Editors: Metin Demiralp, Zoran Bojkovic, Angela Repanovici

Mathematical Methods and Techniques in Engineering & Environmental Science

- Proceedings of the 13th WSEAS International Conference on Mathematical and Computational Methods in Science and Engineering (MACMESE '11)
- Proceedings of the 10th WSEAS International Conference on Data Networks, Communications, Computers (DNCOCO '11)
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Catania, Sicily, Italy, November 3-5, 2011

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Preface

This year the Conferences were held in Catania, Sicily, Italy, November 3-5, 2011. The conferences provided a platform to discuss new mathematical methods, electrical engineering, civil engineering, environmental science, naval engineering, material science, data networks, communications, computers, sensors, signal processing, imaging sensors, machine learning, image synthesis, cognitive vision, biometrics, scientific and mathematical visualization, real time systems, grid computing, robotics, neural networks, fuzzy systems, materials, natural hazards, climate change factors, landscape architecture, public safety 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 indexed by ISI. Please, check it: www.worldses.org/indexes as well as in the CD-ROM Proceedings. They will be also available in the E-Library of the WSEAS. The best papers will be also promoted in 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

Nonlinear Explicit Ordinary Differential Equations: Are They Really Nonlinear?

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Abstract: We (myself, my son, my colleagues in my group and some other collaborators from certain universities) were concerning with construction of a fictituos probabilistic dynamics behind the ordinary differential equations. This was based on the fact that some dynamical systems like quantum dynamics or Liouville dynamics are governed by partial differential equations. However, it is also possible to construct an infinite degree of freedom system over the expectations or expected values of some operators such that these expectations are connected through some ordinary differential equations in infinite number since the operators appearing in the expectations are related to each other recursively through commutators without stopping. At the beginning even these expectation ODEs could have nonlinearities. After intense studies in our group we could be able to show that these ODEs can be structured in linear format by using certain appropriate basis operators. What we have observed was the fact that the lower number of ODEs were resulting in mostly nonlinear structures unless very specific characters are existing in the system under consideration. However infinite number of equations were capable of bringing linearity. This was a one way research. From probabilistic equations to ODEs. Later we focused on the reverse action. To find an appropriate probabilistic structure like partial differential equation became the target of our efforts. Four years ago, my son Emre Demiralp, joined with a group in University Michigan at Ann Arbor to work on neuroscientific problems. By his pushes on me we started to deal with the mathematical structure behind the brain activities. Since these problems were having too many parameters and necessitating huge number of data, the models might need causal and probabilistic aspects. However all systems were at most considered as dynamical systems which are governed by ODEs. If there would be a probabilistic structure it would be behind these mathematical objects. Our efforts intensified and focused on this issue. The last year our project group took some important steps and possibility of birth of a quantum mechanical background system seemed to be appearing on the horizon. This encouraged us to continue and eventually we could be able to develop a probabilistic structure not like quantum or Liouville mechanics but something new. There appeared an evolution operator instead of the Hamiltonian. A first order partial differential equation could have been constructed. Its solution was possessing wave function properties and so on. When this is done what we have seen was an infinite linear ordinary differential equation set with constant coefficient matrix. This was valid for all explicit ODEs, linear or nonlinear. Then we focused on to reveal this feature without using probabilistic toolsand considerations. Today we are at point that all these are accomplished. There is no nonlinear explicit ODEs but the nonlinear representation of infinitely linear structures. In other words, nonlinearity is the folded form of linearity. Many of well known ODEs are now under the attack of our group. Our major studies are directed to this area.

Brief Biography of the Speaker:
Metin Demiralp was born in Turkey on 4 May 1948. His education from elementary school to university was entirely in Turkey. He got his BS, MS, and PhD from the same institution, Istanbul Technical University. He was originally chemical engineer, however, through theoretical chemistry, applied mathematics, and computational science years he was mostly working on methodology for computational sciences and he is continuing to do so. 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 months long postdoctoral visit to the same group in 1979–1980. Metin Demiralp has more than 90 papers in well known and prestigious scientific journals, and, more than 170 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 is one of the principal members of Turkish Academy of Sciences since 1994. He is also a member of European Mathematical Society and the chief–editor of WSEAS Transactions on Computers currently. 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: Fluctuation Free 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.

Plenary Lecture 1

Using Information Technology to Support Knowledge Conversion Process

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Abstract: In documentation process is well known that first impulse is to try to find information on the web. Information literacy courses modules teach the strategies and methods to find information on the web. The purpose of this presentation is to investigate information quality assessment of information retrieved on the web. This paper reports on a usage study that was conducted in the autumn of 2010. The study included a survey of master students of Transilvania University of Brasov, Romania, Faculty of Mechanical Engineering, Mechatronics Department behavior regarding information quality assessment on the web. These four components, consider ting core category were analyzed: credibility of content, credibility of site, predictive relevance and veracity assessment. Content analysis and descriptive statistics were used to identify all attributes of quality assessment.

Brief Biography of the Speaker:
Prof. dr. Angela REPANOVICI teaches in the University Transilvania of Brasov, Romania to Mechanical Engineering Faculty. In 1999 she sustains one PhD thesis in technical science and in 2009 she sustains a PhD thesis in marketing in joint trusteeship with the field of information science. Her research is focused on information literacy, informatization systems, mechatronics systems used in archives and libraries, marketing research and scientometric studies.

Plenary Lecture 2

Idempotent Algebra Solutions for Some Minimax Location Problems

Associate Professor Nikolai Krivulin
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Abstract: Idempotent algebra, which deals with vector semimodules over idempotent semirings, finds expanding application as a promising modeling and solution tool in applied mathematics, computer science, and operations research. The progress in the area is mainly due to the fact that many complicated problems that are actually nonlinear in the ordinary sense become linear and so more tractable when translated into the language of the algebra. Specifically, many classical problems in graph optimization and dynamic programming reduce to solving linear vector equations, finding eigenvalues and eigenvectors of matrices, and to similar computational procedures in the idempotent algebra setting. To illustrate, we examine both unconstrained and constrained multidimensional minimax single facility location problems with rectilinear and Chebyshev distances.
We begin with an overview of preliminary definitions and results in idempotent algebra, including basic concepts of scalar and matrix algebra, and elements of the spectral theory of matrices. A new algebraic approach based on investigation of extremal properties of eigenvalues for irreducible matrices is developed to solve multidimensional problems that involve minimization of functionals defined on idempotent vector semimodules. Furthermore, we provide a conventional description for the location problems of interest and then represent the problem in terms of idempotent algebra. An algebraic solution is given to unconstrained problems that reduce them to evaluating eigenvalues and eigenvectors of an appropriate matrix. The solution is subsequently extended to problems under constraints on the feasible location set. We conclude with a brief discussion about possible lines of further development and new area of applications of the algebraic approach.

Brief Biography of the Speaker:
Nikolai Krivulin received a university degree in applied mathematics and operations research in 1983 from St. Petersburg State University. He got his Ph.D. degree in 1990 and D.Sc. degree in 2010 both in applied mathematics from the same university. In 1983 he joined the Computer Center at St. Petersburg State University as a system software engineer, and in 1985 started his Ph.D. study. In 1987 he joined the Faculty of Mathematics and Mechanics at St. Petersburg State University as an Assistant Professor, and became an Assistant Professor there in 1990. From 1999 to 2002 he was the head of the Department of Information Management at the Graduate School of Management of the same university.
He is currently an Associate Professor of the Department of Statistical Modelling at St. Petersburg State University. His research interests include theory and applications of idempotent algebra, modelling and performance evaluation of queueing systems, methods of optimization, computational statistics and computer simulation. Nikolai Krivulin is an author and coauthor of more than 70 publications including papers published in reviewed journals and conference proceedings, books chapters, textbooks, and a monograph. He is a grantee of national and international foundations, including the Russian Foundation for Basic Research, the Russian Foundation for Humanities Research, the NATO Science Foundation, the USIA and Eurasia Foundation (USA), and the Royal Society (UK). He was a member of program and organizing committees of international conferences on mathematics, computer sciences, and information technology. He is a member of St. Petersburg Mathematical Society, AMS, and SIAM.

Plenary Lecture 3

On Some Wireless Mesh Networks Issues: Architecture, Routing, Applications, Quality of Service

Professor Zoran Bojkovic
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Abstract: Compared to traditional mobile ad hoc networks, wireless sensor networks and infrastructure-based mobile cellular networks,wireless mesh networks (WMNs) are: (a) quasi-static in network topology and architecture, (b) not resource constrained at the mesh routers and (c) are easy and flexible to deploy. These technological advantages are especially appealing to the emerging market requirements on future wireless networks and services. WMNs combine wired and wireless networks with wireless routers as backbones and mobile stations as users. Wireless routers communicate with each other, and conduct multihop communications to forward mobile wireless stations' traffic to/from wired networks.

Mobile users' traffic travels over wireless routers and reaches wired networks. Each mobile station also acts as a router, forwarding packets for other mobile stations. As mobility and energy- saving are no longer issues, WMN routing considers link quality metrics suh as capacity or error probability. Potential applications of WMNs include broadband home networking, community and neighbourhood networking, enterprise networking, building automation, health and medical systems, public safety and security systems,intelligent transportation systems, emergency/disaster networking, metropolitan area broadband Internet access. This wide range of applications have different technical requirements and challenges in the design and deployment of mesh networking architectures, algorithms and protocols.Quality of service (QoS) is a challenging issue in WMNs which promise to support a variety of traffic types. They should satisfy, for example, the requirements of video streaming , Web surfing, bursty traffic over the Internet. In addition, they may need to deal with all different types of traffic simultaneously. As a consequence, various QoS classes are defined according to different traffic types. Users have strong preference for wireless access, and hence the increase in wireless access capacity could drive a wave of innovation that increases the total demand and high speed wreless access proliferates.

This presentation is organized as follows. Starting from the fact that the wireless mesh networking is an emerging technology for future broadband wireless access, WMNs overview is reported, together with streaming over mesh networks. Future wireless networking can benefit from a robust and reliable wireless mesh backbone rendered by mesh routers providing an all wireless ambiance. From this point of view, second part of this work deals with routing in WMNs including metrics as well as cross-layer design. As wireless mesh networking is an important architecture for future generation wireless communication systems, QoS provisioning as a challenging issue is considered in the third part. Open research issues and future work conclude the presentation.

Brief Biography of the Speaker:

Prof. Dr Zoran Bojkovic (http://www.zoranbojkovic.com) is a full professor of Electrical Engineering at the University of Belgrade,Serbia and a permanent visiting professor at the University of Texas at Arlington, TX, USA, EE Department, Multimedia System Lab. He was a visiting professor in more than 20 Universities worldwide and has taught a number of courses in Electrical Technology, Telecommunication Systems and Networks, Speach, Image and Video Processing, Multimedia Wire/Wireless Communication Systems, Computer Networks. Prof. Bojkovic is the co-author of 6 international books/monographies (Publishers: Prentice-Hall, Wiley, CRC Press, WSEAS) Also, some of these books have been published and translated in Canada, China, Singapore and India. He is co-editor in 62 International Books and Conference Proceedings. He has published more than 420 papers in peer-reviewed journals, conference proceedings and publications.He has conducted keynote/plenary lectures, workshops/tutorials as well as seminars , and participated in more than 70 scientific and industrial projects all over the world.He has been a consultant to industry research institutes and academia. His activities included serving as Editor- in- Chief in 2 International Journals and as Associate Editor in 3 International Journals. Prof. Zoran Bojkovic is an active researcher in wire/wireless multimedia communications. He is a Senior Member of IEEE and WSEAS, member of EURASIP, full member of Engineering Academy of Serbia as well as a member of Serbian Scientific Society.

Plenary Lecture 4

Steps in the Development of a New Skates System - Modelling, Simulation and Prototyping

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Abstract: Skates are used by a lot of people for relaxing, having a little fun or, in competition. Specially when relaxing and fun are involved, there has been observed the need for a fast, easy and, meanwhile, safe way of transforming roller skates into ice skates and vice-versa. This paper is about the main steps followed to develop a new and innovative system for positioning and fastening ice blades or rollers assembly onto one special boot. So, aspects of modeling, simulation and rapid prototyping are presented.

Brief Biography of the Speaker:
Has graduated in 1989, "POLITEHNICA" Institute of Bucharest, ROMANIA and in1989 - 1991 worked as an engineer - in the Design Department of a Romanian peripheral equipment factory, FEPER
Since 1991 has been working, as a teacher in "POLITEHNICA" University of Bucharest, ROMANIA - Manufacturing Department, in 2004, being Associate professor. The Doctoral Thesis, in 2000 - was on Quality and Machinability of Thermal Sprayed Layers.
Teaches courses and works into the fields of: Applied Statistics for Engineers; Metal Forming; Manufacturing Technologies; Injection Moulding, being scientific researcher, in about 30 Research Projects and Grants. First-author or, co-author, of about 95 studies and papers - published to International/National Conferences, Sessions, Workshops, Platform Meetings etc; of 12 books on Statistics, Manufacturing Technology, Geometrical Precision Inspection. Member of some professional associations, as Plastics Industry Producers Association - ASPAPLAST, ROMANIA, Rapid Manufacturing Association - RAPIMAN; has some international awards as: Best Innovation Award - at Brussels INNOVA Fair, 2007, Golden Medal - in INVENTIKA - 2008, Bucharest, Romania.
Has papers presented in WSEAS Conferences, in 2008, 2009 and, also published in WSEAS Journals. Was invited Plenary Speaker in WSEAS Conferences, like Venice - November, 2008 ; Cambridge - February, 2009; Baltimore - November 2010. Has performed organizing activities for WSEAS Conferences in Bucharest, in June and, specially, in November, 2008 - when was General Chairman.

Plenary Lecture 5

Knowledge Visualization - Approaches and Application

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Abstract: Knowledge Visualization is rather a new area of research and development. Its appearance is caused by the fact that the range of well investigated and established concepts of Data visualization and Information visualization implemented and integrated in different standard tools and applications cannot provide an adequate support for various activities and/or decision making. But exact this is the requirement on modern computing tools and approaches they have to satisfy in the long list of applications in business, administrations etc. The popular visualization of Data and Information in tables, diagrams, and other medial graphical techniques is focused and presupposes the professional knowledge by user in the application area e.g. to be able to make a decision. To improve these visualization approaches and platforms in order to enable the knowledge visualization one has to analyze origin of it and its role in different processes.
Outgoing point of such analysis is the subdivision of knowledge into declarative and procedural ones. The first is focused on description of objects, events etc. and its visualization is similar to those of Data and Information. The procedural knowledge is focused on activities, handling etc. and its visualization is consequently differs from those of Data or Information visualization. Presented paper describes the decisive aspects of professional knowledge in the context of its visualization and the utilization of this knowledge in selected application areas.

Brief Biography of the Speaker:
Wladimir Bodrow graduated from the Rostov-on-Don State University, Russia in 1975 where he studied theoretical Physics and Informatics. In the 1970s he worked as a senior researcher at the Rostov-on-Don University in the area of theoretical plasma physics. From 1979 till 1984 we worked at the physics department of Ernst-Moritz-Arndt University in Greifswald, Germany. Here he made his PhD project in the field of computing experiments in Plasma. Five years from 1984 until 1989 he worked as a team leader in research center of power provider. He developed the standard solutions for intelligent applications for energy industry. In 1990 Dr. Bodrow changed to University of Applied Sciences Berlin where he works a professor in the department of Business Informatics. His main area of teaching and research is Intelligent Applications in Business, Knowledge Management, Knowledge Based Systems, and e-Learning. As a leader of the knowledge visualization competence center at the university he investigates corresponding concepts and develops solutions to improve or enable different knowledge intensive business applications. He is author of several Books and about 80 papers published in international journals and conference proceedings, and invited book chapters.

Plenary Lecture 6

Controlling the Structure and Properties of Plastics by Specific Nucleation

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Abstract: Final properties of parts processed from semicrystalline polymers are controlled by their molecular, supermolecular and microscopic structure. While the molecular structure is defined within polymerization by material producer, the supermolecular and microscopic structure of thermoplastics develop during the solidification at the end of processing of final parts. Several factors can influence the solidification, i.e. crystallization, of polymer melt, e.g. thermodynamic and flowing conditions and, particularly, addition of heterogeneous nucleating agents. The introduction of heterogeneous nucleating agent can serve as a powerful tool for controlling of the morphology and consequently properties of final plastics part. The lecture will be focused on heterogeneous nucleation in general and the examples of successful use of specific nucleation in chosen plastics application.

Brief Biography of the Speaker:
Dr. Roman CERMAK, associate professor and head of the Department of Polymer Engineering, Tomas Bata University in Zlin, Faculty of Technology, Zlin, Czech Republic. At the same university, he got M.Sc. (2001) and Ph.D. (2005) degrees. His scientific interest is focused on the interrelations between processing, structure and properties of polyolefins. He is author of more than 80 papers and conference contributions.