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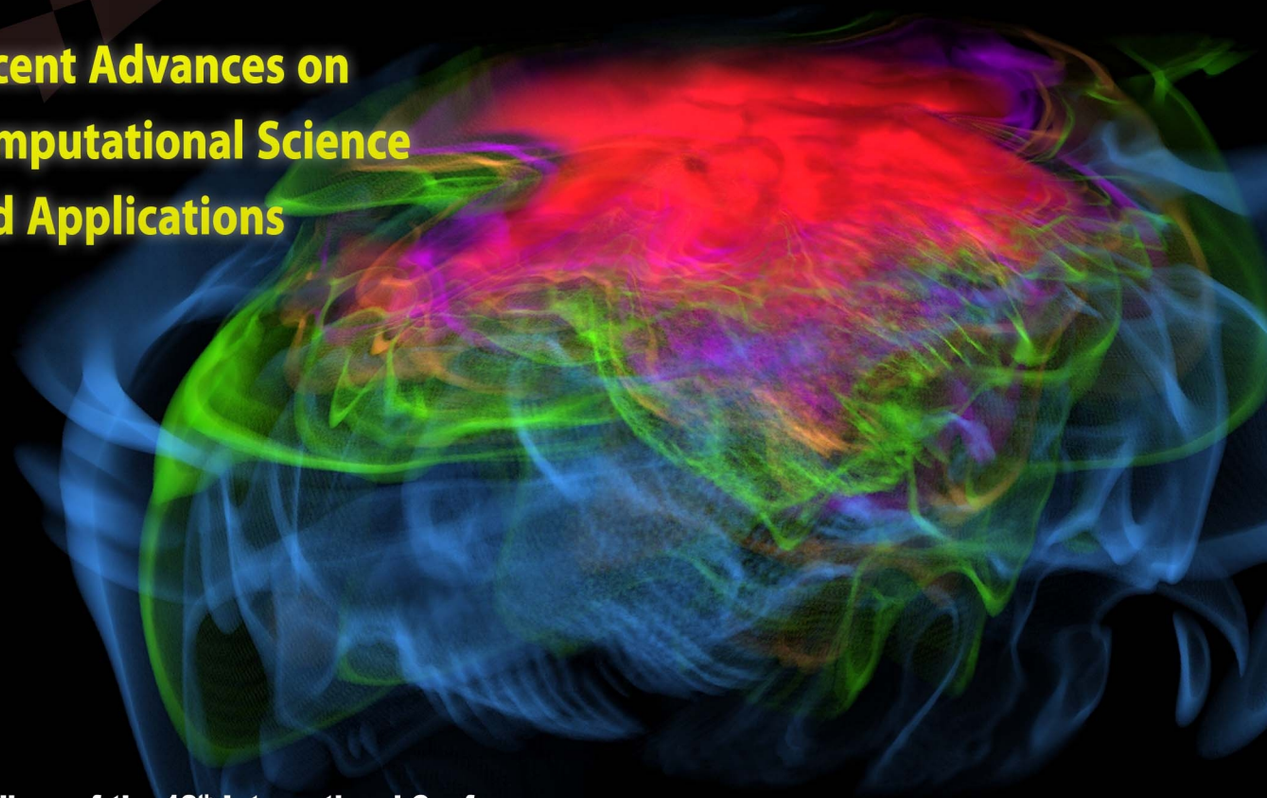
Recent Advances on Computational Science and Applications



Proceedings of the 12th International Conference on E-Activities (E-ACTIVITIES '15)

Proceedings of the 4th International Conference on Applied and Computational Mathematics (ICACM '15)

Seoul, South Korea, September 5-7, 2015

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Preface

This year the 12th International Conference on E-Activities (E-ACTIVITIES '15) and the 4th International Conference on Applied and Computational Mathematics (ICACM '15) were held in Seoul, South Korea, September 5-7, 2015. The conferences provided a platform to discuss e-learning, e-management, e-marketing, numerical analysis and applications, probabilities, statistics, operational research, algorithms, discrete mathematics, systems, communications, control etc. with participants from all over the world, both from academia and from industry.

Their success is reflected in the papers received, with participants coming from several countries, allowing a real multinational multicultural exchange of experiences and ideas.

The accepted papers of these conferences are published in this Book that will be sent to international indexes. They will be also available in the E-Library of the WSEAS. Extended versions of the best papers will be promoted to many Journals for further evaluation.

Conferences such as these can only succeed as a team effort, so the Editors want to thank the International Scientific Committee and the Reviewers for their excellent work in reviewing the papers as well as their invaluable input and advice.

The Editors

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Keynote Lecture 1

Space Pruning Approach to the Solution of Eigenvalue Problems for Singular Ordinary Differential Operators

Professor Metin Demiralp
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Abstract: Metin Demiralp was born in Turkiye (Turkey) on 4 May 1948. His education including the university undergraduate level was completely in Turkiye. His BS, MS degrees and PhD are from Istanbul Technical University. After his theoretical chemistry, applied mathematics, and, numerical analysis years he is now basically working on computational sciences. He has a group (Group for Science and Methods of Computing) in Informatics Institute of Istanbul Technical University (he is the founder of this institute). He collaborated with the Prof. Herschel A. Rabitz's group at Princeton University (NJ, USA) at summer and winter semester breaks during the period 1985–2003 after his 14 month long postdoctoral visit to the same group in 1979–1980. He was also in collaboration with a neuroscience group at the Psychology Department in the University of Michigan at Ann Arbour in three years around 2010 (with certain publications in journals and proceedings).
Metin Demiralp has more than 100 papers in well known and prestigious scientific journals, and, more than 260 contributions to the proceedings of various international conferences. He gave many invited talks in various prestigious scientific meetings and academic institutions. He has a good scientific reputation in his country and he was one of the principal members of Turkish Academy of Sciences since 1994. He has resigned on June 2012 because of the governmental decree changing the structure of the academy and putting politicial influence possibility by bringing a member assignation system. Metin Demiralp is also a member of European Mathematical Society. He has also two important awards of turkish scientific establishments.
The important recent foci in research areas of Metin Demiralp can be roughly listed as follows: Probabilistic Evolution Method in Explicit ODE Solutions and in Quantum and Liouville Mechanics, Fluctuation Expansions in Matrix Representations, High Dimensional Model Representations, Space Extension Methods, Data Processing via Multivariate Analytical Tools, Multivariate Numerical Integration via New Efficient Approaches, Matrix Decompositions, Multiway Array Decompositions, Enhanced Multivariate Product Representations, Quantum Optimal Control.
Metin Demiralp has been officially retired on May 4th 2015 due to age limitation in Turkey state universities. However, he is still an active and productive scientist and occupying a post-retirement position like emeritus professor in his same institution at the moment. He has same group as before, PhD and MS students in the computational science and engineering program and teaching sophisticated graduate courses presently.

Brief Biography of the Speaker: Ordinary Differential Operators (ODOs) are encountered in many branches of sciences and engineering. Especially quantum mechanics have many systems described by Hamiltonians which are of this type. The eigenfunction space of such systems are mostly described by analytic basis functions and it is very well–known that the images of any eigenfunction under any nonnegative integer power of considered ODO remains in the very same space where eigenfunctions lie. However, the singular nature of the considered ODO causes the appearences of certain nonanalytic function components which do not belong to the space spanned by the basis set of analytic functions. To remove these undesired appearences, one can work with an arbitrary infinite linear combination over the entire basis set spanning the space where eigenfunctions lie and try to specifically choose the linear combination coefficients such that the undesired nonanalytic function components vanish. This, in fact, imposes at least one or maybe more than one linear vanishing conditions over the combination coefficients mentioned above. This action prunes the space spanned by the originally chosen basis set. We use the word "prune" since the dimensionality reduction via abovementioned linear vanishing equation impositions is finite against the infinite dimensionality of the original space.
The linear vanishing equation impositions are done not only for a single positive integer power of the ODO under consideration, but for all possible nonnegative integer powers of that ODO. This results in an infinite number of linear equations at the end. Because of the practicality, we do not go to infinity, but instead, until a particularly chosen positive integer for the ODO's power. When these finite number of linear equations are used to eliminate some

coefficients of the infinite linear combinations we have mentioned at the beginning, a new basis function set is obtained such that the first elements of this set approximate the eigenfunctions of the ODO under consideration.
In the space pruning approach, it is very important how the initial basis set is constructed. The eigenvalue problem of an ODO is generally accompanied by the boundary conditions given at the end of the interval of the ODO's independent variable, in other words, most widely encountered problems of ODOs are two point boundary value problems. In addition to all these, one or both of the end points of the independent variable interval correspond(s) to singularities of the ODO. We prefer to focus on problems dealing with the cases with semi infinite interval [0,?) Then, the zero endpoint is considered as the space pruning point as long as the singularity at this point is a regular one. This enable us to use the nonnegative powers of the independent variable as basis set. However these basis set functions grow unboundedly at infinity urging us to use a common factor sufficiently rapid vanishing at infinity to suppress all of these types infinite grows. This common factor can be constructed by solving the asymptotic equivalent of the ODE corresponding to the eigenvalue problem of the considered ODO.
This presentation will focus on these type of issues and rather simple systems will be chosen as the target applications for the easy grasping of the basic philosophy.
URL for full CV: http://uzbilim.be.itu.edu.tr/demiralp/homepage

Plenary Lecture 1

Diffusion in Shrinking Media: A Modeling and Numerical Approach

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Abstract: Diffusion is observed during the drying process of materials. Some materials, especially porous ones, shrink during drying. Soils, clays, bricks and concretes may develop cracks during the drying process. Shrinkage of materials may cause unwanted defects such as crack, bow, crook, cup and twist on timbers. We study the shrinking of such materials during drying to understand the process better. In this talk, we will discuss the derivation of a mathematical model based on macro modeling. The solution is obtained numerically by applying a finite difference method. The model and the numerical scheme are compared with the ones of the unshrinking media.

Brief Biography of the Speaker: He got a Doctor degree in Applied Analysis and Mathematical Physics University of Twente, the Netherlands in 2002. At the same time, he has been a lecturer in the Department of Mathematics, Universitas Halu Oleo, Kendari Indonesia. In 2010 he was promoted to Professor of Industrial and Applied Mathematics. Currently, he is a vice president of the Indonesian Mathematical Society.
His main research areas are focused on Partial Differential Equations and applications. For the case of diffusion equation, he has applied it for modeling of wood drying in industry. Currently, he is also working on the relation of fundamental solution type with temporal probability density function of stock, currency and index dynamics.

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Plenary Lecture 2

Regularity and Critical Cones in Optimal Control

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Abstract: In this talk we explain how a well-known technique used to derive first and second order conditions for certain classes of constrained problems in optimization can be successfully generalized to optimal control theory. This method leads, in a natural way, necessary conditions on different critical cones according to different normality and regularity assumptions imposed on the corresponding extremals. We illustrate through some simple examples the usefulness of the conditions obtained in each case and introduce some recent applications of the main results on second order necessary and sufficient optimality conditions in calculus of variations and optimal control.

Brief Biography of the Speaker: Professor Rosenblueth holds a BSc in Mathematics from the National Autonomous University of Mexico and a PhD in Control Theory from the Imperial College of Science, Technology and Medicine, London, UK. He worked as a researcher in the Centre for Research in Mathematics, Guanajuato, Mexico and, since 1989, joined the Applied Mathematics and Systems Research Institute of the National Autonomous University of Mexico. He is Full Professor and currently a member of the Mathematical Physics Department. He has published more than 70 refereed papers, has spent sabbatical visits at the Weizmann Institute of Science, Rehovot, and Technion Israel Institute of Technology, Haifa, Israel, and has participated in numerous international conferences. His main research interests are in optimal control theory, variational analysis and optimization.

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Plenary Lecture 3

Computational Intelligence Based Tecniques in Power System Security Initiatives

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Abstract: Power system security is not a new issue in power engineering community. Nevertheless, studies are still carried out to alleviate this problem; related to voltage stability improvement, loss minimization, economic dispatch, stability tracing and voltage profile improvement. This talk will highlight several computational intelligence techniques in power system security initiatives. Several experiences associated with power system security will be shared together such as the assessment and improvement techniques. How power tracing was incorporated together in voltage stability will also be addressed. The marriage among computational intelligence techniques are also discussed; it also highlights the importance of reducing the computational burden experienced by the traditional meta-heuristic techniques.

Brief Biography of the Speaker: Prof. Dr. Ismail Bin Musirin obtained Bachelor of Electrical Engineering (Hons) in 1990 from Universiti Teknologi Malaysia, MSc Pulsed Power Technology in 1992 from University of Strathclyde, United Kingdom and PhD in Electrical Engineering from Universiti Teknologi MARA (UiTM), Malaysia in 2005. He is currently a Professor at the Faculty of Electrical Engineering, UiTM and the Director, Community of Research (CoRe), Advanced Computing and Communication (ACC) at UiTM. He also leads the Power System Operation Computational Intelligence Research Group (POSC) at UiTM. He has authored and co-authored 2 books, over 300 technical papers in indexed international journal and conferences. He is also an international journal reviewer for IEEE transactions, Elsevier Science, WSEAS, Energy Policy and many others. He has been the organizing chair for International Power Engineering and Optimization Conference (PEOCO) series for the nine years since 2007. He has delivered a keynote speeches at the 2009 WSEAS international Conference on Knowledge and Data Bases (AIKED2009) at Cambridge University, United Kingdom, International Conference on Computing, Mathematics and Statistics (iCMS2013) and International Conference on Computer and Communication Engineering (ICCCE2014). He has examined numerous PhD and MSc theses form local and foreign universities. His research interest includes artificial intelligence, optimization techniques, power system analysis, renewable energy, distributed generation and power system stability. He is a senior member of International Electrical and Electronics Engineers (IEEE), Senior Member of International Association of Computer Science and Information Technology (IACSIT), member of Artificial Immune System Society (ARTIST), member of International Association of Engineers (IAENG) and member for Association of Energy Engineers (AEE). To date he has conducted numerous short courses for local universities in Malaysia and industries.

Plenary Lecture 4

Mathematical Study of Some Models of the Atmosphere Dynamics Counting with Heat Transfer and Humidity

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Abstract: We investigate some mathematical properties of the solutions of various PDE systems which describe fluid dynamics of the Atmosphere with consideration of heat transfer, humidity and water content. For nonlinear PDE system of seven unknown functions, we prove the existence of the weak solution. For differential operators generated by the corresponding linear system, we find the essential spectrum of inner vibrations and localize the part of the complex plane for all the eigenvalues. We compare the obtained results with our previous study of the spectral properties of the compressible fluid. The results may be applied in the theoretical and computational study of the Atmosphere of the Earth.

Brief Biography of the Speaker: Andrei Giniatoulline received his undergraduate, MSc, and PhD degrees from Friendship University in Moscow, Russia. Since 1993, he has taught undergraduate and graduate level courses at the Department of Mathematics of Los Andes University in Bogota, Colombia, where he holds the position of Associate Professor. His research interests are in the areas of mathematical physics, with an emphasis on hydrodynamics and applied functional analysis. He has delivered invited lectures on the subject of Spectral Theory at universities in Bolivia, Brazil, Japan, Russia, Spain and other countries.

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Plenary Lecture 5

On Two Nonlinear Partial Integro-Differential Models

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Abstract: Two nonlinear partial integro-differential models are considered. Those models arise at mathematical modeling of process of electro-magnetic field penetration in the substance. In the quasi-stationary approximation this process is described by Maxwell's system of nonlinear partial differential equations. In 1983 by Gordeziani D.G., Dzhangveladze T.A. and Korshia T.K., in some assumptions Maxwell's system is rewritten in the following form

$$\frac{\partial H}{\partial t} = -rot\left[a\left(\int_0^t |rot\, H|^2 d\tau \right) rot\, H \right], \qquad (1)$$

where $H = (H_1, H_2, H_3)$ is a vector of magnetic field and coefficient $a(S)$ is defined for $S \in [0, \infty)$.

Modeling of the same process, some generalization of system of type (1) is proposed by Laptev G.I. in 1990 and following so-called averaged system of integro-differential equations is obtained

$$\frac{\partial H}{\partial t} = a\left(\int_0^t \int_\Omega |rotH|^2 dx d\tau \right) \Delta H . \qquad (2)$$

Many scientific works are devoted to the investigation and numerical resolution of (1) and (2) type models. There are still many open questions in this direction.

We study some properties of the initial-boundary value problems for one-dimensional (1) and (2) type models as well as numerical solution of those problems. We compare theoretical results to numerical ones.

Brief Biography of the Speaker: Temur Jangveladze (Dzhangveladze) graduated from Ivane Javakhishvili Tbilisi State University (TSU) Department of Applied Mathematics and Cybernetics in 1977. Professor Jangveladze has earned his PhD (candidate degree) in "Computational Mathematics" in 1984. His dissertation work was supervised by Professor Andro Bitsadze. In 1998 he defended Doctor of Science (Habilitation) Degree in specialty "Theoretical Bases of Mathematical Modeling, Numerical Methods, Program Complexes". He was Junior Scientific Researcher (1977-1983); Scientific Researcher (1983-1988); Senior Scientific Researcher (1988-1998); Leading Scientific Researcher (1998-present) of Ilia Vekua Institute of Applied Mathematics (VIAM) of TSU; Professor (1984-2009) and Invited Professor (2009-present) at TSU; Professor (2006-2010) at Ilia State University; Professor (2010-2014) at Caucasus University and Professor (2013-present) at Georgian Technical University. Since 1977 till now Professor Jangveladze gives lectures at various universities. Field of his scientific interests is Nonlinear Differential and Integro-Differential Equations, Numerical Analysis, Nonlocal Boundary and Initial Value Problems, Mathematical Modeling, etc. The full list of his publications comprises more than 150 scientific papers and text books. Professor Jangveladze is editor and member of editorial board of several international scientific journals. Professor Jangveladze was the member of international program committee and the participant of many international scientific conferences. He is chair of the Enlarged Sessions of the Seminar of VIAM, Section of Partial Differential Equations. He is holder of various national and international grant awards. In 2012-2013 he was awarded grant of Fulbright Visiting Scholar Program which gave him opportunity to visit Naval Postgraduate School in Monterey, CA, USA and to prepare main part of the monograph together with Professors Zurab Kiguradze and Beny Neta. The main part of that monograph is dedicated to the models (1) and (2).

Authors Index

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