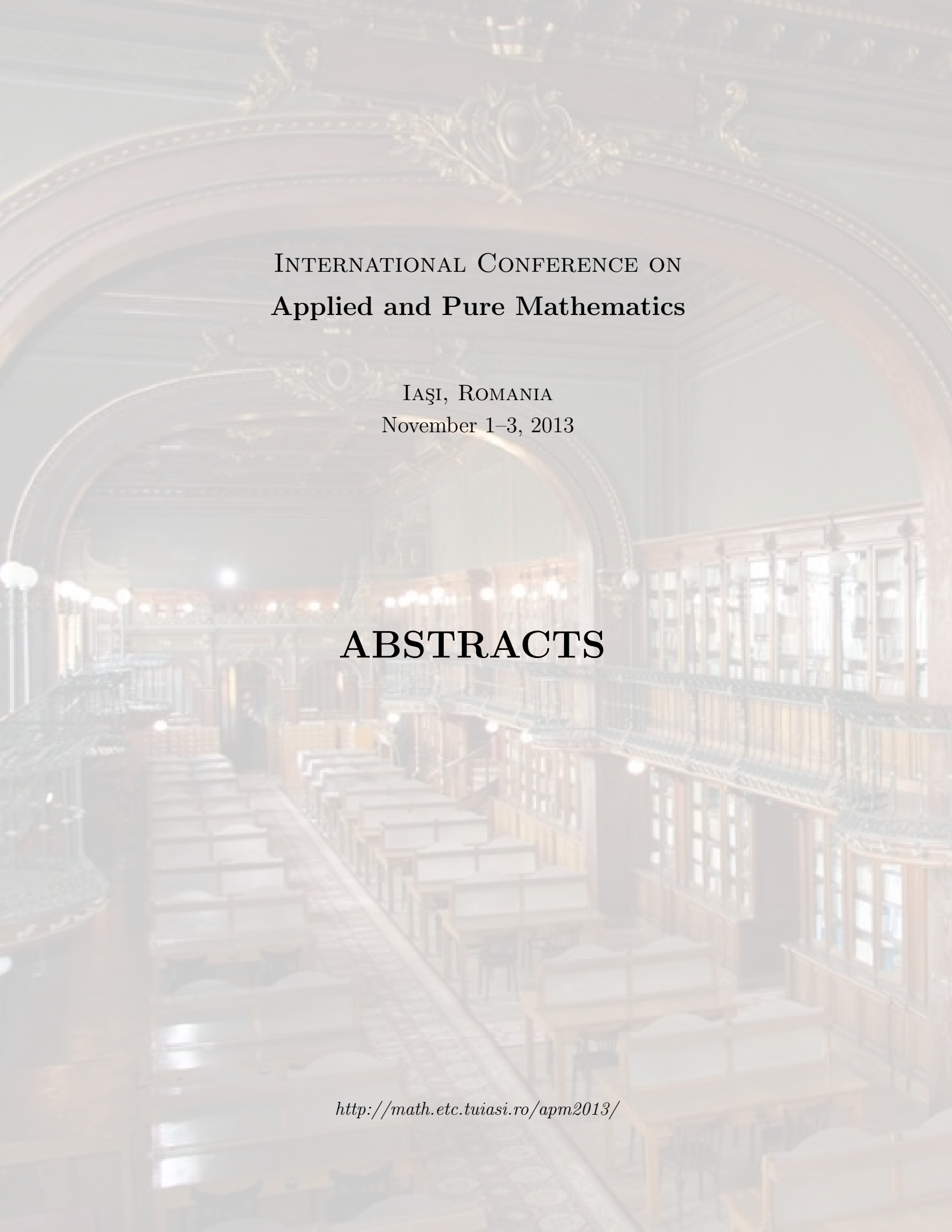

International Conference on

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ABSTRACTS

http://math.etc.tuiasi.ro/apm2013/

Invited Speakers

Markov Processes on the Lipschitz Boundary for the Neumann and Robin Problems

Lucian BEZNEA
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We investigate the Markov process on the boundary of a bounded Lipschitz domain associated to the Neumann and Robin boundary value problems. We first construct L^p-semigroups of sub-Markovian contractions on the boundary, generated by the boundary conditions and we show that they are associated to the transition functions of the forthcoming processes. As in the smooth boundary case the Markov process on the boundary is obtained by the time change with the inverse of a continuous additive functional of the reflected Brownian motion. We use the Revuz correspondence, an exceptional (polar) set occurs. We make the link with the Dirichlet forms approach of M. Fukushima. The talk is based on a joint work with Speranţa Vlădoiu.

How Mild Can Slow Controls Be?

Ovidiu CÂRJĂ
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For a linear control system, if a state can be steered to zero in some time, then it can be steered to zero in any larger time and it is expected that, as the time grows, the norm of the corresponding control to be smaller. We discuss here the behavior of the minimum L^p-control as time duration goes to infinity. The results are applied to various examples. The results are related to the following references:

[1] D. Azé, O. Cârjă, *Fast controls and minimum time*, Control Cybernet. 29 (2000), 887–894.

[2] S. Ivanov, *Control norms for large control times*, ESAIM Control Optim. Calc. Var. 4 (1999), 405–418.

[3] W. Krabs, *On time-minimal distributed control of vibrating systems governed by an abstract wave equation*, Appl. Math. Optim. 13 (1985), 137–149.

[4] K. Narukawa, *Admissible null controllability and optimal time control*, Hiroshima Math. J. 11 (1981), 533–551.

[5] A. Vieru, *On null controllability of linear systems in Banach spaces*, Systems Control Lett. 54 (2005), 331–337.

Ferromagnetic and Ferroelectric Thin Multi-Structures

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In this talk, starting from the classical 3D non-convex and nonlocal micromagnetic energy for ferromagnetic materials (W.F. Brown - 1963), I discuss, via an asymptotic analysis, the free energy of a multi-structure consisting of a nano-wire in junction with a thin film, of a multi-structure consisting of two joined films and of a multi-structure consisting of two joined nano-wires. I also present some results on the polarization in a ferroelectric thin film. This talk collects some results obtained in collaboration with Rejeb Hadiji (Université Paris Est) and with Kamel Hamdache (Ecole Polytechnique, Palaiseau, France).

On the Large Time Behaviour of Solutions of a Nonlocal Ordinary Differential Equation

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We study the nonlocal ordinary differential equation which one obtains by neglecting the diffusion term in a nonlocal reaction-diffusion equation with mass conservation, which was originally proposed by Rubinstein and Sternberg as a model for phase separation in a binary mixture. We present a new method based upon rearrangement theory and the study of the solution profile. We show that the solution stabilizes for large times and give a detailed characterization of its asymptotic limit as t tends to infinity. In the general case, it turns out that the limiting function is a step function, which takes at most two values. We also show by means of a nontrivial counterexample that, when a certain hypothesis on the initial function does not hold, the limiting function may take three values. This is joint work with Hiroshi Matano, Thanh Nam Nguyen and Hendrik Weber.

Càdlàg Reflected Problems with Elastic Projections

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An existence and uniqueness result for a càdlàg Skorokhod problem driven by a maximal monotone operator and a generalized projection Π :

$$\begin{cases} dx_t + A(x_t)(dt) + dk_t^d \ni dm_t, \ t \geq 0, \\ x_0 = m_0, \end{cases} \tag{1}$$

where $x_t = \Pi(x_{t-} + \Delta m_t)$ if $x_{t-} + \Delta m_t \notin \overline{\mathrm{Dom}(A)}$ and k^d a pure jump function is presented.

A solution of (1) is a pair (x, k) of càdlàg functions such that

$$x_t + k_t = m_t \ , \quad t \geq 0,$$

$x_t \in \overline{\mathrm{Dom}(A)}$, for any $t \geq 0$, $k = k^c + k^d$ has locally bounded variation with k^c being its continuous part, $dk_t^c \in A(x_t)(dt)$ and

$$k_t^d = \sum_{0 \leq s \leq t} \Delta k_s = \sum_{0 \leq s \leq t} (I - \Pi)(x_{s-} + \Delta m_s) .$$

If $\Pi = \Pi_{\overline{\mathrm{Dom}(A)}}$ is the orthogonal projection then (1) is equivalent to

$$\begin{cases} x_t + k_t = m_t \ , \quad t \geq 0, \\ dk_t \in A(x_t)(dt) . \end{cases} \tag{2}$$

It is highlight the particular case of an elastic projection Π and

$$A = \partial I_{\overline{D}}(x) = \begin{cases} 0, & \text{if } \ x \in D, \\ \mathcal{N}_{\bar{D}}(x) , & \text{if } \ x \in \mathrm{Bd}(D) , \\ \emptyset, & \text{if } \ x \in \mathbb{R}^d \backslash \overline{D}, \end{cases}$$

where $\mathcal{N}_{\overline{D}}(x)$ is the outward normal cone to the convex and closed $\overline{D} \subset \mathbb{H}$ at $x \in \mathrm{Bd}\left(\overline{D}\right)$ and $I_{\overline{D}}$ is the indicator function, i.e.

$$I_{\bar{D}}(x) = \begin{cases} 0, & \text{if } \ x \in \bar{D}, \\ +\infty, & \text{if } \ x \notin \bar{D}. \end{cases}$$

In this case the term $-\partial I_{\overline{D}}(x_t)(dt)$, which is added to the input dm_t, acts, in a minimal way, as an "inward push" that prevents x_t from exiting the domain $\overline{D}$ and the jumps outside of the constrained set $\overline{D}$ are counteracted by the elastic projection Π.

Metapopulations and Metaecoepidemic Models

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Classical population theory has recently evolved from the study of interacting populations and food chains to the more complex situations of communities living in separate environments, joined by possible migrations. Landscape fragmentation due to natural causes or human activities put a threat on the survival of wild populations. The population thriving in the unperturbed environment becomes separated into subpopulations, which may become more sensitive to adverse conditions, leading to possible species extinction. Metapopulation theory represents a modelling approach to study these situations, [3]. A notable result is the fact that populations may persist globally, although disappearing locally in some cases, [1, 3]. Ecoepidemiology is a rather new branch of population theory, dealing with the study of systems in which diseases spread among interacting populations. An introduction can be found in [2]. We consider at first simple predator-prey model for a diseased prey population, with two possible living environments, in which one of them might constitute a refuge for the sound prey population. We then consider a demographic model for one population and three patches, investigating the outcomes of possible path disruptions.

[1] I. Hanski, *Single-species spatial dynamics may contribute to long-term rarity and commonness*, Ecology 66 (1985), 335–343.

[2] H. Malchow, S. Petrovskii, E. Venturino, *Spatiotemporal patterns in Ecology and Epidemiology*, Boca Raton: CRC, 2008.

[3] J. A. Wiens, *Wildlife in patchy environments: metapopulations, mosaics, and management*, in D. R. McCullough (Ed.) Metapopulations and Wildlife Conservation, Washington: Island Press, 1996, 53–84.

Nonlocal Reaction-Diffusion Equations in Population Dynamics

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We will discuss new models in population dynamics which take into account nonlocal and global consumption of resources. From the mathematical point of view these are integro-differential equations which can be considered as nonlocal reaction-diffusion equations. We will use them to describe emergence and evolution of biological species.

Delay Evolutions Subjected to Nonlocal Initial Conditions

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We survey some recent results concerning abstract nonlinear delay evolution equations governed by continuous perturbations of m-dissipative operators and subjected to very general "initial constraints" including: periodic, anti-periodic, mean as well as classical initial conditions. This class of problems encompasses a large variety of mathematical models in Physics, Chemistry, Biology, Population Dynamics, Meteorology. In addition, in many circumstances, it proves more appropriate than its classical counterparts, i.e. the class of initial value problems or that of periodic problems.
Acknowledgement. Supported by the Romanian National Authority for Scientific Research, CNCS–UEFISCDI, project number PN-II-ID-PCE-2011-3-0052.

Representation of Monotone Operators in Banach Spaces by Convex Functions and Applications

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One of the most important examples of maximal monotone operators is the subdifferential of a lower semicontinuous proper convex function. Many properties of maximal monotone operators were first proved for the subdifferential of convex functions then for the general case, some of them only in reflexive Banach spaces, with independent proofs. In 1988 S. Fitzpatrick associated a convex function to a maximal monotone operator, function which was rediscovered by Martinez Legaz–Théra (2001) and Burachik–Svaiter (2002). The Fitzpatrick function is just an example of a (convex) representative for a maximal monotone operator. Later on, using representatives for maximal monotone operators, it was possible to derive, with much easier proofs, known results on this class of operators as well as some new results.

The aim of my talk is to present this new technique in the study of maximal monotone operators.

Contributes Talks

Continuity Properties for Set Multifunctions in Wijsman Topology

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In this paper, continuity properties, including regularity of set multifunctions in Wijsman topology are introduced and some relationships among them are established.

Admissibility and Exponential Dichotomy of Dynamical Systems in Infinite-Dimensional Spaces

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We present some recent results that we have obtained in the study of exponential dichotomy of infinite dimensional dynamical systems ([1] and [2]). Our first aim is to present the connection between the admissibility of pairs of sequence spaces and the exponential dichotomy of discrete linear systems. Furthermore, the equivalence between the uniform exponential dichotomies of the discrete and the continuous systems is proved. Afterwards, we present a concept of integral admissibility which implies the nonuniform exponential dichotomy of (nonuniform) evolution families. Finally, we discuss some open problems concerning this topic.
Acknowledgment. Supported by a grant of the Romanian National Authority for Scientific Research, CNCS - UEFISCDI, PN-II-RU-TE-2011-3-0103.

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[2] A. L. Sasu, M. G. Babuţia, B. Sasu, Admissibility and nonuniform exponential dichotomy on the half-line, Bull. Sci. Math. 137 (2013), 466-484.

Concepts of Polynomial Dichotomy on the Half-Line for Evolution Operators

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In this talk we present some recent results concerning the polynomial asymptotic behaviors of evolution operators on the half-line and we introduce some new concepts which are later motivated through examples and counterexamples and connected with those from the literature.
Acknowledgment. Supported by a grant of the Romanian National Authority for Scientific Research, CNCS - UEFISCDI, PN-II-RU-TE-2011-3-0103.

Walker Manifolds and Harmonicity

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A Walker manifold is a a pseudo-Riemannian manifold endowed with a null distribution which is parallel with respect to the Levi-Civita connection of the metric. This paper provide necessary and sufficient conditions for the harmonicity of certain maps on Walker manifolds.

Ricci Solitons in Paracontact Geometry

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Two problems are studied in this talk: the class of parallel symmetric tensor fields of $(0, 2)$ type and Ricci solitons.

Polygonal Numbers and Fermat's Last Theorem

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We begin with the elementary Diophantine $x^2 + y^2 = z^2$ in positive integers, which we know has infinite solutions. Fermat's Last Theorem does not let us generalize this for higher powers. But if we can look at squares not as indices but as polygonal numbers, we can in fact prove that there are infinitely many n-gonal numbers which can be represented as a sum of m n-gonal numbers, for all m and n. Now, if we consider the above Diophantine for higher dimensional regular convex polytope numbers (squares above being two dimensional regular convex polytopes), we notice that there are special cases in each dimension where the solutions do not exist. As we see where the solutions exist and where they do not, we gain some new insights into Fermat's Last Theorem. We observe that Fermat's Last Theorem does not simply give us a family of Diophantine equations having no positive integer solutions, but rather the boundary in each dimension where the solutions to the above Diophantine cease to exist. Lastly, based on our insights, we ask a few questions, which if answered, could actually explain in a different way why Fermat's Last Theorem holds!

Quadratic Differential Systems on $\mathbb{R}^3$ Having a Semisimple Derivation

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The classification, up to a center-affinity, of the homogeneous quadratic differential systems defined on $\mathbb{R}^3$ that have at least a semisimple derivation with nonzero kernel, is achieved. It is proved that there exist four classes of affine nonequivalent such systems, only.

Viability for a Semilinear Reaction-Diffusion System with Delay

Monica-Dana BURLICĂ[1], Daniela ROŞU
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We present some necessary and sufficient conditions for a time-dependent set to be viable with respect to a semilinear reaction-diffusion system with delay.
Acknowledgement. Supported by the Romanian National Authority for Scientific Research, CNCS–UEFISCDI, project number PN-II-ID-PCE-2011-3-0052.

A Stability Result for Strongly Continuous Semigroups on Hereditary Indecomposable Reflexive Banach Space

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The characterization of the asymptotic behavior of strongly continuous semigroups through spectral properties of its generator is a classical subject. As the hereditary indecomposable Banach space (denoted $H.I.$) provides us a necessary and sufficient condition for the semigroup to be strongly stable under rather weak assumptions,we can deduce that the restriction of the semigroup to a certain subspace of X is always strongly stable, provided that X is reflexive.The main tool in our proof is the decomposition theorem of Jacobs-Glicksberg-de Leeuw.

Spaces of Almost Periodic Functions and Measures

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We study the Bochner property and problems of approximation in the space of those almost periodic functions on a locally compact group with the property that their series of Fourier coefficients are absolutely convergent. We also establish results of existence and uniqueness of solutions in the case of some convolution equations involving almost periodic measures.

Properties of a Gould Type Set-Valued Integral

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Since 1965, when Aumann defined the integral of set-valued functions, the theory concerning set-valued integrals has become an interesting and important topic, with many applications in mathematical economics, theory of control, statistics, decision making theory, artificial intelligence. We present some properties of a Gould type set-valued integral for set-valued functions with respect to a non-negative set function.

Data Assimilation Applications in Hydrology

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Data assimilation techniques have become more popular over the last decade in modelling and forecasting large systems due to the ever increasing computational resources. By combining any available measurements of the state of the system with the model dynamics, data assimilation provides a more robust model and improves the knowledge of the system using the Kalman filter framework which adds to the deterministic model a stochastic part both in the model dynamics and in the measurements. In this paper we review some data assimilation applications in hydrology and we investigate the benefits of applying the ensemble Kalman filter methods on a specific hydrodynamic model of a river network using the MIKE 11 software.

Reduced Order Modeling Applied to Some Biological Models

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We discuss computational issues of several biological systems carried out by reduced order methods. We implement Proper Orthogonal Decomposition (POD) and then a combination of POD with Discrete Empirical Interpolation Method (DEIM). A comparative analysis of the numerical simulations with respect to the accuracy of the results is given.

Cooperative Differential Games on Time Scales

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The objective of this paper is to present differential games in the generic context of time scales and to study necessary conditions for cooperative N-player differential games on this time scale.

Scalarization of Constraints System in Some Vector Optimization Problems and Applications

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We employ a new method to penalize a constrained non solid vector optimization problem by means of a scalarization functional applied to the constraints system. Then, we formulate optimality conditions which mainly use several types of regularity for single and set-valued maps. In order to motivate our demarche, we discuss in detail the assumptions used in the main results and we show how it can be verified.

Lusin Theorem in Vietoris Topology

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In a previous paper, we have introduced and studied continuity In this talk, we present a set-valued Lusin type theorem in Vietoris topology for $\mathcal{P}_0(X)$-valued monotone set multifunctions, X being a Hausdorff, linear topological space.

Periodic Oscillations and Bifurcation Analysis for a Cohen-Grossberg Neural Network Model with Impulsive Perturbations

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In this paper, a Cohen-Grossberg neural network composed of two neurons which are subject to periodic impulsive perturbations is proposed and investigated. By employing Mawhin's continuation theorem, we first determine sufficient conditions for the existence of semi-trivial periodic solutions. Under these assumptions, the asymptotic stability of semi-trivial periodic solutions is investigated by using the Floquet theory of impulsive differential equations. Finally, we obtain the bifurcation of nontrivial periodic solutions with the help of a projection method.

Permanence, Periodicity and Stability for an Impulsively Perturbed Single Species Model

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A single species model which is subject to periodic impulsive perturbations is investigated from the viewpoint of finding sufficient conditions for permanence, for the existence of periodic solutions, and for their global asymptotic stability. First, an auxiliary equation, whose solutions are continuous functions but which incorporates the effects of impulsive perturbations, is constructed, the relationship between its solutions and the solutions of the initial system being investigated. The permanence of the system is then established via a comparison argument, while the existence and global asymptotic stability of periodic solutions makes use, in addition to comparison estimations, of Brouwer's fixed point theorem.

Some Compactness Results for the Solution Operator of a Linear Evolution Equation with Measures

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In this paper we establish and prove some sufficient conditions for the compactness in $C([a,b];X)$ of $\mathcal{L}^\infty$-solution operator $(\xi,g)\mapsto u$ associated to a linear Cauchy problem involving measures $du=(Au)dt+dg$, $u(a)=\xi$, where A generates a compact C_0-semigroup in a Banach space X, $\xi\in X$ and $g\in BV([a,b];X)$.

On the Geometry of Riemannian Manifolds With Metallic Structure

Mircea CRÂŞMĂREANU, **Cristina-Elena HREŢCANU**[1]

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In this paper we focus on the geometry of submanifolds endowed with structures induced by metallic Riemannian structures, due to an analogy with the theory of submanifolds in almost product manifolds. A research on the properties of a metallic Riemannian manifold $(\overline{M},g)$ endowed with a metallic structure J (i.e. $J^2=pJ+qI$, where I is the identity operator on the Lie algebra of the vector fields on $\overline{M}$ and p,q are fixed positive integer numbers) and g is *J-compatible* (i.e. $g(JX,Y)=g(X,JY)$ for every vector fields X,Y on $\overline{M}$). We find conditions for this kind of submanifold to be also a metallic Riemannian manifold in terms of invariance.

On the Computation of the Third Order Terms of the Series Defining the Center Manifold for Systems of Delay Differential Equation

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When considering a general system of delay differential equations with a single constant delay, we encounter a certain lack of uniqueness in determining the coefficient of one of the third order terms of the series defining the center manifold. We solve this problem by considering a perturbation of the initial considered problem, perturbation that allows us to remove the singularity. The result generalizes a similar result obtained for scalar delay differential equations (J. Dyn. Diff. Eqns., 24/2012).

Differential Inclusions With One-Sided Perron Multifunctions

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We study qualitative properties of the solution set of almost lower (upper) semicontinuous one-sided Perron differential inclusion with state constraints in finite dimensional spaces.

Positive Solutions for a Higher-Order Multi-Point Boundary Value Problem

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By using the fixed point index theory, we prove the existence and multiplicity of positive solutions of a coupled system of higher-order nonlinear ordinary differential equations with multi-point boundary conditions.

Multivalued Differential Equation with Singular Input and Driven by Fréchet Subdifferential Operator

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We show the existence and the uniqueness of the solution for the next variational inequality, considered in a non-convex setup,

$$\begin{cases} dx\left(t\right)+\partial^{-}\varphi\left(x\left(t\right)\right)\left(dt\right)\ni dm\left(t\right), & t>0,\\ x\left(0\right)=x_{0}\ , \end{cases}$$

where $m:\mathbb{R}_{+}\rightarrow\mathbb{R}^{d}$ is only continuous and $\partial^{-}\varphi$ is the Fréchet subdifferential of a semiconvex function φ.

Gehring's Lemma for Orlicz Spaces on Metric Spaces and Regularity Properties of Minimizers of Variational Integrals

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Gehring's lemma [2], a celebrated result on the self-improving property of reverse Haslder inequalities, is a powerful tool in the L^p-theory of quasiregular mappings and nonlinear PDE's. The generalizations of Gehring' s lemma for Lebesgue spaces on metric measure spaces [5], as well as for Orlicz spaces on Euclidean spaces [1], have been applied to investigate gradient regularity for minimizers of variational integrals. We prove an extension of Gehring's lemma to Orlicz spaces on a doubling metric measure space. Our result is related to Gehring' s lemma in Orlicz spaces on $\mathbb{R}^n$ proved by Iwaniec [4] and generalizes a higher integrability result of Kinnunen [3] for Lebesgue spaces defined by means of a doubling weight on $\mathbb{R}^n$. This new generalization of Gehring's lemma allows us to extend, from the Euclidean case to the setting of a doubling metric measure space, a higher integrability property for the upper gradient of minimizers of variational integrals with non-standard growth, proved in [1].

[1] A. Cianchi, N. Fusco, *Gradient regularity for minimizers under general growth conditions*, J. Reine Angew. Math., 507 (1999), 15–36.

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Stabilization of the Phase Field System by Boundary Proportional Feedbacks

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We design here finite-dimensional stabilizing feedback Dirichlet boundary controllers for steady-state solutions to the phase field system. The feedback controllers are easily manageable from computational point of view since they are expressed in terms of the eigenfunctions $\{\phi_j\}_{j=1}^N$, $N \in \mathbb{N}$, corresponding to the eigenvalues $\{\lambda_j\}_{j=1}^N$ of the Laplace operator in $\Omega \subset \mathbb{R}^q$, $q = 2, 3$. The stabilizing algorithm, we develop here, is applicable under the assumption that the system $\left\{\frac{\partial \phi_j}{\partial \mathbf{n}}\right\}_{j=1}^N$ is linearly independent on the part of the boundary where the control is applied.

L^p-Weak Solutions for Nonlinear Equations of Measure-Valued Branching Processes

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We solve in an L^p-weak sense nonlinear Schroedinger type equations related to measure-valued branching processes, involving positive definite extensions of the solution from base space E to the set of all finite positive measures on E. The extensions to the set of measures is related to the classical connection (from the works of M. Nagasawa, N. Ikeda, S. Watanabe, and M.L. Silverstein) between these nonlinear equations and the discrete branching Markov processes. We also investigate the existence of the bounded solutions for the Dirichlet problem associated to the above equation, with bounded boundary data. Our approach is based on probabilistic and analytic potential theoretical methods, used on both spaces E and the set of all finite configurations of E. The talk is based on joint works with Lucian Beznea.

Mathematical Model of Cloverleaf Magnetic Trap

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The magnetic traps are largely used in plasma physics, to control the nuclear fusion. We obtain in the present paper a mathematical model for a configuration inspired from Ioffe-Pritchard magnetic trap Ioffe bars beeing replaced with eight circuits that create a cloverleaf. All the magnetic field lines produced by electric currents create a magnetic flow which induce a magnetic geometric dynamic. The physical properties of a magnetic field not being changed due to approximations of Biot-Savart-Laplace integrals from the magnetic field components, it results that the approximated form of the total magnetic field created by the cloverleaf configuration permits the study of the geometric dynamic around the magnetic trap around the origin.

Existence for a Nonlinear Delay Reaction-Diffusion System with Mixed Initial Conditions

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We present an existence result for C^0-solution to a class of nonlinear delay reaction-diffusion systems with mixed initial conditions.
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A Non-Convex Setup for Differential Equations Driven by Oblique Subgradients

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We prove the existence and the uniqueness of a solution for a multivalued deterministic variational inequality with oblique subgradients, considered on a non-convex domain. The system is driven by the multivalued operator $\partial^{-}\varphi$, which is the Frechet subdifferential of a semi-convex function φ and by the Lipschitz mapping given by the matrix application $x \mapsto H(x)$. The presence of the oblique reflection brought by the term $H(x)\,\partial^{-}\varphi(x)$

leads to the use of different techniques compared to the ones used for the cases of standard reflection on non-convex domains or oblique reflection in convex domains.

Some Convergence Estimates for Abstract Second Order Differential Equations with Two Small Parameters

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In a real Hilbert space we consider a singularly perturbed Cauchy problem for linear abstract second order differential equations with two small parameters. We study the behavior of solutions to the perturbed problem relative to solution to the corresponding unperturbed problem, as small parameters tend to zero. We obtain some a priori estimates of solutions to the perturbed problem, which are uniform with respect to parameters, and a relationship between solutions to both problems. We establish that the solution to the unperturbed problem has a singular behavior, relative to the parameters, in the neighbourhood of $t = 0$. We show the boundary layer and boundary layer function in two different cases.

Regular Linear Relations on Banach Spaces

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For a Banach space the notion of regular linear relation is introduced and studied. Furthermore, the notion of regular resolvent set for a closed linear relation T is introduced. Several characterizations of regular resolvents are presented, in terms of the gap metric between corresponding null spaces, and in terms of generalized resolvents of the linear relation T.

Kernel Representation of Dirac Structures for Infinite-Dimensional Systems

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For a Banach space the notion of regular linear relation is introduced and studied. Furthermore, the notion of regular resolvent set for a closed linear relation T is introduced. Several characterizations of regular resolvents are presented, in terms of the gap metric between corresponding null spaces, and in terms of generalized resolvents of the linear relation T.

Several Issues of Measure Driven Equations

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The goal of this talk is to present several aspects of the theory of measure driven equations, such as: the links between differential and integral problems, the choice of solution concept or the existence of solutions. We will be concerned both with single and multivalued case in the lack of Lipschitz-type assumptions.

Construction of Approximate Schemes Using the Principle of Decomposition

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The problem of transport of any substance in some medium appears in many domains, including ecologies, hydrogeology, physique and other. The mathematical modeling of these problems depends of the domain where this process is studied. The main factors in modeling the transport of any substance in atmosphere are the diffusion process, the absorbtion of substance and the advection-convection process. The classical model of this problem with one space variable uses the partial derivatives of first and second order (cf.

[1]). In recent years many authors use the fractional space derivative in modeling such process.

The class of approximate schemes for such models has been constructed in [2] for the case of one space variable. In this article we consider the same problem with two space variables. Using the decomposition principle it is possible also to construct the class of stable approximate schemes.

[1] G. I. Marchuk, *Mathematical models in enviromental problems*, Nauka, Moscow, 1982 (in Russian).

[2] I. Secrieru, V. Ticau, *Weighted approximate scheme for fractional order diffusion equation*, Buletinul Institutului Politehnic din Iaşi, tomul LVII(LXI), fasc.1, Secţia matematică, mecanică teoretică, fizică, Iaşi, 2011.

About Vector Integrals for Multifunctions

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We present some kinds of vector integrals for vector multifunctions by respect to vector multisubmeasures, the relationships between them, some calculus rules and some converging results.

Double Hopf Bifurcation with Non-Semisimple 1:1 Resonance

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We shall discuss here the bifurcation of small periodic solutions in a time-reversible and conservative four-dimensional nonlinear system that arises in Differential Geometry, in the study of biharmonic maps from torus into spheres. The linearized system has two pairs of pure imaginary eigenvalues, which are double (the case of 1:1 resonance) and non-semisimple. Using a normal form transformation, we reduce the original system to a three-dimensional system, which is analyzed qualitatively with regard to the unfolding parameters.

Density Models for Populations of Neurons

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We consider population density model for a population structured with respect to its potential and the connection with age-structured systems is discussed next.

The Darboux Problem Associated with a Lipschitzian Hyperbolic Inclusion of Third Order

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In this paper we consider the Darboux problem for a third order hyperbolic inclusion of the form $u_{xyz} \in F(x, y, z, u)$, where $F : D \times \mathbb{R}^n \to 2^{\mathbb{R}^n}$, $D = [0, a] \times [0, b] \times [0, c] \subset R^3$, is Lipschitzian with respect to u, $F(x, y, z, u)$ is nonconvex set for which we prove three existence theorems. The results are obtained by the successive approximations method, using two selection theorems. This method was applied by A. F. Filippov, H. Hermes, C. J. Himmelberg and F. S. Van Vleck for the inclusion $\dot{x} \in F(t, x)$ and by G. Teodoru for the hyperbolic inclusion of second order $z_{xy} \in F(x, y, z)$.

Binary Signals: the Set of the Periods of a Periodic Point

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The asynchronous systems are the discrete time and real time models of the asynchronous circuits from digital electrical engineering. The 'nice' functions that these systems work with, called (binary) signals, are the models of the electrical signals. In our paper we define the periodicity of the points of the (binary) signals and we prove that their sets of periods is of the form p, $2p$, $3p$, ..., p positive integer (discrete time) and T, $2T$, $3T$, ..., T positive real (real time).

Generalizations of Prime Ideals in Semirings

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H. S. Vandiver introduced the concept of a semiring in 1935. A nonempty set R together with two associative binary operations $+$ and $\cdot$, is called a semiring if: (1) $(R,+)$ is a commutative monoid with identity element 0; (2) $(R,\cdot)$ is a monoid with a nonzero identity element 1; (3) the multiplication is distributive with respect to the addition both from the left and from the right; (4) $a\cdot 0 = 0\cdot a = 0$ for all $a \in R$. A semiring R is commutative if $(R,\cdot)$ is a commutative semigroup. Throughout this talk all semirings are considered to be commutative.

A nonempty subset I of a semiring R is called an ideal if $a, b \in I$ and $r \in R$ imply that $a+b \in I$ and $ra \in I$. A prime ideal of R is a proper ideal P of R with the property that whenever $a, b \in R$ with $ab \in P$ then either $a \in P$ or $b \in P$. Badawi in [1] defined a nonzero proper ideal I of a commutative ring R to be a 2-absorbing ideal of R if whenever $a, b, c \in R$ and $abc \in I$, then $ab \in I$ or $ac \in I$ or $bc \in I$. In this talk we first study the concept of 2-absorbing ideals in semigroups and semirings, and investigate some basic properties of this concept. Then we apply the results in semigroups to prove some results concerning 2-absorbing ideals in commutative rings.

[1] A. Badawi, *On* 2*-absorbing ideals of commutative rings*, Bull. Austral. Math. Soc., 75 (2007), 417–429.

On Asymptotic Behavior of the Solutions to a Functional Parabolic Equation

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We study a class of semilinear parabolic equations, where the nonlinear part contains deviating argument in the form of "maxima". The asymptotic behavior and stability of the solution are discussed. These equations are applied in computer simulations and some chemical reaction-diffusion processes. In this case many difficulties appear.