

Editor

Ana Julia Viamonte



Mathematical Models and Methods in Modern Science

**Proceedings of the 14th WSEAS International Conference on
Mathematical Methods, Computational Techniques and Intelligent Systems (MAMECTIS '12)**



Host Organization and Sponsor



Porto, Portugal, July 1-3, 2012

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Preface

This year the 14th WSEAS International Conference on Mathematical Methods, Computational Techniques and Intelligent Systems (MAMECTIS '12) was held in Porto, Portugal, July 1-3, 2012. The conference provided a platform to discuss differential equations, finite differences, variational calculus, stochastic systems, integral equations, neural networks, fuzzy logic, evolutionary computing etc. with participants from all over the world, both from academia and from industry.

Its 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 this conference 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.

Conference such as this 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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Plenary Lecture 1

Multipoint Boundary Value Problem for Integral-Differential Equations



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Abstract: The main problem in a reactor theory is to find the neutrons distribution, hence its density. This is the solution of an integral-differential equation named the neutron transport equation and its knowledge guaranties the safety and efficiently of the nuclear reactor. This study deals with a topical problem of the nuclear-physics: the solving of neutron transport equation with variable coefficients. We shall use the linearized version of the Boltzmann equation with the numerous applications in physics, geophysics, astrophysics, light scattering, radiative transfer of stellar and planetary atmosphere. To solve the transport equation we subdivide the overall domain into regions within which the coefficients of equation (i.e. the medium properties) are constant. A new homotopy perturbation method is applied to obtain the continuous solution of the integral-differential equation for a multipoint boundary value problem. The idea of this method consists in determining the series, whose sum represents this solution. The speed of convergence of the series is quite good, so only a few first terms calculation ensures the satisfactory approximation of the sought solution. A numerical example that confirms the usefulness of the proposed algorithm for solving the problems of this kind is also presented.

Brief Biography of the Speaker: Olga Martin graduated the Faculty of Mathematics and Mechanics, University of Bucharest, Romania. She received his PhD in mathematics with the specialization in Dynamic Plasticity with paper work 'Applications of the Finite Element Method in Dynamic Plasticity'. During of twenty years, she had been senior researcher in Aircraft Institute, Strength Materials Department. Technical experience: structural strength computing reports using ANSYS program (wing-fuselage, fuselage frame, fin, elevator, rudder and aileron), dynamic and static test-programs for aircraft structures, fatigue test-programs for aircraft structures, iterative methods for the study of the reactions, which correspond to movable control surfaces, attached at n – points to an elastic structure and program of this, static and fatigue computation of the propeller (mono-bloc hub, blades and blades retention system). Nowadays, she is Professor at Applied Sciences Faculty, University "Politehnica" of Bucharest. Fields of specialization: Mathematical Analysis, Mathematical Physics, Computational and Experimental Solid Mechanics, Numerical Analysis, Statistical Calculus. She has published over 90 research papers and 18 books. Member of the editorial boards: Politehnica Sci. Bull. Series A, WSEAS Transactions on Applied and Theoretical Mechanics, WSEAS Transactions on Mathematics and she was involved in the program/organizing committees for many international conferences. Membership of Professional Societies: Society of Computer Aided Engineering – Member National Union of Romanian Scientists (Founding member), Balkan Society of Geometers member, Romanian Society of Mathematicians. Reviewer: WSEAS Press (books and journals), Scientific Bulletin, University "Politehnica" of Bucharest, Acta Mathematica universitatis Comenianae, Journal of Quantitative Spectroscopy and Radiative Transfer. Scientific Evaluation Societies: RELANSIN, University "Politehnica" of Bucharest, ARACIS, Bucharest, Bucharest, National Science Fund of Bulgaria.

Plenary Lecture 2

Solution of Direct and Inverse Problems in Eddy Current Testing



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Abstract: Two aspects of mathematical modeling of eddy current testing problems are analyzed in the talk. Available mathematical models for the solution of direct problems in eddy current testing are discussed in detail. Special attention is given to the analysis of assumptions and limitations of the models. In particular, the effect of a finite size of a conducting sample on the change in impedance of a coil is analyzed. The results of comparison of theoretical calculations with experimental data are discussed.

The second aspect is related to the solution of inverse problems. Applications include determination of electrical conductivity of metal plates and estimation of thickness of metal coatings. Results of numerical solution of inverse problems are presented.

Brief Biography of the Speaker: Andrei Kolyshkin received his undergraduate degree in Applied Mathematics in 1976 at the Riga Technical University. In 1981 he received a Ph.D in differential equations and mathematical physics at the University of St. Petersburg (Russia). Andrei Kolyshkin is currently a full professor at the Department of Engineering Mathematics at the Riga Technical University. His current research interests include investigation of stability problems in fluid mechanics with applications to open- channel flows, transient flows in hydraulic systems and mathematical models for eddy current testing. He is the co-author of three monographs published by Academic Press and CRM. Andrei Kolyshkin has participated in more than 40 international conferences and has published more than 70 papers in refereed journals since 1980. As a visiting professor and visiting researcher he spent a few years at the University of Ottawa and Hong Kong University of Science and Technology.

Plenary Lecture 3

Fractional Dynamical Systems



Professor J. A. Tenreiro Machado

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Abstract: Fractional Calculus (FC) started in 1695 when L'Hopital wrote a letter to Leibniz asking for the meaning of $D^n y$ for $n = 1/2$. Starting with the ideas of Leibniz many important mathematicians developed the theoretical concepts. During the thirties A. Gemant and O. Heaviside applied FC in the areas of mechanical and electrical engineering, respectively. Nevertheless, these important contributions were somehow forgotten and only during the eighties FC emerged associated with phenomena such as fractal and chaos and, consequently, in the modeling of dynamical systems. This lecture introduces the FC fundamental mathematical concepts, and reviews the main approaches for implementing fractional operators. Based on the FC concepts, are presented several applications in the areas of modeling and control, namely fractional PID, electromagnetism, fractional electrical impedances, evolutionary algorithms, nonlinear system control, and finance.

Brief Biography of the Speaker: J. A. Tenreiro Machado was born at 1957, graduated with 'Licenciatura' (1980), PhD (1989) and 'Habilitation' (1995) degrees in Electrical and Computer Engineering at the University of Porto. During 1980-1998 worked as Professor at the Department of Electrical and Computer Engineering of the University of Porto. Since 1998 is Coordinator Professor at the Institute of Engineering of the Polytechnic Institute of Porto, Department of Electrical Engineering. The main research interests are: Nonlinear Dynamics, Modeling, Fractional Calculus, Evolutionary Computing, Control, and Robotics.

Plenary Lecture 4

The Chronicles Paradigm and its Computational Applications



Professor Jose Aguilar

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Abstract: In this conference we review the temporal logic approach called Chronicle. We present the different studies regarding the reasoning and learning mechanisms proposed for such an approach and its utilization in different problems: recognition problems, distributed systems, ambient intelligence, etc. Finally, we analyze its potentiality in autonomic computing.

Brief Biography of the Speaker: Professor Jose Aguilar received the B. S. degree in System Engineering in 1987 from the Universidad de los Andes-Merida-Venezuela, the M. Sc. degree in Computer Sciences in 1991 from the Université Paul Sabatier-Toulouse-France, and the Ph.D degree in Computer Sciences in 1995 from the Université Rene Descartes-Paris-France. He was a Postdoctoral Research Fellow in the Department of Computer Sciences at the University of Houston (1999-2000). He is a Titular Professor in the Computer Science Department at the Universidad de los Andes (ULA), researcher of the Center of Studies in Microelectronics and Distributed Systems (CEMISID). Also, currently he is the head of the Department of Computer Science and Coordinator of the Applied Science Doctoral Program, Faculty of Engineering, University of the Andes. He is member of the Mérida Science Academy and of the IEEE CIS Technical Committee on Neural Networks.

He has published more than 350 papers in journals, books and proceedings of international conferences in the field of parallel and distributed systems (performance evaluation, task/data/transaction assignment and scheduling, fault tolerance, middleware design, etc.), computational intelligence (artificial neural networks, evolutionary computation, fuzzy logic, swarm intelligence, multi-agent systems, etc.) applied to combinatorial optimization, pattern recognition, control systems (identification and supervision systems, distributed and intelligent control, industrial automation, etc.), among others. He has published 9 books in the domain of computational sciences, and science and technology management. He has been Chairman of Symposia, Workshops, etc.; editor of proceedings and books, and member of more than 30 Program Committees for different International Conference and scientific juries. He has more than 50 conferences in different international or national congress. In addition, he has participated in training courses both nationally and internationally. He has received several awards and some of his papers have received special awards. Dr. Aguilar has been a visiting research/professor in different universities and laboratories (Université Pierre et Marie Curie-Paris-France, Université de Versailles Paris-France, Université Rene Descarte-Paris-France, Laboratoire d'Automatique et Analyses de Systèmes Toulouse-France, University of Houston-USA, Universidad de la Coruña-Spain, Universidad Complutense Madrid-Spain, Universidad Carlos III Madrid-Spain Institute National de Recherche en Informatique Nice-France, etc.). Aguilar has supervised more than 35 M.S. and Doctoral students in their theses and dissertation work. He is currently supervising 7 Ph.D. dissertations and 2 M.S. theses.

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