Academic Days of Cluj-Napoca
ICTP 50 International Conference

Semicentennial "Tiberiu Popoviciu" Institute of Numerical Analysis

Cluj-Napoca, Romania, May 7–10, 2008

BOOK OF ABSTRACTS/PROGRAM

Honorary Chair:

Prof. Dr. Honoris Causa DIMITRIE D. STANCU
Honorary Member of the Romanian Academy

Scientific Committee:

Acad. M. Iosifescu
Acad. I. Cuculescu
Acad. D.D. Stancu
Prof. Dr. P. Blaga
Prof. Dr. Şt. Cobzaş
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Prof. Dr. M. Ivan
C.S. I Dr. G. Marinoschi
Prof. Dr. Şt. Măruşter
Prof. Dr. M. Megan
Prof. Dr. T. Precupanu
Prof. Dr. I. Raşa

Invited speakers:

S. Amat Plata(Spain)
I. K. Argyros (USA)
R. Beauwens (Belgium)
I. Cuculescu (Romania)
B. Lafuerza-Guillén (Spain)
T. Precupanu (Romania)

Local Organizers:

Ion Păvăloiu
Costică Mustăţa
Emil Cătinaş
Călin Vamoş
Mira-Cristiana Anisiu
Maria Crăciun
Diana Otrocol
Cornelia Revnic
Călin-Ioan Gheorghiu

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GENERAL INFORMATION

The meeting is devoted to aspects of Numerical Analysis, Approximation Theory, Mathematical Modeling, Computer Science, Historical aspects in the development of the Institute.

The issue 2 (vol. 37, 2008) of the journal "Revue d'Analyse Numérique et de Théorie de l'Approximation" will be devoted to this event. The authors are encouraged to send original work after the conference.

LOCATION

On May 7 the conference will take place at "Lucian Blaga" Central University Library, Clinicilor st., no. 2 (in "Piaţa Păcii").
On May 8 and 9 the conference will take place in rooms 5/I and 9/I, at the first floor of the main building of "Babeş-Bolyai" University, M. Kogălniceanu st., no. 1.

SOCIAL PROGRAM

The social program includes:

The Conference Dinner which will be held at "Cortez" Restaurant on Thursday, May 8, starting at 19:00 (departure at 18:30 from the front of "Babeş-Bolyai" University).

Trip On May 10 it is scheduled a trip to Jidvei Castle (a small castle in a region of Transylvania famous for winery) to taste wine; the departure will be at 09:30, from the front of "Babeş-Bolyai" University.

CONFERENCE SCHEDULE

Wednesday, May 7

"Lucian Blaga" Central University Library

8:30-10:00 Registration

10:00-11:50 OPENING CEREMONY

10:00-10:05	Welcome speech
10:05-10:10	**C. Mureşanu**
10:10-10:30	**I. Păvăloiu**
10:30-10:45	**D. D. Stancu**
10:45-10:55	**A. Petruşel**
10:55-11:15	**Şt. Măruşter**
11:15-11-20	**O. Aramă**
11:20-11:40	**E. Popoviciu**
11:40-11:50	**Şt. Ţigan**
11:50-12:45	COFFEE BREAK

Plenary Lectures

	Chairman: D. D. Stancu
12:45-13:25	**R. Beauwens** Discretization of the linear Boltzmann equation
13:25-14:05	**S. Amat Plata** The Piecewise Polynomial Harmonic Reconstruction in Image Denoising Applications
14:05-16:00	LUNCH BREAK

"Lucian Blaga" Central University Library

Talks

	Chairman: R. Beauwens
16:00-16:20	**J. Tanner** How many random projections does one need to recover a k-sparse vector?
16:20-16:40	**M. Ivan** Some remarks on generalized divided differences
16:40-17:00	**C. Cartis** Adaptive cubic overestimation methods for unconstrained optimization
17:00-17:20	**R. Precup, A. Buica** An abstract result on the quasilinearization method and its applications
17:20-17:40	COFFEE BREAK
	Chairman: J. Tanner
17:40-18:00	**C. Popa** Preconditioning by an extended matrix technique for convection-diffusion-reaction equations
18:00-18:20	**S. Gal** Approximation by some complex Kantorovich type polynomials and their iterates in compact disks
18:20-18:40	**M. Anisiu** Palindrome factors in finite words

Thursday, May 8

"Babes-Bolyai" University, Faculty of Mathematics and Computer Science

Plenary Lectures (Room 5/I)

	Chairman: St. MĂRUŞTER
09:00-09:40	**B. Lafuerza-Guillén** Survey on PN spaces
09:40-10:20	**T. Precupanu** About dual characterizations in best approximation problem
10:20-11:00	COFFEE BREAK

Section Talks

	Section A (Room 5/I)
	Chairman: I. CUCULESCU
11:00-11:20	**St. Măruşter** Preconditioning sparse nonlinear systems
11:20-11:40	**V. Berinde** Stabilyzing chaotic discrete dynamical systems by means of fixed point iterative method
11:40-12:00	**Cristina Popîrlan** The Mann and Ishikawa iterations - convergence analysis
12:00-12:20	**O. Cira** Start iteration for Ezquerro-Hernandez method
12:20-12:40	**E. Cătinaş** Controlling the convergence of the Newton-GMBACK method
12:40-15:00	LUNCH BREAK

	Section B (Room 9/I)
	Chairman: S. Gal
11:00-11:20	**S. Bica** New numerical method for Fredholm integral equations with modified argument
11:20-11:40	**L. Sasu** Dichotomy of difference equations and applications
11:40-12:00	**A. Vernescu** Some lighting jewellery of Tiberiu Popoviciu in Mathematical Analysis
12:00-12:20	**P. Pop** A Survey of Different Models of the Generalized Minimum Spanning Tree Problem
12:20-12:40	**M. Bencze, F. Popovici** A simple proof of Popoviciu's inequality
12:40-15:00	LUNCH BREAK

	Section A (Room 5/I)
	Chairman: V. Berinde
15:00-15:20	**T. Trif** Asymptotic behavior of intermediate points in certain mean value theorems
15:20-15:40	**N. Pop** A numerical method for solving of the boundary value problems for ordinary differential equations
15:40-16:00	**N. Suciu** Itô equation model for dispersion of solutes in heterogeneous media

19:00 CONFERENCE DINNER (departure: 18:30 from the front of the "Babeş-Bolyai" University)

Friday, May 9

"Babes-Bolyai" University, Faculty of Mathematics and Computer Science

Plenary Lectures (Room 5/I)

	Chairman: T. Precupanu
09:30-10:10	**I. Cuculescu** Generalization of some probabilities on $\mathbb{R}^n$ with uniform marginals
10:10-10:50	**I. K. Argyros** On a Class of Newton-like Methods for Solving Nonlinear Equations
10:50-11:30	COFFEE BREAK

Section Talks

	Section A (Room 5/I)
	Chairman: M. Ivan
11:30-11:50	**E. Popoviciu** Interpolation, convexite et approximation
11:50-12:10	**Şt. Ţigan** About some Multiple Criteria Ranking Procedures with multiple weighting and alternative random evaluations. Applications in the medical field
12:10-12:30	**D. Marian** Some types of convex functions on networks
12:30-15:00	LUNCH BREAK

	Section B (Room 9/I)
	Chairman: B. Lafuerza-Guillen
11:30-11:50	**I. Raşa** Positive operators and strongly continuous semigroups
11:50-12:10	**Şt. Cobzaş** Compact and precompact sets in asymmetric locally convex spaces
12:10-12:30	**C. Mustăţa** On a best uniform approximation problem for semi-Lipschitz functions
12:30-15:00	LUNCH BREAK

	Section A (Room 5/I)
	Chairman: I.K. Argyros
15:00-15:20	**R. Haeltermann** Extending Broyden's method to interaction problems
15:20-15:40	**I. Păvăloiu** On a Steffensen-Hermite type method of order three
15:40-16:00	**Claudiu Popîrlan** A Mobile Agents approach for shapes recognition
16:00-16:20	**M. Mihoc** Some observations concerning the connection between functional equations and nomography
16:20-17:00	COFFEE BREAK
	Chairman: C. Popa
17:00-17:20	**D. Pop, R. Trîmbiţaş** Approximation of the solution of a polylocal problem-a Computer Algebra Approach
17:20-17:40	**Şt. Ţigan** On a generalization of a monotone equilibrated optimization problem
17:40-18:00	**S. A. H. A. E. Tabatabei** A high order approximation for numerical solution of 1-D quasi-linear unsteady biharmonic problem

	Section B (Room 9/I)
	Chairman: St. Tigan
15:00-15:20	**N. Suciu** On the multi-decadal oscillation of Atlantic tropical storm activity
15:20-15:40	**R. D. Ene** Thermal stability problems in a thin, porous plate
15:40-16:00	**C. I. Gheorghiu** Accurate spectral methods for high order eigenvalue problems
16:00-16:20	**C. Revnic** Effect of the Magnetic Field and Heat Generation on the Free Convection Flow in a Tall Cavity Filled with a Porous Medium
16:20-17:00	COFFEE BREAK
	Chairman: Şt. Cobzaş
17:00-17:20	**A. Diaconu** On some iterative methods of approximation using divided differences
17:20-17:40	**A. Croicu** Stochastic control problems in biosciences: a numerical and computational analysis
17:40-18:00	**M. Crăciun** Detrending errors of the parameters of a noise superposed on a deterministic trend

Saturday, May 10

Trip to Jidvei Castle. Departure at 09:30, from the front of the "Babeş-Bolyai" University. Arrival back in Cluj about 18:00.

INVITED TALKS

The Piecewise Polynomial Harmonic Reconstruction in Image Denoising Applications

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When considering fast multiresolution techniques for image denoising problems, there are three important aspects. The first one is the choice of the specific multiresolution, the second one the choice of a proper filter function and the third one the choice of the thresholding parameter. The aim of this paper is to present and analyze a new algorithm improving, if possible, the classical ones, namely, linear wavelet algorithms with Donoho and Johnstone's Soft-thresholding with the universal shrinkage parameter.

On a Class of Newton-like Methods for Solving Nonlinear Equations

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2000 Mathematics Subject Classification. 65K10, 65G99, 65J99, 49M15, 49J53, 47J20, 47H04.

We provide a semilocal convergence analysis for a certain class of Newton-like methods considered also in [3], [4], [9], in order to approximate a locally unique solution of an equation in a Banach space.

Using a combination of Lipschitz and center-Lipschitz conditions, instead of only Lipschitz conditions [19], we provide an analysis with the following advantages over the work in [19] which improved the works in [5], [6], [8], [9], [12]-[23]: larger convergence domain and weaker sufficient convergence conditions. Numerical examples further validating the results are also provided.

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Discretization of the linear Boltzmann equation

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The linear Boltzmann equation describes a.o. the neutron distribution in a nuclear reactor and the photon distribution in a stellar atmosphere. Under its stationary monoenergetic form which we shall consider here, this distribution depends upon three spatial and two angular variables describing the neutron or photon position and its speed direction. We intend to review in the present talk two methods of discretization to which we contributed in past and ongoing works under progress at our department as well as through a variety of national and international collaborations.

The first one concerns the development of mixed hybrid discretization techniques actively developed in the recent years for many PDEs and based, for the linear Boltzmann equation, on the even and odd (angular) parity flux decomposition introduced by Vladimirov in the late nineteen fifties. This decomposition allows us to define primal and dual and thus also mixed variational formulations while the hybrid methods are characterized by the introduction of Lagrange multipliers to enforce interface continuity properties rather than imposing them in a strong sense. We shall discuss the present results and the unsolved problems.

The second review concerns the development of the boundary source (BS) method, an integral transport method introduced in the nineteen sixties for solving transport problems in piecewise homogeneous media, further developed in various ways and whose interest has risen since the development of transverse integration based nodal codes which transform three-dimensional problems into sets of one-dimensional problems coupled by transverse leakage terms. Our recent developments concerned the case of anisotropic scattering in

plane geometry and showed that the BS method may be considered as the most accurate available method in this field. We shall discuss its possible extension to other geometries and the difficulties (mainly pertaining to approximation problems) that have limited its development even in the case of 1D geometries.

Generalization of some probabilities on R^n with uniform marginals

Ioan Cuculescu[1] and Radu Theodorescu[2]

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Let $I = [0,1], (u_1, ..., u_q) \leq (v_1, ..., v_q)$ mean $u_i \leq v_i$ for all i. A track is a continuous function $A : I \to I^q$ such that $A(0) = 0, A(1) = 1$ (symbols 0 and 1 are also used for points having all coordinates equal to 0 and 1 respectively) and $A(s) \leq A(t)$ for $s < t$. $Q : I^q \to I$ is called a copula if it is the distribution function of a probability on I^q with all marginals uniform on I and a quasicopula if for every track T there exists a copula C_T which coincides with Q on T. We prove that: Q is a quasi-copula if and only if the following hold:
1. $Q(u_1, ..., u_q) = 0$ if at least one coordinate of $(u_1, ..., u_q)$ is 0; if all coordinates of $(u_1, ..., u_q)$ are 1 except u_k, then $Q(u_1, ..., u_q) = u_k$.
2. Q is nondecreasing in each of its arguments.
3. Q is Lipschitzian.

Survey on PN spacess

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We consider several open problems regarding probabilistic normed spaces. As is to be expected, the general question is how much of functional analysis can be applied within this framework.

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About dual characterizations in best approximation problem

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We consider the best approximation problem in extended form given by Ky Fan. For this problem associated to a nonvoid set A in a linear normed space with respect a given function f on A we establisch a dual characterization in minimax form. Consequently, we obtain optimality criteria by hypotheses of weak compactity and weak continuity.The special case of Hilbert space is also considered.

TALKS

On the multi-decadal oscillation of Atlantic tropical storm activity

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Long term Atlantic tropical storm activity is described by the time series of the yearly Accumulated Cyclone Energy (ACE) Index for the time interval 1851 - 2007. The ACE Index is a measure of total wind energy for North Atlantic basin and land falling tropical cyclone activity. The yearly ACE time series is non-stationary, and one step toward detecting possible long-term quasi-periods is to detrend the original data. In this paper, we use a procedure for data transformation by which ACE index is fitted with polynomials of increasing order, followed by detrend. It is shown that, with some approximation, the resulted time series is cyclo-stationary, and a multi-decadal oscillation is detectable, as indicated by the power spectrum analysis.

Palindrome factors in finite words

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The complexity function of a word over an alphabet with q letters assigns to each nonnegative integer n the number of factors (subwords) having the length equal to n. The total complexity of a word

counts all its nonempty factors. If instead of factors we consider palindrome factors (words equal to their mirror image), we get the notion of palindrome complexity function, respectively of total palindrome complexity.

We present the values which can be taken by the total palindrome complexity for words of a given length. For $M_q(n)$, the average number of palindromes in all words of length n, we prove that the limit of $M_q(n)/n$ is 0. A more elaborate estimation leads to $M_q(n) = O(\sqrt{n})$.

A simple proof of Popoviciu's inequality

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2000 Mathematics Subject Classification. Primary 26A51, 26D15; Secondary 26B25.

T. Popoviciu [4] has proved in 1965 the following inequality relating the values of a convex function $f : I \to \mathbb{R}$ at the weighted arithmetic means of the subfamilies of a given family of points $x_1, ..., x_n \in I$:

$$\sum_{1\le i_1<\cdots<i_p\le n} (\lambda_{i_1} + \cdots + \lambda_{i_p})\, f\left(\frac{\lambda_{i_1}x_{i_1} + \cdots + \lambda_{i_p}x_{i_p}}{\lambda_{i_1} + \cdots + \lambda_{i_p}}\right)$$
$$\le \binom{n-2}{p-2}\left[\frac{n-p}{p-1}\sum_{i=1}^{n}\lambda_i\, f(x_i) + \left(\sum_{i=1}^{n}\lambda_i\right) f\left(\frac{\lambda_1x_1 + \cdots + \lambda_nx_n}{\lambda_1 + \cdots + \lambda_n}\right)\right].$$

Here $n \ge 3$, $p \in \{2, ..., n-1\}$ and $\lambda_1, ..., \lambda_n$ are positive numbers (representing weights).

The inequality above (denoted $(P_{n,p})$ in what follows) is nontrivial even in the case of triplets (that is, when $n = 3$ and $p = 2$). Several alternative approaches of $(P_{3,2})$ are discussed in the recent book of C. P. Niculescu and L.-E. Persson [1]. See [3] and [2] for additional information.

Popoviciu's inequality is a refinement of Jensen's inequality and characterizes the convex functions.

The aim of our talk is to offer a simple argument of $(P_{n,p})$ based on mathematical induction and on a variant of the majorization inequality.

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Stabilizing chaotic dynamical systems through fixed point iterative methods

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In recent years, deterministic chaos has been observed when applying simple models to various phenomena in nature and science: population dynamics, chemical reactions, electronic circuits, cardiology, laser technology etc. One of the topics related to chaotic dynamical systems has been the development of techniques for the control of chaotic phenomena. Some of the basic methods of controlling chaos are summarized in Lynch [7], where a selection of various applications of chaos control in the real world are listed, see also Ditto et al. [3] and Chu [2]. Stabilizing unstable dynamical systems through feedback adjustment methods have dominated the recent research in the field off chaos control, see Huang [5] and references therein. This method has been shown theoretically and by numerical simulations to be effective in stabilizing unstable periodic points of chaotic discrete systems. In this article, a simple growth-rate type mechanism for controlling chaos in discrete systems, similar to that in Huang [6] but originating in iterative approximation of fixed points [1], is developed. We show in theory and by numerical simulations that our technique of stabilizing unstable periodic points of chaotic discrete systems is

effective and, moreover, compared to other stabilizing methods, has a extremely high speed. The main idea of the new method is inspired from recent and classical methods in the iterative approximation of fixed points, see Berinde [1].

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New numerical method for Fredholm integral equations with modified argument

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A method which combine the sequence of successive approximations, the trapezoidal quadrature rule and spline interpolation, is constructed to approximate the solution of nonlinear Fredholm integral equations with modified argument. Keywords and phrases: numerical method, Fredholm integral equations with modified argument, successive approximations, quadrature rule, spline interpolation.

Adaptive cubic overestimation methods for unconstrained optimization

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An Adaptive Cubic Overestimation (ACO) algorithm for unconstrained optimization is proposed, generalizing at the same time an unpublished method due to Griewank (Technical Report NA/12, 1981, DAMTP, Univ. of Cambridge), an algorithm by Nesterov & Polyak (Math. Programming 108(1), 2006, pp 177-205) and a proposal by Weiser, Deuflhard & Erdmann (Optim. Methods Softw. 22(3), 2007, pp 413-431). At each iteration of our approach, an approximate global minimizer of a local cubic overestimator of the objective function is determined, and this ensures a significant improvement in the objective so long as the Hessian of the objective is locally Lipschitz continuous. The new method uses an adaptive estimation of the local Lipschitz constant and approximations to the global model-minimizer which remain computationally-viable even for large-scale problems. We show that the excellent global and local convergence properties and worst-case iteration complexity bounds obtained by Nesterov and Polyak are retained, and sometimes extended to a wider class of problems, by our ACO approach. Numerical experiments with small-scale test problems from the CUTEr set show superior performance of the ACO algorithm when compared to a trust-region implementation.

Controlling the convergence of the Newton-GMBACK method

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GMBACK is a Krylov solver for large linear systems

$$Ax = b, \quad A \in \mathbb{R}^{N\times N} \text{ nonsingular}, b \in \mathbb{R}^N,$$

which is based on backward error minimization properties. For a given subspace dimension $m \in \{1, \ldots, N\}$ and an initial approximation $x_0 \in \mathbb{R}^N$ having the residual $r_0 = b - Ax_0$, GMBACK finds $x_m^{GB} \in x_0 + \mathcal{K}_m = x_0 + \text{span}\{r_0, Ar_0, \ldots, A^{m-1}r_0\}$ by solving:

$$\left\|\Delta_m^{GB}\right\|_F = \min_{x_m \in x_0 + \mathcal{K}_m} \|\Delta_m\|_F \quad \text{w.r.t. } (A - \Delta_m)x_m = b,$$

where $\|\cdot\|_F$ denotes the Frobenius norm of a matrix.

We consider nonlinear systems $F(y) = 0$, solved by the Newton-GMBACK method; the resulted iterations may be written either as inexact Newton methods or as quasi-Newton iterations. We compare different techniques for controlling the convergence orders of the resulted iterations, and we report numerical results for different test problems.

Start iteration for Ezquerro-Hernandez method

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We present a numerical method for solving nonlinear equation systems, namely Ezquerro-Hernandez method with a rate of convergence equal to 4. The main result of this article is an algorithm that determines a start iteration for the method within its quadruple convergence sphere.

Compact and precompact sets in asymmetric locally convex spaces

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Let X be a real vector space. An asymmetric seminorm is a sublinear functional $p : X \to \mathbb{R}_+$. If further, $p(x) = p(-x) = 0$ implies $x = 0$, then p is called an asymmetric norm. The main difference with respect

to a seminorm is that $p(x)$ can be different from $p(-x)$ for some $x \in X$. An asymmetric metric on a set Z is called a quasi-metric.

If P is a family of seminorms on X, then one defines, in the usual way, an asymmetric locally convex topology (LCS) $\tau(P)$ on X. This topology is derived from a quasi-uniformity on X, so an asymmetric LCS is also a quasi-uniform space (see [6]). The basic properties of asymmetric LCS were studied in [2].

Asymmetric normed spaces were studied in several papers (see, for instance, [5] and the references quoted therein). Some a applications of this theory to the study of complexity spaces were given in [7] and in other papers. It is worth to mention that the relations between completeness, compactness, precompactness and total boundedness are much more complicated in quasi-metric and in quasi-uniform spaces than in the symmetric case (see [6] and [3]). A detailed study of compactness and precomapactness in asymmetric normed spaces was done in the papers [4] and [1]. The aim of this paper is to extend these results to asymmetric LCS. Compact linear operators on asymmetric normed spaces, including a Schauder-type theorem on the compactness of the conjugate mapping, were considered in [3]. We shall try also to extend these results to asymmetric LCS.

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Stochastic control problems in biosciences: a numerical and computational analysis

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Biosciences research is not just to understand the dynamics, but to use that understanding to control the quantities of practical interest. The ability to control therapy or to control species has obvious, huge far-ranging human and economic impacts. It is unfortunate that the parameters that describe a biological model, e.g. initial or boundary conditions, model parameters, etc., are likely to not be known accurately, or in other words, are uncertain. Control without including these uncertainties can lead to significant errors. Therefore, a stochastic control would be more appropriate because it will take into the account the variability and uncertainty in the model parameters and it will be suitable for the entire class of individuals.

The key ingredient in the analysis of the stochastic control is the way uncertainties are modeled, as well as the information available for control. Quite often, probability distribution is used to model the uncertain variables. On the other hand, complete, incomplete, or no information is available for designing the control.

We will analyze a couple of stochastic control problems when no information on the state variables or on the observations is available. The analysis is motivated by the fact that sometimes it would be quite impractical and very expensive to reach to any kind of information. For instance, it is unrealistic to ask a patient to donate blood every hour (or day) in order to process the information related to a certain drug administration. Therefore we will look for deterministic controls which minimizes the classical expectation of the objective function versus the controls that represent the expectation of all stochastic optimal control strategies. The two strategies will be analyzed and compared in simple population growth models.

On the approximation of equations' solutions through methods that use divided differences

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The results presented in this paper concern the approximation methods of the equations' solutions that use the divided differences or some of their generalizations. Therefore, the use of the Fréchet differential is avoided. If $(X, \|\cdot\|_X)$ is a linear normed space and $X^* = (X, \mathbb{R})^*$, then for any $a \in$
$\in X \setminus \{\theta_X\}$ there exists $u \in X^*$ such that $\|u\| = 1$ and $u(a) = \|a\|_X$.

Therefore, if $x, y \in X$, $x \neq y$, there exists the mapping $U_{xy} \in X^*$ such that $\|U_{xy}\| = 1$ and $U_{xy}(x - y) = \|x - y\|_X$. Thus we define:

$$[x, y; f] : X \to Y,\ [x, y; f]\, h = \frac{U_{xy}(h)\, f(x) + U_{yx}(h)\, f(y)}{\|x - y\|_X}$$

and we can verify that $[x, y; f](y - x) = f(y) - f(x)$.

If $(X, \langle\cdot|\cdot\rangle)$ is a space with a scalar product we have for any $x, y \in X$, $x \neq y$, $h \in X$:

$$U_{xy}(h) = \left\langle h | \frac{x - y}{\|x - y\|_X} \right\rangle,\ [x, y; f]\, h = \frac{\langle x - y | h\rangle \cdot [f(x) - f(y)]}{\|y - x\|_X^2}.$$

An arbitrary mapping $\Gamma_{f;x,y} : X \to Y$ that verifies the equality

$$\Gamma_{f;x,y}(y - x) = f(y) - f(x)$$

is a **generalized abstract divided difference**. An example for $\Gamma_{f;x,y}$ is $[x, y; f]$.

Therefore the **method of the chord** has a meaning. This method consists in the building of the sequence $(x_n)_{n \in \mathbb{N}^*}$, startind from $x_0 \in D$ such that for any $n \in \mathbb{N}$ is verified the equality:

$$\Gamma_{f;x_{n-1},x_n}(x_{n+1} - x_n) + f(x_n) = \theta_Y.$$

and therefore we have a consistent study of its convergence.

We suppose: **i)** $(X, \|\cdot\|_X)$ is a Banach space; **ii)** the existence of a constant $L > 0$ such that for any $x, y, z \in D$ with $x \neq y$ and $y \neq z$ we have $\|\Gamma_{f;x,y} - \Gamma_{f;y,z}\| \leq L \|x - z\|_X$; **iii)** there exists the mapping $\Gamma^{-1}_{f;x_0,x_1} \in$
$\in (Y, X)^*$; **iv)** restrictions for the choice of the initial elements $x_0, x_1 \in D$.

With these hypotheses we prove: **j)** the existence for any $n \in \mathbb{N}$ of the inverse mapping $\Gamma^{-1}_{f;x_{n-1},x_n} : Y \to X$; **jj)** the existence in D of a solution $\overline{x}$ of the equation $f(x) = \theta_Y$ and the convergence of the sequence $(x_n)_{n\in\mathbb{N}^*}$ to $\overline{x}$; **jjj)** finally, an estimation of $\|\overline{x} - x_n\|$. The convergence order is $\alpha = \left(1+\sqrt{5}\right)/2$.

We study the improvement of the convergence order with respect to the method of Steffensen and Aitken-Steffensen or their generalizations through the method of the auxiliary sequences.

Let us consider an initial element $x_0 \in D$. Besides the main sequence $(x_n)_{n\in\mathbb{N}^*} \subseteq D$ we also use two auxiliary sequences $(y_n)_{n\in\mathbb{N}^*}, (z_n)_{n\in\mathbb{N}^*} \subseteq D$. We request the existence of the numbers $K_1, K_2, p, q > 0$ such that for any $n \in \mathbb{N}^*$ we have:

$$\|f(y_n)\|_Y \leq K_1 \|f(x_n)\|_Y^p, \ \|f(z_n)\|_Y \leq K_1 \|f(x_n)\|_Y^q. \qquad (1)$$

We will build the new iterate $x_{n+1} \in D$ for the verification of the equality:

$$\Gamma_{f;y_n,z_n}(x_{n+1} - y_n) + f(y_n) = \theta_Y \Longleftrightarrow \Gamma_{f;y_n,z_n}(x_{n+1} - z_n) + f(z_n) = \theta_Y.$$

For this method we suppose: **i)-ii)** the same conditions of the chord method; **iii)** for the elements of the sequences $(x_n)_{n\in\mathbb{N}^*}$, $(y_n)_{n\in\mathbb{N}^*}$ and $(z_n)_{n\in\mathbb{N}^*}$ for any $n \in \mathbb{N}^*$ the equality:

$$\Gamma_{f;y_n,z_n}(x_{n+1} - y_n) + f(y_n) = \theta_Y$$

and the inequalities (1) with the constants $a, K > 0$ are proven; **iv)** there exists the mapping $\Gamma^{-1}_{f;y_0,z_0} \in (Y,X)^*$; **v)** restrictions for the choice of the initial element $x_0 \in D$.

The following conclusions are true as well: **j)** for any $n \in \mathbb{N}^*$ we have that $x_n, y_n, z_n \in S(x_0, \delta)$, there exists the mapping $\Gamma^{-1}_{f;y_n,z_n} \in (Y,X)^*$ and:

$$x_{n+1} = y_n - \Gamma^{-1}_{f;y_n,z_n} f(y_n) = z_n - \Gamma^{-1}_{f;y_n,z_n} f(z_n);$$

jj) the sequences $(x_n)_{n\in\mathbb{N}^*}, (y_n)_{n\in\mathbb{N}^*}, (z_n)_{n\in\mathbb{N}^*} \subseteq X$ are convergent to the limit $\overline{x} \in S(x_0, \delta)$ such that $f(\overline{x}) = \theta_Y$; **jjj)** for any $n \in \mathbb{N}^*$ the following inequalities are fulfilled:

$$\|x_{n+1} - x_n\|_X \leq \lambda d^{2(p+q)^{n-1}} + \mu d^{(p+q)^n};$$

$$\|x_n - \overline{x}\|_X \leq \frac{\lambda d^{2(p+q)^{n-1}}}{1 - d^{2(p+q)^{n-1}(p+q-1)}} + \frac{\mu d^{(p+q)^n}}{1 - d^{(p+q)^n(p+q-1)}}.$$

Here λ, μ and $d < 1$ are determined numbers and α is the unique root from $]0, +\infty[$ of the equation $x^{p+q-1} + 2x^2 + 2x - 1 = 0$.

The convergence order of the sequence $(x_n)_{n\in\mathbb{N}^*}$ is $p + q$.

Thermal stability problems in a thin, porous plate

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Some numerical and analytical aspects of the stability of the formal solution for the dynamical problem associated with the governing equations in a thin, porous plate under a constant thermal source are discussed.

Approximation by Some Complex Kantorovich-Type Polynomials and Their Iterates in Compact Disks

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In this paper, Voronovskaja-type results with quantitative upper estimates and the exact orders in simultaneous approximation by complex Bernstein-Kantorovich and Stancu-Kantorovich polynomials and their iterates in compact disks of the complex plane are obtained.

Accurate Spectral Methods for High Order Eigenvalue Problems

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Two linear hydrodynamic stability problems are considered. The first one corresponds to an electro hydrodynamic convection between two parallel walls. The problem is an eighth order eigenvalue one containing homogeneous boundary conditions for the even order derivatives up to sixth order. By variational arguments it is shown that its smallest eigenvalue is real and positive. The problem is transformed into

a second order differential system supplied with Dirichlet boundary conditions. Two classes of methods are used in order to solve the problem, namely, direct methods (based on series of Chandrasekar-Galerkin type and of Budiansky-DiPrima type) and spectral methods (tau, Galerkin and collocation) based on Chebyshev and Legendre polynomials. For certain values of physical parameters the numerically computed eigenvalues from the low part of the spectrum are displayed in a table. They are accurate and confirm the analytical results. The second problem refers to the onset of convection in a horizontal layer of fluid heated from below in the presence of a gravity field varying across the layer. This problem is a sixth order one and is analyzed in a similar manner.

Extending Broydens method to interaction problems

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The solution of problems involving the interaction of different systems is a domain of ongoing research although often a good solver exists for each system separately. In this paper we draw our ideas from one of the best known all-round quasi-Newton methods: Broydens rank-one update, which we extend to algorithms using 2 approximate Jacobians. A comparison is made with the iterative substructuring method and Aitkens acceleration method.

A Remark on Generalized Interpolation

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We define a generalized interpolation scheme and generalize the notion of divided difference in the case of abstract interpolation by attaching to each interpolation operator a linear functional satisfying several conditions. The divided difference involved is used to generalize the Leibniz-type formula for divided differences.

Some types of convex functions on networks

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We present and study some kinds of convex functions defined on undirected networks. The relations between these concepts are also presented. We adopt the definition of network as metric space used by Dearing P. M. and Francis R. L. in 1974.

Preconditioning of Sparse Nonlinear Systems

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The paper deals with the precondition of nonlinear systems of equations with the view of using some asynchronous algorithms. The suggested precondition is suitable for algorithms which use the jacobian, the main idea being the improving some computational properties of the jacobian from the iterative algorithms point of view. Three methods are considered, Newton (classic), Gradient (a variant proposed by Fridman) and Conjugate Gradient with a Fletcher-Reeves type weight factor. The precondition consists in the finding a permutation of rows and columns which brings all non-zero elements of the jacobian around the main diagonal. Some characteristics of the diagonal blocks of matrices arisen from some partition of the system, will be presumable improved. For example, the condition numbers of every block are diminished in a great extent which produces a major improvement of the rate of convergence. A variant of Hill Climbing algorithm for unsymmetric matrices is considered. Some numerical examples are given, both for the bandwidth reduction algorithms and for the solving certain preconditioned sparse nonlinear systems using the considered methods. The results are encouraging, the soundness and the rate of convergence are significant improved in the case of precondition. Finally, the problem of partition (both the number of partitions and the dimension of every partition) and its influence about the computational properties is pointed out.

Modified Beta approximating operators of the first and second kind

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By using the modified beta distributions of the first kind (MB1) and of the second kind (MB2) we obtain a general class of modified beta first kind operators and modified beta second kind operators. We obtain several positive linear operators as a special case of this modified beta operators.

Some observations concerning the connection between functional equations and nomography

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In the current paper we present some functional equations that characterize the functions which are nomographicaly represented by various types of nomograms (plane or in space). We will approach the nomographical representation of the pseudo-sums of two and three variables. A mention will also be made of the functional equations that have as a solution the pseudo-sums.

On a best uniform approximation problem for semi-Lipschitz functions

Costică Mustăţa

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One considers the problem of best approximation of a real valued semi-Lipschitz fucntion F, defined on a asymmetric metric space (X, d), by the elements of the set $\mathcal{E}_d(\ F|_Y\ )$ of all extensions of $F|_Y$ $(Y \subset X)$, preserving the smallest semi-Lipschitz constant. It is proved that this problem has always at least a solution, if (X, d) is $(d, \overline{d})$ - sequentially compact, or of finite diameter.

On a Steffensen-Hermite type method of order three

Ion Păvăloiu and Emil Cătinaş

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It is known that the Steffensen and Aitken-Steffensen type methods are obtained from the chord method, using controlled nodes. The chord method is an interpolatory method, with two distinct nodes. Using this remark, the Steffensen and Aitken-Steffensen methods have been generalized using interpolatory methods obtained from the inverse interpolation polynomial of Lagrange or Hermite type. In this talk we study the convergence and efficiency of some Steffensen type methods which are obtained from the inverse interpolatory polynomials of Hermite type with two controlled nodes.

Approximation of the solution of a polylocal problem – a Computer Algebra approach

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Consider the problem:

$$\begin{aligned} -y''(x) + q(x)y(x) &= r(x), \qquad x \in [a, b] \\ y(c) &= \alpha \\ y(d) &= \beta, \qquad c, d \in (a, b). \end{aligned}$$

The aim of this paper is to present an approximate solution of this problem based on B-splines. We construct the approximation using collocation on a mesh based on Legendre points. Using computer algebra techniques and a Maple implementation, we obtain an analytical expression of the approximation and give examples.

A numerical method for solving of the boundary value problems for ordinary differential equations

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Newton interpolating series constructed by means of Newton interpolating polynomials are use to obtain approximate solutions of boundary value problems for linear differential equations.

A Survey of Different Models of the Generalized Minimum Spanning Tree Problem

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In this survey paper, we discuss the development of the Generalized Minimum Spanning Tree Problem, denoted by GMSTP, and we focus on the integer programming formulations of the problem. The GMSTP is a variant of the classical minimum spanning tree problem (MST), in which the nodes of an undirected graph are partitioned into node sets (clusters) and we are looking for a minimum cost tree spanning a subset of nodes which includes exactly one node from every cluster. In this paper we describe ten distinct formulations of the

GMSTP based on integer programming. Apart from the standard formulations all the new formulations that we describe are 'compact' in the sense that the number of constraints and variables is a polynomial function of the number of nodes in the problem. Comparisons of the polytopes corresponding to their linear relaxations are established.

Preconditioning by an extended matrix technique for convection-diffusion-reaction equations

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In this paper we consider a preconditioning technique for nonsymmetric elliptic boundary value problems. The rectangular preconditioning matrix is constructed via the transfer operators between successive discretisation levels of the initial problem. In this way we get an extended, square but no more invertible linear system which is solved by a conjugate gradient algorithm. Numerical experiments are presented for a 2D convection-diffusion-reaction problem.

A Mobile Agents approach for shapes recognition

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The importance of shapes (figures) recognition in virtual reality and computational vision was a long motivation for researchers. In this paper the shape recognition using a mobile agents technology is presented. The shapes is represented with a graphical user interface implemented in Java. The mobile agents (chosen The Aglet System developed by IBM in my proposed system) are used to extract information about shapes and recognizing the figure. The users can design the shapes on the interface and the application, using mobile agents,

return the name of the figures, if there are recognized. A lot of geometrical shapes (figures) are recognized and presented using mobile agents application.

The Mann and Ishikawa iterations - convergence analysis

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Suppose we have a real Banach space E and K a nonempty subset of E. Let T be a map on K. This paper analyzes the convergence of the Mann iteration process to a fixed point of T. In the same conditions as above, the convergence of Ishikawa iteration to a fixed point of T is analyzed. The paper compares the fastness of these two convergences when there are imposed condition to T and K.

Interpolation, convexité et approximation

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On donne une interpretation concernant la liaison entre les trois concepts: interpolation, convexité et approximation. On remarque les propriétés de convexité de ,,l'approximante" d'un objet, le procédé d'approximation étant précisé. La convexité, dont on parle, est construite à l'aide d'un procédé d'interpolation précisé.

An abstract result on the quasilinearization method and its applications

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The quasilinearization method goes back to Bellman and Calaba and was recently enriched by Lakshminkatham and his co-workers. Applying this method one obtains a quadratically convergent and monotone sequence of approximations to the solution to a given problem. Usually the problems that were treated came from differential equations.

In this talk we present a recent result on the quasilinearization method that holds for abstract operator equations in ordered Banach spaces.

We ilustrate the abstract result considering problems from differential equations that were not considered before by other authors.

Positive Operators and Strongly Continuous Semigroup

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We present some qualitative and quantitative results concerning the representation of certain strongly continuous semigroups as limits of suitable iterates of positive linear operators. By means of this representation, the properties of the semigroups can be related to those of the positive operators.

Effect of the Magnetic Field and Heat Generation on the Free Convection Flow in a Tall Cavity Filled with a Porous Medium

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A analytical study of the steady magnetohydrodynamics (MFD) free convection in an tall cavity filled with a fluid-saturated porous medium and with internal heat generation has been performed. It is considered that the Darcy law model is used. It is assume that a uniform magnetic field normal to the walls of the cavity is externally imposed. The values of the governing parameters are as follows: Hartmann number $Ha = 0, 10$ and 50, Rayleigh number $Ra = 10^3$, and the aspect ratio $a = 0.01$. The velocity and temperature profile are determined. These profiles are presented graphically at the center line of the cavity. It is found that the analytical solution is in very good agreement with the numerical solution which is obtained by solving partial differential equations using a finite-difference method.

Dichotomy Of Difference Equations And Applications

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We study the existence of exponential dichotomy of a discrete variational system in terms of the solvability of an associated control system. We consider as input space the space of all sequences with finite support and the output space is an l^p -space. We deduce necessary and sufficient conditions for exponential dichotomy and apply them at the study of dichotomy roughness. We obtain a very general lower bound for the dichotomy radius in terms of the norm of input-output operators.

On a generalization of some monotonic balanced optimization problems

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The balanced optimization problem is a combinatorial problem that was introduced by Martello et al. [5]. Several of it's variants and particular cases have been investigated by a number of authors (e.g., Ahuja [1], Camerini et al. [2], Galil and Schieber [3]). In the same line of research we notice the work of Punnen and Aneja [6] concerning some lexicographic variants of the balanced optimization problem. The goal of this paper is to consider a generalization of the monotonic balanced optimization problem [8] that contains as particular cases several types of generalized balanced optimization problems and the corresponding lexicographic versions and to show that the algorithm of Punnen and Aneja [6] can be extended for solving these new classes of balanced optimization problems. In this sense we use a monotonic combination of two specific bottleneck criteria that will lead to a generalization of the classical balanced optimization problem for which the complexity results due to Punnen and Aneja [6] still hold. We consider also two particular cases of the interval balanced optimization problem (with difference and ratio objectives) that can be formulate as monotonic lexicographic balanced problems. Based on the procedures for monotonic balanced optimization problem, we propose also some methods for solving some types of stochastic balanced optimization problems (see, Stancu-Minasian et al. [7]). Some applications for solving fuzzy balanced optimization problems are related to fuzzy random bottleneck problems (see, Katagiri et al. [4]).

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Itô equation model for dispersion of solutes in heterogeneous media

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Using the Itô formalism, we obtain a decomposition of the second spatial moment of the concentration in terms of the factors which govern non-reactive transport in heterogeneous media such as plasmas, aquifers and turbulent atmosphere. An "ergodic moment" independent of the initial state as well as a new "memory term" describing the persistent influence of the initial conditions are explicitly defined. The latter explains the non-ergodic behavior of the solute dispersion found in numerical experiments for large initial plumes.

A high order approximation for numerical solution of 1-D quasi-linear unsteady biharmonic problem

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In this paper a new discretization method based on mixing higher order finite difference scheme and some good approximations for numerical solution of 1-D quasi-linear unsteady biharmonic equation is introduced. Family of biharmonic equation has an extra range of types of the forth order partial differential equation. In real world a lot of physical phenomena concerns with biharmonic equation in several forms. For instances we can refer to the problem of determining the deflection of a thin clamped plate under the action of a distributed load f [3] or the problems related to blending surface [5]. In especial cases, nonlinear biharmonic equation arises in the study of traveling waves in suspension bridges or in the study of static deflection of an elastic plate in a fluid [2, 4]. There are some numerical methods for each type of biharmonic equation. Most of these methods are based on variational calculus, finite elements methods, integral equations and finite difference methods [6-7]. The accuracy of these numerical schemes goes back to the nature and type of biharmonic equation family and its related initial boundary value problems. In complicated geometry some domain decomposition methods can simplify reaching numerical results [1]. An implicit finite difference scheme using three spatial grid points for solving 1-D unsteady quasi-linear biharmonic problem was proposed by Mitchell [8] with A=1 and f=0 at the first time. Based on using and extending this approach for deriving difference model we have constructed a numerical method for 1-D unsteady quasi-linear biharmonic equation with higher accuracy. In this method combination of values of function u and its second derivatives respect to x is used to extract discrete difference formula. This combining causes fictitious points to be appeared for boundary values in discrete scheme. These fictitious points are approximating with good approaches so their errors do not overcome on the errors of the main numerical scheme. Depending on the function f the derived set of equations may be nonlinear, so appropriate iterative methods can be useful for decreasing the computational cost of solving set of equations. This paper is organized as follows. In the first section corresponding PDE is introduced along with its applications.

To introduce the underlying PDE, at first we consider the initial boundary value problem involving a 1-D fourth order quasi-linear partial differential equation with variable coefficients. The analytic solution of mentioned initial boundary problem can not be found for that with arbitrary components, so numerical methods are applied to approach these problems in associate physical models. In the second section our numerical scheme and its theoretical aspects are given. For introducing our numerical scheme at first proper approximations for function and its partial derivatives are provided and then second order derivatives are approximated by second order finite difference method. Enforcement of initial and boundary conditions will be made at the end of this computational sequence. At the first stage like what can be seen in [9] some appropriate approximations are introduced for function elements of initial-boundary value problem presented by the main equations. At the end of this section the discrete matrix relations for some specified cases are given. Error and stability considerations are given in the third section which is followed by some numerical examples validating our proofs and results. According to involved discretization approaches local truncation errors of gained numerical scheme are calculated. The underlying method is implicit and we prove that its corresponding local truncation error is of order six in place and four in time respectively. Besides accuracy the most advantage of this method is proper approaching the appeared fictitious points in discretization. Some quasi-linear and linear examples are approached by applying the new numerical scheme and satisfactory results are gained. This method can also be extended for some partial differential equations with more complex nonlinear terms. Last section deals with some concluding remarks and useful suggestions.

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How Many Random Projections Does One Need to Recover a k-sparse Vector?

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The essential information contained in most large data sets is small when compared to the size of the data set. That is, the data can be well approximated using relatively few terms in a suitable transformation. This paradigm of Compressed Sensing suggests a revolution in how information is collected and processed. In this talk we consider a stronger notion of compressibility, sparsity, which measures the number of non-zero entries. For data sets which are sparse (possibly following a transformation), the data can often be recovered efficiently, with relatively few randomized measurements by utilizing highly non-linear optimization based reconstruction techniques.

Specifically, consider an underdetermined system of linear equations $y = Ax$ with known y and $n \times N$, matrix A with $n < N$. We seek the sparsest solution, i.e., the x with fewest nonzeros satisfying $y = Ax$. In general this problem is NP-hard. However, for many matrices A there is a threshold phenomenon: if the sparsest solution is sufficiently sparse, it can be found by linear programming. Quantitative values for a strong and weak threshold will be presented. The strong threshold guarantees the recovery of the sparsest solution x_o, whereas a weaker sparsity constraint ensures the recovery of the sparsest solution for most x_o. Connections with high-dimensional geometry imply results about the structure of Gaussian point clouds and the neighborliness of polytopes.

Asymptotic behaviour of intermediate points in certain mean-value theorems

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Let I be an open interval in $\mathbb{R}$, let $a \in I$, let $n \in \mathbb{N}$, and let $f : I \to \mathbb{R}$ be a function whose derivative $f^{(n)}$ exists on I. Then for any other point x in I one can expand $f(x)$ about the point a up to nth power by the Lagrange–Taylor formula to obtain

$$f(x) = T_{n-1}(f;a)(x) + \frac{f^{(n)}(\xi)}{n!}\,(x-a)^n, \tag{1}$$

where $T_{n-1}(f;a)$ denotes the Taylor polynomial of degree $n-1$ associated to f at a. In (1) the intermediate point (or points) ξ lies (lie) strictly between a and x. In the special case when $n = 1$, formula (1) becomes the classical (Lagrange) mean value theorem

$$f(x) - f(a) = f'(\xi)(x-a). \tag{2}$$

In the last three decades there was some interest in the asymptotic behaviour of the intermediate point $\xi = \xi(x)$ in (1), (2) and other mean value theorems, when $x \to a$. Thus, A. G. Azpeitia [Amer. Math. Monthly **89** (1982), 311–312] proved that given $p \in \mathbb{N}$, the point ξ in (1) satisfies

$$\xi = \xi(x) = a + \binom{n+p}{n}^{-1/p}(x-a) + o(|x-a|) \qquad (x \to a)$$

if $f^{(n+p)}$ exists on the whole interval I and is continuous at a with $f^{(n+j)}(a) = 0$ $(1 \le j < p)$ and $f^{(n+p)}(a) \neq 0$. This result was generalized by U. Abel [Amer. Math. Monthly **110** (2003), 627–633]. He derived for ξ a complete asymptotic expansion of the form

$$\xi = \xi(x) = a + \sum_{k=1}^{\infty} \frac{c_k}{k!}\,(x-a)^k \qquad (x \to a),$$

provided that f possesses derivatives of sufficiently high order at a.

A well-known generalization of (2) is the Cauchy mean value theorem: consider two functions $f, g : I \to \mathbb{R}$ such that the derivatives

f' and g' exist both on I. If g' does not vanish in I, then for every $x \neq a$ in I one has

$$g'(\xi)[f(x) - f(a)] = f'(\xi)[g(x) - g(a)], \tag{3}$$

with intermediate point (or points) ξ strictly between a and x. In a recent paper, D. I. Duca and O. Pop [Math. Inequal. Appl. **9** (2006), 375–389] proved that given $p \in \mathbb{N}$, the point ξ in (3) satisfies

$$\xi = \xi(x) = a + \frac{1}{\sqrt[p]{p+1}}\,(x-a) + o(|x-a|) \qquad (x \to a)$$

whenever the derivatives $f^{(p+1)}$ and $g^{(p+1)}$ exist on I and are both continuous at a, $f^{(j)}(a)g'(a) = f'(a)g^{(j)}(a)$ for all $j \in \{2 \ldots, p\}$, and $f^{(p+1)}(a)g'(a) \neq f'(a)g^{(p+1)}(a)$.

In our talk we present similar asymptotic expansions for the intermediate points in other mean value theorems: the Cauchy–Taylor mean value theorem (which is a common generalization of (1), (2) and (3)), a generalization due to I. Pawlikowska of Flett's mean value thorem, and a Cauchy version of Pawlikowska's mean value theorem.

About some Multiple Criteria Ranking Procedures with multiple weighting and alternative random evaluations. Applications in the medical field

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The goal of this work is to present for the Multiple Criteria or Multi-attribute ranking problems [4] some new ranking methods using multiple weights and random alternative evaluations. The ranking procedures with random weights (KRM - Kataoka ranking method, BRM - Bereanu ranking method) are obtained by exploiting some ideas from continuous stochastic optimization [3] that can be found in Kataoka [1], and Bereanu [2], respectively. We illustrate and apply these ranking procedures for multi-criteria evaluating and ranking in the medical domain (ranking medical treatments, medical offices, risk factors, etc.). Each of these methods is numerically illustrated and the correlations between the results obtained by different methods are presented.

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Detrending errors of the parameters of a noise superposed on a deterministic trend

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A preliminary essential procedure in time series analysis is the separation of the deterministic component from the random one. If the signal is the result of superposing a noise over a deterministic trend, then first one must estimate and remove the trend from the signal to obtain an estimation of the stationary random component. We call detrending errors the errors affecting the statistical estimators of the noise due to the differences between the estimated and real trend. In this paper we analyze the detrending errors by means of a Monte Carlo method based on automatic numerical algorithms for nonmonotonic trends generation and for construction of estimated trends alike to those obtained by subjective methods. As an illustration of the detrending errors of the serial correlation we consider the fluctuations of the relative area of a human red blood cell freely floating in a fluid.

Some lighting jewellery of Tiberiu Popoviciu in Mathematical Analysis

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Tiberiu Popoviciu, a great Romanian mathematician and founder of the Institute , as his famous predecessor Dimitrie Pompeiu, was attracted to clarify certain fine questions of Mathematical Analysis and did it, creating some mathematical jewellery. We present a few of these.

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