

TECHNICAL UNIVERSITY OF CLUJ-NAPOCA
FACULTY OF AUTOMATION AND COMPUTER SCIENCE
DEPARTMENT OF MATHEMATICS

BABES-BOLYAI UNIVERSITY OF CLUJ-NAPOCA
FACULTY OF MATHEMATICS AND COMPUTER SCIENCE
DEPARTMENT OF MATHEMATICS

Theodor Angheluta Seminar

ABSTRACT BOOK

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□ **Direct results for certain operators based on Pólya distribution**

ANA MARIA ACU, PURSHOTTAM AGRAWAL AND TRAPTI NEER

We introduce the Bézier variant of genuine-Durrmeyer type operators having Pólya basis functions. We give a global approximation theorem in terms of second order modulus of continuity, a direct approximation theorem by means of the Ditzian-Totik modulus of smoothness and a Voronovskaja type theorem by using the Ditzian-Totik modulus of smoothness. The rate of convergence for functions whose derivatives are of bounded variation is obtained. Further, we show the rate of convergence of these operators to certain functions by illustrative graphics using the Maple algorithms.

□ **On modified Picard and Gauss linear positive operators**

OCTAVIAN AGRATINI

The paper aims to study two classes of linear positive operators representing modifications of Picard and Gauss operators. The new operators reproduce both constants and a given exponential function. Approximation properties in polynomial weighted spaces are investigated and the speed of convergence is measured using a certain weighted modulus of smoothness. Also, the asymptotic behavior of the integral operators are established. Finally, aspects on generalized convexity are analyzed.

□ **On a class of initial-boundary value differential problems on $[0, 1]$ related to generalized Kantorovich operators**

FRANCESCO ALTOMARE

The lecture will be centered about some recent results concerning a class of initial-boundary value differential problems associated with differential operators of the form

$$V(u)(x) = \frac{\alpha(x)}{2}u''(x) + a(b-x)u'(x)$$

($u \in C^2([0, 1])$, $0 \leq x \leq 1$), where $\alpha \in C([0, 1])$, $0 \leq \alpha(x) \leq x(1-x)$ for every $0 \leq x \leq 1$, $b \in [0, 1]$ and $a \geq 0$.

Among other things, such problems occur when describing some one-dimensional diffusion models from population dynamics.

The main aim is to discuss existence, uniqueness and continuous dependence from initial data of the solutions of these problems through the theory of the C_0 -semigroups of operators.

Furthermore, a special attention will be devoted to the approximation of such solutions in terms of a new sequence of positive linear operators which generalize the Kantorovich operators (and some of their variants).

These operators have been recently introduced and studied in [1]. For $\alpha(x) = x(1-x)$ ($0 \leq x \leq 1$), they are defined by setting for every $f \in C([0, 1])$

$$C_n(f)(x) = \sum_{k=0}^n \binom{n}{k} x^k (1-x)^{n-k} \int_0^1 f\left(\frac{k+at}{n+a}\right) d\mu_n(t).$$

($n \geq 1, f \in C([0, 1]), 0 \leq x \leq 1$).

Extensions of similar problems to multidimensional settings will be also discussed

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Existence Criteria For the Solutions of a Variational Relation Problem

MIRCEA BALAJ

Many quasivariational inclusions or quasiequilibrium problems encountered in the literature, are special cases of a variational relation problem proposed by Agarwal et al. in a paper published in 2012 in the Journal of Optimization Theory and Applications. Our purpose is to establish new existence results for the solutions of this problem. The main ingredients in the proofs are some continuous selection and fixed point theorems, and an interesting section result. Finally, we prove that, applied for some concrete relations, our results are different from those obtained by other authors.



Entropies associated to q -distributions of probability

ADINA ELENA BĂRAR, DANIELA IOANA INOAN AND IOAN RAŞA

We consider the distributions of probability associated with the q -Bernstein, q -Szász-Mirakyan, q -Meyer-König and Zeller operators. The paper is devoted to investigating convexity-like properties of the Shannon, Rényi and Tsallis entropies of these distributions in the limiting case when $q \rightarrow 0$.

□ **On the relationship between the statistical properties of the time series and its GRNN model**

ALINA BARBULESCU

Studies on forecasting with Generalized Regression Neural Network (GRNN) and Support Vector Regression (SVM) show that this technique can be a promising option to nonlinear time series modeling, in general, and for financial series, in particular. Since systematic studies concerning their performances on modeling different time series were not performed, our aim is to provide such an analysis.

The first step is to test the statistical properties of these series, as randomness, trend existence, stationarity and the change point's existence.

The second one is building models for the series, the subseries detected after the segmentation and the deseasonalized ones.

Finally, comparisons of the modeling results are done, for the initial series, the deseasonalized and the detrended series, for observing the influence of the seasonality or trend removal on the models' quality. It is proved that "regularity" properties don't influence the models quality, but the seasonality removal conduct to better models.

□ **A new generalization of Lupaş operators**

GÜLEN BAŞCANBAZ-TUNCA, MURAT BODUR AND DILEK SÖYLEMEZ

Abstract. In this talk, we state a generalization of Lupaş operators in the sense of Jain's construction for Szász-Mirakyan operators. We give a recurrence formula for the moments and show that these operators are non-increasing when the original function is convex. Moreover, we study the weighted uniform approximation for these operators.

□ **The contraction mapping principle: beyond metric spaces and back**

MAHER BERZIG, CRISTINA-OLIMPIA RUS AND MIRCEA-DAN RUS

We present several versions of the contraction mapping principle [1] in different metric-like structures: extended metric spaces (where the distance mapping is allowed to take the value ∞), (extended) inframetric spaces (where the distance mapping satisfies a weaker version of the triangle inequality), and metric spaces endowed with a (compatible) binary relation (where the contraction conditions is required only for pairs that satisfy the given binary relation).

We extend some earlier partial results obtained by Diaz [2], Jachymski [5], Jung [6] and Luxemburg [7]. We also discuss a version of a discrete fixed point result of Eilenberg [3, Chapter I, p. 19] that was proposed by Jachymski [4] as a generalization of the contraction mapping principle.

We emphasize that all these separate results can be unified with the original contraction principle, using some constructive metrization results.

2010 MSC: Primary 47H10; Secondary 03E20, 54E35, 54E99, 54H25.

Key words: Fixed point; contraction principle; inframetric; extended metric; metrizability; uniform space; binary relation.

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Rates of convergence for the iterates of some positive linear operators

MARIUS BIROU AND FADEL NASAIH

In this article we give rates of convergence for the iterates of a large class of positive linear operators which preserve the linear functions. This class includes the Bernstein operator, the genuine Bernstein-Durrmeyer operator, the Stancu operator and their q -variant. Also, we obtain rates of convergence for the iterates of some King type operators.

□ **Delay Evolution Systems with Nonlinear Constraints**

OCTAVIA-MARIA BOLOJAN

The purpose of the present work is to study the existence of solutions for a class of nonlinear delay reaction-diffusion systems subjected to nonlinear constraints. Using the fixed point principles of Perov and Schauder, combined with the technique that uses matrices with the spectral radius less than one and vector-valued norms, we establish new existence results for these type of delay evolution systems. This vectorial approach is very fruitful for treating of systems in general, allowing the system nonlinearities to behave independently as much as possible. Moreover, we remark the importance of the constants from the contraction or growth conditions which play an essential role in connection with the support of the nonlinear operators expressing the constraints.

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□ **Fixed points of some nonlinear operators in the spaces of multifunctions**

JANUSZ BRZDEK AND MAGDALENA PISZCZEK

We present a fixed point theorem for nonlinear operators, acting on the function spaces of set-valued maps and satisfying suitable inclusions. We also show some applications of it in the Ulam type stability of several functional equations for set-valued maps.

□ **Variational fixed points problems and applications to singular differential equations and systems**

ANGELA BUDESCU AND RADU PRECUP

The paper is devoted to the existence and variational characterization of the weak solutions of the Dirichlet boundary value problem for singular second-order ordinary differential equations of the type

$$(1) \quad \begin{cases} -(p(x)u'(x))' = f(x, u(x)) & \text{a.e. } x \in (0, 1) \\ u(0) = u(1) = 0, \end{cases}$$

and for a system of two equations

$$(2) \quad \begin{cases} -(p(x)u'(x))' = f(x, u(x), v(x)) \\ -(q(x)v'(x))' = g(x, u(x), v(x)) \\ u(0) = u(1) = 0 \\ v(0) = v(1) = 0. \end{cases}$$

The solution appears as a minimizer of the energy functional associated to the equation, and in the case of systems, as a Nash type equilibrium of the pair of energy functionals (E_1, E_2) , where E_1, E_2 are associated to the first and second equation, respectively. More exactly, we are interested into such a solution that

$$E_1(u^*, v^*) = \min E_1(., v^*) \quad \text{and} \quad E_2(u^*, v^*) = \min E_2(u^*, .).$$

The results are connected with the recent abstract fixed point theory due to the second author and with its application given by the first author, to semilinear operator problems of Michlin type.

□ **Characterizations of vector equilibria with explicit constraints**

ADELA CAPĂȚĂ

The aim of this talk is to present necessary and sufficient conditions for the existence of solutions of weak vector equilibrium problems subject to explicit constraints. For this means, two different approaches are used. As an application, sufficient conditions for the existence of weak saddle points for generalized Nash two-person noncooperative games are illustrated.

□ **Some results on Jain type operators**

NURSEL ÇETIN

In this talk, we consider a generalization of Jain operators and investigate some approximation results related to these operators.

□ **Properties of the analytic functions defined by an integral operator**

LUMINIȚA-IOANA COTÎRLĂ

The object of the present paper is to show some properties of an integral operator for analytic functions in the open unit disc. By means of this integral operator, we define new classes $CL(m, \mu, \alpha)$, $\mathcal{I}_n(\alpha)$, $\mathcal{L}_n(\alpha, \beta)$ and $\mathcal{L}_n^*(\alpha, \beta)$ involving functions $f \in \mathcal{A}$.

Keywords: Integral operator, starlike function, analytic functions.

2000 Mathematics Subject Classification: 30C45, 26D15.

□ **What Everyone Ought to Know About Optimal Control Applied in Medicine**

ANA-MARIA CROICU

Dynamical systems, systems that evolve in time, occur frequently in many scientific fields, ranging from science and engineering to economics and social sciences. The behavior of these dynamical systems may be controlled successfully by intervention through so-called "controls". The theory of optimal control is concerned with determining such "controls" which, at minimum cost, either direct the system along a given trajectory or enable it to reach a given point in its state space. Optimal control theory opens new possibilities in medicine, as well. To demonstrate the impact of optimal control in the medical field, Pontryagin's classical control theory is applied to a mathematical model of HIV Infection of $CD4^+T$ cells and a mathematical model of Ebola Virus Disease. Optimal therapies that successfully control these diseases have been developed.

□ **Preserving properties of the generalized Bernardi-Libera-Livingston integral operator defined on some subclasses of starlike functions**

OLGA ENGEL AND RÓBERT SZÁSZ

In this paper we study the properties of the image of some subclasses of starlike functions, through the generalized Bernardi-Libera-Livingston integral operator. A new subclass of functions with negative coefficients is introduced, and we study some properties of this class.

□ **Series involving tails of Riemann zeta function values**

OVIDIU FURDUI AND ALINA SÎNTĂMĂRIAN

The paper is about discussing recent results involving the evaluation of series containing harmonic numbers and quadratic and cubic tails of Riemann zeta function values.

□ **Time stepping schemes for a class of hybrid dynamical systems**

BOGDAN GAVREA

We analyze a class of hybrid dynamical systems from the numerical point of view. Integration schemes that are formulated as mixed complementarity problems are presented. We are interested in the robustness of these numerical schemes when uncertainties due to model formulation and noisy data are present. Strategies that are used in designing robust controls are also presented.

□ **A study of water pressure optimization for a city network**

ANA-MARIA GECZI, CALIN NEAMTU AND DALIA CIMPEAN

Developing a system plan for water supply of a city is a challenging task due to the system complexity. Parametric models which describe the water pressure data, are proposed here and a local regression smoothing is used. A statistical validation of the obtained fitting functions of the models, was carried out and discussed. A number of goodness-of-fit measures was used to evaluate the overall performance of these simulation models. The results and discussion are clearly pointed out and compared in graphs, in order to obtain the best prediction during a considered time period.

□ **Riemann type of functional equation**

DORIN GHISA

The series $\sum_{n=1}^{\infty} 1/n^s$, $s = \sigma + it$, converges for $\sigma > 1$ and represents an analytic function in the half plane $\Re s > 1$. The respective function can be extended analytically across the line $\Re s = 1$ and it represents a meromorphic function in the complex plane having the unique simple pole $s = 1$ with the residue 1. This is known as the Riemann Zeta Function, ζ . Riemann has shown that ζ satisfies the following functional equation:

$$\zeta(s) = W(s)\zeta(1-s), \quad \text{where } W(s) = 2(2\pi)^{s-1}\Gamma(1-s)\sin\frac{\pi s}{2}$$

and he realized that the zeros of $\zeta(s)$, which are not zeros of $W(s)$, the so-called non trivial zeros of $\zeta(s)$, might be all located on the (critical) line $\Re s = 1/2$. This is the celebrated Riemann Hypothesis (RH).

Starting with Dirichlet, generalizations of ζ have been studied, obtained by analytic continuation of more general series:

$$\zeta_{A,\Lambda}(s) = \sum_{n=1}^{\infty} a_n e^{-\lambda_n s},$$

where $A = \{a_n\}_{n \in \mathbb{N}}$ is an arbitrary infinite sequence of complex numbers and $\Lambda = \{0 = \lambda_1 < \lambda_2 < \dots\}$ is an increasing sequence of non negative real numbers such that $\lim_{n \rightarrow \infty} \lambda_n = +\infty$.

We deal in this paper with such functions, the Riemann type of functional equations they can satisfy and the implications regarding a similar Riemann Hypothesis: the Great Riemann Hypothesis (GRH).

□ **Approximation of Baskakov type Pólya-Durrmeyer operators**

VIJAY GUPTA, FLORIN SOFONEA AND ANA MARIA ACU

We propose the Durrmeyer type modification of Baskakov operators having Pólya basis functions. Some approximation results, which include the Voronovskaja type asymptotic formula, local approximation and error estimation in terms of the modulus of continuity and weighted approximation are obtained.

□ **Positive solutions for Neumann-Robin BVPs with ϕ -Laplacian**

DIANA HERLEA

We study the existence, localization and multiplicity of positive solutions for the boundary-value problem

$$\begin{aligned}(\phi(u'))' + f(t, u) &= 0, \\ u(0) - au'(0) = u'(1) &= 0,\end{aligned}$$

where $\phi : \mathbb{R} \rightarrow (-b, b)$, $0 < b \leq \infty$, is an increasing homeomorphism with $\phi(0) = 0$. We obtain existence, localization and multiplicity results of positive solutions using Krasnosel'skiĭ's fixed point theorem in cones and a weak Harnack type inequality. Concerning systems, the localization is established by the vector version of Krasnosel'skiĭ's theorem, where the compression-expansion conditions are expressed on components.

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□ **Two area preserving maps from the square to the p -ball**

ADRIAN HOLHOȘ

We construct two area preserving maps from the square to the ball in the L^p space and use them to obtain low distorted uniform grids on the p -ball.

□ **Logic type functions in some problems of deformable body mechanics**

VASILE HOREA ILE

Using the logic type functions in the forming of equations of some plane domains boundaries, it is formulated mathematically the solution of the partial derivative equation with boundary conditions. The possibility of the analytical expression of the complex form boundaries, suggests also large perspectives to use this method in many technical problems.

□ **Some decompositions of positive operators related to quantum information theory**

MARIA ANASTASIA JIVULESCU, ION NECHITA AND PAȘC GĂVRUȚA

Inspired by some problems in Quantum Information Theory we give some results concerning the decomposition of a positive operator on Hilbert spaces. Especially, we give properties related on decomposition by a symmetric family of positive operators, in connection to Welch type inequalities as sum of low-rank terms. Some open problems are also presented.

□ **On the stability of solutions for a system of inequalities**

JÓZSEF KOLUMBÁN AND MARCEL BOGDAN

Closedness of the solution map is obtained for a sequence of parametric inequality problems related to a limit problem governed by a topologically pseudomonotone function. The main result gives sufficient conditions to this aim. Some relationships between Γ -convergence and our conditions are emphasized, when particular cases for the sequence functions are considered. The main result stands when the sequence of functions are perturbed with an upper semi-continuous function in its first variable

□ **The minimization problem of a convex function on dense sets**

SZILÁRD CSABA LÁSZLÓ

We provide several results, concerning the behaviour of a convex function on dense sets, in a Hausdorff locally convex topological vector space setting. We obtain a general coincidence result for two convex functions that coincide on a dense set. Conditions, that ensure that the infimum, relative to a dense set, of a proper, lower semicontinuous and convex function, coincides to its global infimum, are also provided. We show by counterexamples, that these conditions are essential in order to obtain some minimax results on dense sets.

□ **Coupled fixed point for φ -contractions in b -metric spaces**

TANIA ANGELICA LAZĂR, VASILE LUCIAN LAZĂR AND GABRIELA PETRUȘEL

In this paper, we will present some coupled fixed point theorems for operators satisfying a contraction condition with respect to a comparison function. The approach is based on a Ran-Reurings type fixed point theorem for φ -contractions. An application to a system of integral equations is also given.

□ **Generalized Durrmeyer and Taylor-Durrmeyer type operators**

ANTONIO JESÚS LÓPEZ MORENO

We present a modification of different Durrmeyer type operators that generalizes some other sequences of operators that have appeared recently in the literature. We study several approximation properties and the asymptotic behaviour of these sequences.

□ **Some generalized monotone operators**

DANIELA MARIAN, IOAN RADU PETER AND CORNEL PINTEA

The talk will present some monotone operators namely Minty-Browder and η -monotone operators. It is shown how Minty-Browder operators generate η -monotone operators. Several properties of η -monotone operators are presented. We also provide estimates for the parameters of monotonicity of two composed operators as well as for the sum of two operators. The estimates are given in terms of the parameters of monotonicity of the involved operators and they produce examples of h -monotone operators which are not Minty-Browder monotone. As an application to these estimates we prove a global injectivity result.

□ **Efficient quadrature processes for computing integrals of highly oscillatory functions and some classes of special functions**

GRADIMIR V. MILOVANOVIĆ

The standard methods for numerical integration are not applicable to integration of rapidly oscillating functions, which appear in the theory of special functions, as well as in many applications in theoretical physics, quantum chemistry, the theory of transport processes, acoustic scattering, problems in electromagnetics, fluid mechanics, etc. Conventional techniques for computing values of special functions are power series, asymptotic expansions, continued fractions, differential and difference equations, and so on. Using suitable integral representation of special functions, in this lecture, we show how existing or specially developed quadrature formulas can be successfully applied to effectively calculation values of some special functions, such as highly oscillatory integrals of Fourier type with Hankel kernel, oscillatory Bessel transformation, Bessel-Hilbert transformation, etc. Theoretical results and numerical examples illustrate the efficiency and accuracy of the proposed methods.

□ **On the Cauchy-Schwarz inequality in an inner product space**

NICUSOR MINCULETE

The aim of this presentation is to discuss new results concerning the Cauchy-Schwarz inequality in an inner product space. Also we obtain several applications of these inequalities.

□ **Double condensation of singularities for a class of product quadrature rules of interpolatory type on Jacobi nodes**

ALEXANDRU MITREA

This paper is concerned with the topological structure of the set of singularities regarding a class of interpolatory product quadrature formulas on Jacobi node matrices. The main result of the paper highlights the phenomenon of double condensation of singularities regarding these formulas with respect to the Banach space of real continuous or differentiable functions, and to a Banach space of absolute integrable functions (equivalence classes of functions), defined on the interval $[-1, 1]$ of the real axis.

□ **Radiation of charged particles undergoing drift/diffusion**

GABRIELA RALUCA MOCANU AND IOAN RAȘA

Charged particles undergoing any type of accelerated motion emit electromagnetic radiation. In physical situations, complex interaction between initial conditions, particle motion and external medium leads to description of motion through a stochastic differential equation. The purpose of this work is to obtain the radiation emitted by a charged particle undergoing Brownian motion; as this entails both analytical and numerical work it thus becomes interesting to discuss the connection between the numerical solutions of the stochastic differential equation [1], obtainable through relatively low analytical effort and the Hörmander representation of the associated (deterministic) drift/diffusion differential operator [2].

The approach will be exemplified by considering the motion of a charged particle in a few particular cases: the unit sphere, the canonical simplex and the unit hypercube.

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□ **Efficient approximations for fractional order controllers**

ROZICA GABRIELA MOGA, DANIEL MOGA AND VLAD MURESAN

While the simulation of fractional order controllers performance is done on machines with powerful processors, their implementation would be much more appropriate on embedded processors. Superior performance of the control algorithms based on fractional derivative approximation with classical numerical methods was obtained only using a large number of digits. The paper presents an approximation of the Gamma function that is appropriate for implementation on 32 bit embedded processors.

□ Gronwall lemma and applications

VIORICA MUREȘAN

By using Picard operators' theory in an ordered L-space, I. A. Rus formulated abstract Gronwall lemma (see [2]).

This result can be used to obtain Gronwall type inequalities for functional-integral operators (see [1]).

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□ Isogonal transformations in hyperbolic plane

ANDREI NEAG

Let ABC be a triangle in the hyperbolic plane and M with barycentric coordinates (X_0^0, X_1^0, X_2^0) a point not on the sides of the triangle. We define a *isogonal transformation* to be a function that associates another point M' called the barycentric isogonal point for M .

Let M be a point in triangle ABC with barycentric coordinates (X_0^0, X_1^0, X_2^0) and M' its isogonal point in the triangle ABC . Then the coordinates of M' are:

$$\left(\frac{\sinh^2 a}{X_0^0}, \frac{\sinh^2 b}{X_1^0}, \frac{\sinh^2 c}{X_2^0} \right)$$

There are a lot of similarities between isogonal transformation in euclidian plane and isogonal transformations in hyperbolic plane. The scope of this paper is to give some example of properties that are kept in hyperbolic geometry and some properties that are changed with isogonal transformations.

□ **A Perov type result in gauge spaces and application to integral systems on semi-axis**

ADELA NOVAC

In this paper we present Perov type fixed point theorems for contractive mappings in Gheorghiu's sense on spaces endowed with a family of vector-valued pseudo-metrics. Applications to systems of integral equations are given to illustrate the theory. The examples also prove the advantage of using vector-valued pseudo-metrics and matrices that are convergent to zero, for the study of systems of equations.

□ **Modified Hadamard product properties of certain class of analytic functions with varying arguments defined by Sălăgean derivative**

AGNES ORSOLYA PALL-SZABO

In this paper we study the modified Hadamard product properties of certain class of analytic functions with varying arguments defined by Sălăgean derivative. The obtained results are sharp and they improve known results.

Key Words: analytic functions, modified Hadamard product, Sălăgean derivative

2010 AMS Subject Classification Code: 30C45

□ **Estimating the degree of approximation with Ditzian-Totik modulus**

RADU PĂLTĂNEA

We obtain new results concerning the estimate of the degree of approximation by Bernstein operators using the Ditzian-Totik modulus.

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□ **A mathematical model of the transition from the normal hematopoiesis to the chronic and acceleration-acute stages in myeloid leukemia**

LORAND-GABRIEL PARAJDI, RADU PRECUP AND EDUARD-ALEXANDRU BONCI

In this paper we propose a refined version of a mathematical model due to Dingli–Michor (2006), which allows us to make the transition from the normal hematopoiesis to the chronic and acceleration-acute stages in myeloid leukemia. The model parameters are $a, b_1, b_2, c; A, B, C$ and represents the nonrestrictive growth rates, the bone marrow microenvironment sensitivities and death rates of normal and leukemic stem cells, respectively. The parameter b_1/b_2 represents the humoral feedback from peripheral target tissue which allows for the possibility that the leukemic stem cells are less sensitive to the bone marrow microenvironment than the normal stem cells. To reflect this advantage for the leukemic stem cells, we assume that $b_1 > b_2$.

For the new model we obtain the steady-states and we investigate their stability. Compared to the original model, a new steady-state appears, corresponding to the chronic phase of the disease. Also, numerical simulations are given in order to illustrate the theoretical results.

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□ **A bound of the Finslerian Ricci scalar**

IOAN RADU PETER

In the Riemannian as well as in the Finslerian geometry, certain conditions on the Ricci scalar or the Ricci tensor imply obstructions on the topology of the base manifold and so on the configuration of cut points by limitations of the injectivity radius. In this paper we show that conversely, prescribing the injectivity radius of a Finsler manifold some limitations of the Ricci scalar are obtained. The case when the Ricci tensor is h -parallel with respect to the Chern-Rund connection turns out to be very interesting.

□ **Monotone operators. Applications**

CORNEL PINTEA

We enlarge the class of Minty-Browder monotone operators in such a way that some properties, possibly in weaker forms, are preserved. We study the monotonicity of the sum and the composition of two such generalized monotone operators and provide some applications.

□ **Some applications for scalar and vector optimization problems**

EMILIA LOREDANA POP AND DOREL DUCA

To an optimization problem, the first approximated optimization problem and the dual optimization problem are attached to it. For these problems are presented some connections between their optimal solutions and saddle points.

In the vector case are considered the optimization problem and the first approximated optimization problem attached to it. The applications here refers to the connections between the efficient solutions and saddle points for the Lagrangian of these two problems.

□ **The number of sums and differences for a set**

VASILE POP

For a finite set of real numbers A we consider the sum $A + A = \{x + y | x, y \in A\}$ and the difference $A - A = \{x - y | x, y \in A\}$. We denote by $S(A)$, respectively $D(A)$ the number of elements of the set $A + A$, respectively $A - A$. In this article we determine all the values which $S(A)$ and $D(A)$ can take. In particular, we show that the minimal values are obtained when A is an arithmetic progression and the maximal values are obtained when A is a geometric progression.

□ **Positive standing wave solutions for Schrödinger equations with oscillating state-dependent potentials**

RADU PRECUP

Motivated by relevant physical applications, we study Schrödinger equations with state-dependent potentials. Existence, localization and multiplicity results are established for positive standing wave solutions in the case of oscillating potentials. To this aim, a localized Pucci-Serrin type critical point theorem is first obtained. Two examples are then given to illustrate the new theory.

□ **Approximation properties of the iterates of some linear positive operators depending on a parameter**

VOICHIȚA ADRIANA RADU AND ANA MARIA ACU

During the last decade, q -Calculus was intensively used for the construction of various generalizations of many classical linear and positive operators. The aim of this paper is to study the convergence of the iterates of some positive linear operators depending on a parameter, using contraction principle (the weakly Picard operators theory) and first and second moduli of continuity (some quantitative results). Also some applications of different kind of linear and positive operators are provided.

Keywords: Linear and positive operator, q -integers, iterates, contraction principles, weakly Picard operators

MSC[2010]: 41A36, 41A25, 47H10, 54H25

□ **Orthogonal functions and hybrid approximations in calculus of variations and control theory**

MOHSEN RAZZAGHI

The available sets of orthogonal functions can be divided into three classes. The first class includes sets of piecewise constant basis functions (e.g., block-pulse, Haar, Walsh, etc.). The second class consists of sets of orthogonal polynomials (e.g., Chebyshev, Laguerre, Legendre, etc.). The third class is the set of sine-cosine functions in the Fourier series. While orthogonal polynomials and sine-cosine functions together form a class of continuous basis functions, piecewise constant basis functions have inherent discontinuities or jumps. In recent years, the hybrid functions consisting of the combination of block-pulse functions with Chebyshev polynomials, Legendre polynomials, Bernoulli polynomials, or Taylor series have been shown to be a mathematical power tool for discretization of selected problems.

In this talk, we present the hybrid functions of block-pulse with Legendre polynomials and block-pulse with Bernoulli polynomials. These hybrid functions are then utilized to reduce the solution of the problems in calculus of variations and control theory to a system of algebraic equations.

The method is computationally very attractive and gives very accurate results. The numerical solutions are compared with available exact or approximate solutions in order to assess the accuracy of the proposed method.

□ **Periodic orbits in a non-smooth discrete map**

GHEORGHE TIGAN

We study in this work the existence of periodic orbits in a generalized Nordmark non-smooth discrete map. The Nordmark map is related to the study of a class of two-order non-autonomous differential equations which model oscillators with impacts.

□ **Duality for an extended equilibrium problem**

LIANA TIMBOȘ

In this presentation we consider an extended equilibrium problem with sum of two functions, one being composed with a linear mapping and we introduce and study a dual problem associated to it. We show that the solutions of the two problems are strictly related to the saddle points of an associated Lagrangian function and, under appropriate conditions, to the solutions of the associated optimization problem and its dual. Among the special instances of our results, we rediscover results obtained for the generalized equilibrium problem considered by Bigi, Castellani and Kassay, and we also prove that for some particular cases the duality scheme considered here become the duality scheme concerning variational inequalities introduced in the literature.

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□ **Basic Morita equivalences and cohomology of block algebras of finite groups**

CONSTANTIN-COSMIN TODEA

Let k be an algebraically closed field and G be a finite group. First we recall the definition of basic Morita equivalence and of cohomology of a block algebra kGb , where b is a block idempotent. After this, we present a first result which gives an answer (for a particular class of blocks) to a question related to cohomology of blocks, proposed by Sasaki in 2014, using basic Morita equivalences. Mislin's Theorem, in the context of fusion systems associated to blocks, has applications to various questions related to basic Morita equivalences between two blocks. This theorem, related notations and results are also presented.

□ **Nonlocal Cauchy problems at infinity**

ADRIAN VIOREL

This contribution aims at investigating, in an abstract setting, the existence of solutions to the nonlocal Cauchy problem at infinity

$$\begin{cases} \frac{du}{dt} = f(t, u), & t \geq 0, \\ u(\infty) = g(u). \end{cases}$$

Unlike their standard counterparts, introduced by L. Byszewski in the early 1990s and which consider nonlocal initial conditions of type

$$u(0) = g(u),$$

nonlocal problems with conditions at infinity are intimately connected to ergodic theory and the asymptotic behavior of evolutionary equations in general, providing a series of interesting applications.

□ **A new elementary proof of Arzela's theorem for the Riemann integrable functions**

MIHAI VORNICESCU AND NECULAE VORNICESCU

The bounded convergence theorem for the Riemann integrable functions is a particular case of the bounded convergence theorem for the Lebesgue integrable functions. The problem is to find a proof that does not require notions of measurable sets. There exist a lot of, so called, elementary proofs. For example, such proofs were published by F. Riesz, L. Bieberbach, F. Hausdorff, W. F. Eberlein, W. A. Luxemburg.

This paper contains a new elementary proof of the following strong form of Arzela's theorem.

Theorem. Let $f_n : [a, b] \rightarrow \mathbb{R}$ be sequence of Riemann integrable functions converging a.e. on $[a, b]$ to a Riemann integrable function f . If there exists a constant $M > 0$ such that $|f_n(x)| \leq M$ for every $x \in [a, b]$ and every $n \in \mathbb{N}$, then $\lim_{n \rightarrow \infty} \int_a^b f_n(x) dx = \int_a^b f(x) dx$.

The proof uses the following results: an open set is an at most countable union of disjoint open intervals, the length of an open interval is the same as the length of the closed interval, the length of a bounded open set is the sum (or series) of the lengths of its components, and the properties of sets with zero measure.

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