



Mathematical Methods and Applied Computing

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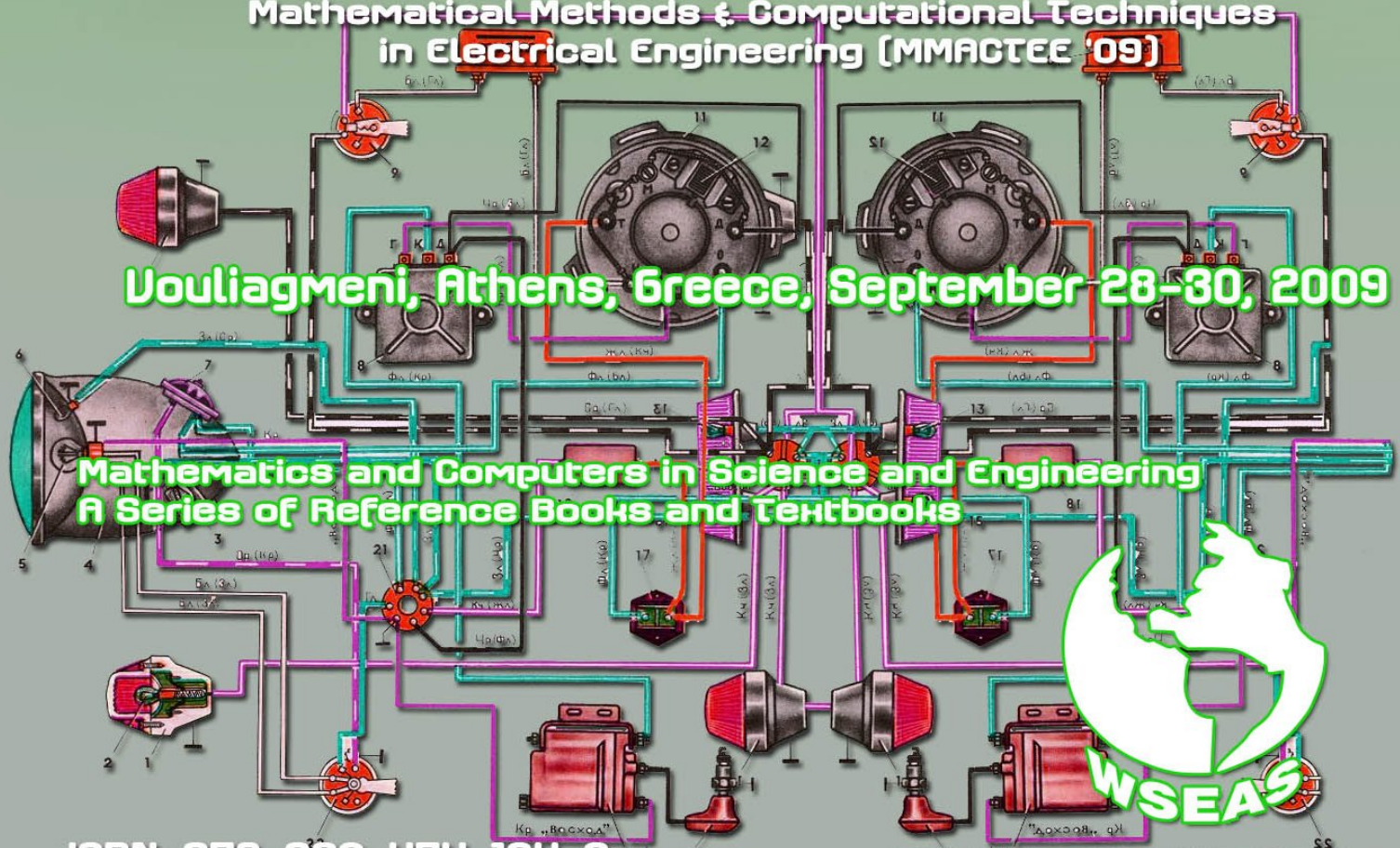
# Mathematical Methods and Applied Computing

VOLUME II

- Proceedings of the Applied Computing Conference 2009 (ACC '09)
- Proceedings of the 11<sup>th</sup> International Conference on Mathematical Methods & Computational Techniques in Electrical Engineering (MMAGTEE '09)

Douliagmeni, Athens, Greece, September 28-30, 2009

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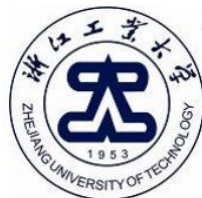
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**Preface**

This year the APPLIED COMPUTING CONFERENCE 2009 (ACC '09) and the 11th International Conference on MATHEMATICAL METHODS AND COMPUTATIONAL TECHNIQUES IN ELECTRICAL ENGINEERING (MMACTEE '09) were held in Vouliagmeni, Athens, Greece, September 28-30, 2009. The conferences remain faithful to their original idea of providing a platform to discuss algorithms, automata, formal languages, programming languages, software engineering, artificial intelligence, computational intelligence, real time and embedded systems, circuits, networks, electronics, microelectronics, nanoelectronics, automation, control, robotics 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](http://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.

A 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





## Table of Contents

<b>Keynote Lecture: High Dimensional Model Representation(s) as Multilinear Array Decomposition Method(s)</b> <i>Metin Demiralp</i>	19
<b>Plenary Lecture 1: Formal Testing Approach for the Conformance and Interoperability of MANET Routing Protocols</b> <i>Stephane Maag</i>	20
<b>Plenary Lecture 2: Immune Network and Adaptive Control</b> <i>Marius-Constantin Popescu</i>	21
<b>Plenary Lecture 3: Monte Carlo Cellular Automaton Simulation in Biomedical Science: Cancer Research and Min Protein Dynamics</b> <i>Yongwimon Lenbury</i>	22
<b>Plenary Lecture 4: Visualization and Interaction of the Virtual Human Organs for the Pre-operative Planning</b> <i>Lucio Tommaso De Paolis</i>	23
<b>Plenary Lecture 5: Potential Method in the Performance Evaluation of a Network Node</b> <i>Andrzej Chydzinski</i>	24
<b>Plenary Lecture 6: Simulation of Power Plants and Energy Conversion Systems</b> <i>Reinhard Leithner</i>	25
<b>Plenary Lecture 7: Electronic Health Record from an Australian Perspective</b> <i>Eugene Lutton</i>	26
<b>Plenary Lecture 8: Decision Precising Technologies in Decision Making Systems</b> <i>Gia Sirbiladze</i>	27
<b>Plenary Lecture 9: Iterative Numerical Methods for Simulation of Coupled Engineering Problems</b> <i>Ion Carstea</i>	28
<b>Plenary Lecture 10: Campus Web based Information System for Monitoring Quality of Life: A Case Study Applied to the University of Minhho</b> <i>Rui Antonio Rodrigues Ramos</i>	29
<b>Plenary Lecture 11: The Operating Risk Assessment for Dependable Systems</b> <i>Gabriela Tont</i>	30
<b>Part I</b>	31
<b>The C Compiler Generating a Source file in VHDL for a Dynamic Dataflow Machine</b> <i>Jorge Luiz E. Silva, Kelton A. P. Da Costa, Valentin Obac Roda</i>	33
<b>An Empirical Analysis of Convergence Related Particle Swarm Optimization</b> <i>Milan R. Rapaic, Zeljko Kanovic, Zoran D. Jelcic</i>	37

<b>Energy Consumption Forecasting in Process Industry Using Support Vector Machines and Particle Swarm Optimization</b>	43
<i>Milena R. Petkovic, Milan R. Rapaic, Boris B. Jakovljevic</i>	
<b>Lightweight Mix Columns Implementation for AES</b>	48
<i>Eslam Gamal Ahmed, Eman Shaaban, Mohamed Hashem</i>	
<b>CSCA-Based Expectivity Indices for LIDAR-Based Computer Vision</b>	54
<i>Donald J. McTavish, Galina Okouneva, Aradhana Choudhuri</i>	
<b>A New Paradigm: Web 2.0 Mashup Patterns</b>	62
<i>Cheng-Jung Lee, Shung-Ming Tang, Chang-Chun Tsai</i>	
<b>Modeling Multicomponent Vapor-Liquid Diffusion at High Pressure Including Convective Effects in the Vapor Phase</b>	68
<i>Elif Solak, Gulcin Cem, Betul Unlusu</i>	
<b>Optimality and Stability Criteria for Software Testing Process Control Model</b>	73
<i>Ljubomir Lazic, Nikos E. Mastorakis</i>	
<b>Implementation and Application of Extended Precision in Matlab</b>	103
<i>Z. L. Krougly, D. J. Jeffrey</i>	
<b>Effect of Artificial Viscosity on Central Finite Volume Solution of Time-Dependent Concentration Diffusion</b>	109
<i>Saeed-Reza Sabbagh-Yazdi, Mohammad-Amin Panahkhahi, Nikos E. Mastorakis</i>	
<b>High-Level Secured Signature Scheme</b>	115
<i>Nicolae Constantinescu, Costin Boldea</i>	
<b>Monte Carlo Cellular Automaton Simulation in Biomedical Science: Heterodimerization of Receptors</b>	119
<i>A. Wisitsorasak, W. Triampo, D. Triampo, C. Modchang, Y. Lenbury</i>	
<b>Comparison of Feature Detectors for Rover Navigation</b>	126
<i>Aldo Cumani, Antonio Guiducci</i>	
<b>Return on Investment in Business Intelligence in Small and Mid-Sized Businesses</b>	132
<i>Zeljko Panian</i>	
<b>Middleware Mechanisms for Dependable Network Services in a Distributed Processing System</b>	138
<i>Matei Dobrescu, Manuela Stoian, Cosmin Leoveanu</i>	
<b>Do Business Intelligence Systems Actually Improve Information Quality?</b>	144
<i>Jurij Jaklic, Pedro Simoes Coelho, Ales Popovic</i>	
<b>A Modified SOM Learning Algorithm for Mixed Types of Symbolic and Fuzzy Data</b>	150
<i>De-Hua Chen, Miin-Shen Yang, Wen-Liang Hung</i>	
<b>Temporalized Dempster-Shafer belief Structure in Discrimination Analysis</b>	156
<i>Anna Sikharulidze, Gia Sirbiladze</i>	
<b>Fuzzy Covering Problem Based on the Expert Valuations</b>	163
<i>Gia Sirbiladze, Anna Sikharulidze, Bezhan Ghvaberidze</i>	

<b>A New Method for Designing Network Management System</b> <i>Yanjun Zhao, Jinrong Tong, Mao Zhan</i>	171
<b>Design of Autonomous Control System for Underwater Vehicles</b> <i>Jinrong Tong, Yanjun Zhao</i>	176
<b>A Forward Secure Direct Anonymous Attestation Scheme</b> <i>Deng-Guo Feng, Jing Xu, Xiao-Feng Chen</i>	182
<b>Assessment of Improved Transformer Thermal Models</b> <i>Eleonor Stoenescu, Marius C. Popescu, Cornelia A. Bulucea</i>	189
<b>Simulations of Oil-filled Transformer Loss-of-Life Models</b> <i>Florentina Ilie, Cornelia A. Bulucea, Marius C. Popescu</i>	195
<b>Implementation of New Solution Software for Three Tank System Control</b> <i>Marius-Constantin Popescu, Gheorghe Manolea, Liliana Perescu-Popescu, Adrian Drighiciu</i>	202
<b>Solving Applications by Use of Genetic Algorithms</b> <i>Marius-Constantin Popescu, Liliana Perescu-Popescu</i>	208
<b>A Map-Coloring Application</b> <i>Liliana Perescu-Popescu, Mirela Lucia Calina, Marius-Constantin Popescu, Alexandru Calina</i>	214
<b>Learning with Edutainment: A Multi-Platform Approach</b> <i>Khaled Ayad, Dimitrios Rigas</i>	220
<b>Edutainment in E-learning Interfaces</b> <i>Dimitrios Rigas, Khaled Ayad</i>	226
<b>A Virtualized Environment and Orthogonal Array as a Method for Software Testing</b> <i>Snezana Popovic, Ljubomir Lazic, Nikos E. Mastorakis</i>	231
<b>Introduction of an Hamiltonian Function and a Canonical Representation in view of a Possible Optimal Control of a Cellular Colony</b> <i>J. Quartieri, S. Steri, Nikos E. Mastorakis, C. Guarnaccia</i>	241
<b>A Uniform Design of Microstrip Hairpin Line Filter at 7.2 GHz</b> <i>Haralambos P. Kokkalellis, Evangelia A. Karagianni</i>	252
<b>IS Change and RFID Deployment Protocol: A Collaboration of Two Models</b> <i>Tolga Pusatli, Eugene Lutton, Brian Regan</i>	258
<b>Patient Identification within a Healthcare System: The Role of Radio Frequency Identification and Bar Code Technologies</b> <i>Eugene Lutton, Brian Regan, Geoff Skinner</i>	264
<b>An IP Network Design Algorithm for Mixed Traffic</b> <i>Annop Monsakul, Pisit Charnkeitkong, Sanon Chimmanee, Panida Sampranpiboon</i>	270
<b>On the Deployment of AQM Algorithms in the Internet</b> <i>Pawel Mrozowski, Andrzej Chydzinski</i>	276
<b>On the Stability of AQM Algorithms</b> <i>Pawel Mrozowski, Andrzej Chydzinski</i>	282

<b>Soft-Computing Methods for Text-to-Speech Driven Avatars</b>	288
<i>Mario Malcangi</i>	
<b>Using the Active Queue Management Schemes to Achieve Intra-Class Fairness for the 802.11 WLAN EDCA Queues</b>	293
<i>Agnieszka Brachman</i>	
<b>Static, Adaptive, Adaptable, and Mixed-Initiative Approaches in E-Commerce: Controllability and Customisation</b>	300
<i>Khalid Al-Omar, Dimitrios Rigas</i>	
<b>An Initial Study into a Multimodal Note-Taking System</b>	306
<i>Mohamed Sallam, Dimitrios Rigas</i>	
<b>An IMS-based Virtualized Architecture: Performance Analysis</b>	311
<i>Giovanni Della Corte, Mario Di Mauro, Antonluca Robustelli, Maurizio Longo</i>	
<b>MANS: A Softbot with Adaptive Negotiation Strategies in the B2B E-Commerce</b>	317
<i>Sung Ho Ha, Dong-Sup Kim, Jong Sik Jin</i>	
<b>The Effect of Size of Personalised Menus on User Satisfaction</b>	322
<i>Khalid Al-Omar, Dimitrios Rigas</i>	
<b>Numerical Simulations for Dynamic Stochastic Models of Internet Networks</b>	328
<i>G. Mircea, M. Neamtu, A. L. Ciurdariu, D. Opris</i>	
<b>Modeling and Simulation of Catastrophic Events Affecting Critical Infrastructure Systems</b>	334
<i>Panagiotis D. Scarlatos, Evangelos I. Kaisar, Ramesh Teegavarapu</i>	
<b>A Determination of the Significant Points on Sporting Shooter Body for Comparison of the Computing and Measuring Shooter Movement</b>	347
<i>Martin Macko, Teodor Balaz, Frantisek Racek</i>	
<b>Iterative Methods for Simulation of Coupled Engineering Problems</b>	351
<i>Ion Carstea, Daniela Carstea, Alexandru Adrian Carstea</i>	
<b>Comparability of LSI and Human Judgment in Text Analysis Tasks</b>	359
<i>R. B. Bradford</i>	
<b>Analysis on Muscle Activities of Different Movement Patterns on an Unstable Platform using Association Rule Mining</b>	367
<i>Jung-Ja Kim, Yong-Jun Piao, Ah Reum Lee, Tae-Kyu Kwon, Yonggwon Won</i>	
<b>Risk Evaluation by Modelling Exposure to Direct Sunlight on Rural Highways – A GIS Approach</b>	373
<i>Christos Chalkias, Antigoni Faka</i>	
<b>A Model of Distributed Control for the Hybrid Transmission System using Multi-Agents</b>	379
<i>Eugen Diaconescu</i>	
<b>Efficient Execution of Parallel Applications in Grid with MPI Library</b>	384
<i>Felicia Ionescu, Mihai Chiru, Vlad Sandulescu, Mihail Ionescu</i>	
<b>Computational Aspects in Modelling of the Convection Flow in Porous Medium</b>	390
<i>Aurel Chirita, Horia Ene, Bogdan Nicolescu, Ion Carstea</i>	

<b>Numerical Approximation to Multivariate Functions Using Fluctuationlessness Theorem with a Trigonometric Basis Function to Deal with Highly Oscillatory Functions</b>	394
<i>N. A. Baykara, Ercan Gurvit, Metin Demiralp</i>	
<b>Numerical Integration of Bivariate Functions Using Fluctuationlessness Theorem with a Trigonometric Basis Function to Deal with Highly Oscillatory Functions</b>	400
<i>Ercan Gurvit, N. A. Baykara, Metin Demiralp</i>	
<b>Experimentations on the Gaussian Wave Type Basis Set for the Matrix Representations of Certain Univariate Functions</b>	406
<i>Meseret Tuba Gulpinar, Caner Gulpinar, Metin Demiralp</i>	
<b>Experimentations on the Associate Laguerre Basis Set for Certain Univariate Function Matrix Representations</b>	413
<i>Caner Gulpinar, Meseret Tuba Gulpinar, Metin Demiralp</i>	
<b>Expectation Value Evolutions for the One Dimensional Quantum Harmonic Oscillator Under the Influence of External Dipol Effects</b>	419
<i>Muzaffer Ayvaz, Metin Demiralp</i>	
<b>Part II</b>	425
<b>A Discrete Event Simulation to Model Passenger Flow in the Airport Terminal</b>	427
<i>G. Guizzi, T. Murino, E. Romano</i>	
<b>Prevention of Relapses in the Bipolar I Disorder: A Comparative Study between Quetiapine Monotherapy vs. Quetiapine-Valproate Combined Therapy</b>	435
<i>Petru Ifteni, Victoria Burtea, Corneliu Mosoiu</i>	
<b>The Influence of Metabolic Syndrome in Major Depressive Disorder Outcome</b>	438
<i>Petru Ifteni, Victoria Burtea, Vasile Chirita, Corneliu Mosoiu</i>	
<b>Valuing the Theory of Multiple Intelligences in Formal Curriculum. New Trends</b>	441
<i>Mariana Norel, Rodica Mariana Niculescu, Doina Usaci, Daciana Lupu</i>	
<b>The Perspective of a New Curriculum Focused on (Pre) Adolescents Self-Esteem Development</b>	446
<i>Daciana Lupu, Rodica Mariana Niculescu, Mariana Norel, Doina Usaci</i>	
<b>Study Regarding Life Quality Aspects on a Group of Pupils, Children and Adolescents</b>	452
<i>Florina Maria Gabor-Harosa, Nicolae Miu, Cristina Maria Borzan, Floarea Mocean</i>	
<b>Using Modern Information Technology in Health Promotion through Various Forms of Health Education at Community</b>	458
<i>Floarea Mocean, Lucia Lotrean, Lorena Filip, Cristina Borzan, Mihaela Baritz</i>	
<b>Interdisciplinary Model using Information Technology for Prevention of Violence and Intellectual Fatigue in Rural Student Communities</b>	463
<i>Floarea Mocean, Lucia Lotrean, Doina Miere, Cristina Borzan, Mihai Turcanu</i>	
<b>A Model of Approaching Melotherapy through On-Line Sources - An Alternative to the Treatment of Children with Communicative Deficiencies</b>	467
<i>Nelida Nedelcut, Ciprian Gabriel Pop, Cristina Borzan</i>	

<b>Aspects of Natality and Fertility in the North-Western Region of Romania, in the Period 2002-2006</b>	473
<i>Cristina Borzan, Marian Borzan, Floarea Mocean, Mihai Borzan</i>	
<b>Radon Impact in Patients with Broncho-Pulmonary Cancer in Centre Areas of Transylvania</b>	478
<i>Doina Adina Todea, Constantin Cosma, Loredana Elena Rosca, Andreea Cristina Herescu, Tiberius Dicu, Natalia Neagoe</i>	
<b>Nosocomial Infections - Ethical Opinions</b>	483
<i>Ion Moleavin, Izabela Voinea, Liliana Rogozea, Cristina-Elena Veregut</i>	
<b>The Usage of an Informatic System to Improve Monitoring Patients with Diabetes</b>	489
<i>Ion Moleavin, Cristina-Elena Veregut</i>	
<b>The Psychological Dynamics. The Mechanism of the Need for Psychological Stimulation</b>	493
<i>Alin Gilbert Sumedrea</i>	
<b>Committed Learning - A Core Issue of Curriculum in Health Education</b>	497
<i>Rodica Mariana Niculescu</i>	
<b>The Overlap of Depression and Anxiety Symptoms in a Community Sample of Romanian Young Adults</b>	503
<i>Victoria Burtea, Corneliu Mosoiu, Mihai Varciu, Florin Leasu</i>	
<b>Dimensions of Anxiety Symptoms in Romanian Young Adult Subjects from Brasov County</b>	507
<i>Dumitru Victor Burtea, Victoria Burtea, Corneliu Mosoiu, Alin Gilbert Sumedrea</i>	
<b>Syndrome Specification by Factor Analysis In Schizophrenia</b>	511
<i>Corneliu Mosoiu, Victoria Burtea, Alin Gilbert Sumedrea, Petru Ifteni</i>	
<b>Medical Statistics Methods used in the Study of Ischemic and Haemorrhagic Strokes Diagnosed through Computer-Tomography</b>	516
<i>Andrea Fleancu, Gabriela Sechel, Mihai Turcanu</i>	
<b>A Study on the Level of Stress in a Health Unit</b>	520
<i>Cristina Borzan, Floarea Mocean, Cristina Stefana Borzan, Livia Vincze</i>	
<b>Implication of Bologna Process on the Academic Curriculum. An Approach Focused on Student's Perspective</b>	525
<i>Doina Usaci, Mariana Norel, Rodica Mariana Niculescu, Daciana Lupu</i>	
<b>Web-services for Monitoring the Resistance to Antibiotics of Pathogen Germs</b>	531
<i>Mihaela Elena Idomir, Liliana Rogozea, Codruta Gabriela Nemet</i>	
<b>Prospects for the Design of an E-health System for Monitoring Patients with Diabetes and Stroke</b>	535
<i>M. Ivanovici, P. Borza, L. Nedelcu, H. Decean, C. Falup, M. Romanca, I. Szekely</i>	
<b>Capacity Development for Speeding and Speed Running of 11 Years Old Athletes</b>	541
<i>Cecilia Gevat, Alin Larion, Dana Badau</i>	
<b>Two Years Risk of Death Prediction after Acute Myocardial Infarction Treated with Fibrinolytics. A Statistical Model</b>	547
<i>Diana Tint, Gh. Pamfil, Mariana Radoi, Florin Leasu</i>	

<b>Promoting the Researches in the Field of Medicine through Institutional Repositories</b>	551
<i>Angela Repanovici, Gabriela Sechel, Andrea Fleancu, Luciana Cristea</i>	
<b>A New Approach for a Healthcare Network Architecture and Security</b>	557
<i>Mihai Scutaru, Radu Toev, Mihai Romanca, Marian Alexandru</i>	
<b>Prognosis Factors in Muscle-Skeletal Tumors (Osteosarcomas and Soft Tissue Sarcomas)</b>	563
<i>Milena Adina Man, Dana Alexandrescu, Dana Badau</i>	
<b>PET-CTi Contribution in Staging Macronodular versus Nodular non Small Cell Lung Carcinoma</b>	569
<i>Dana Alexandrescu, Milena Man, Bogdan Ratiu-Duma, Roxana Miclaus</i>	
<b>The Juridical Protection for the European Health Insurance Card</b>	575
<i>Laura Manea, Adrian Constantin Manea</i>	
<b>Aspects Concerning Misconduct during a Clinical Trial</b>	579
<i>Laurentiu Nedelcu, Liliana Rogozea, Alexandru Balescu, Camelia Scarneciu</i>	
<b>The Evolution of Synthetic and Demographic Indices after 10 Years from the Introduction of the Healthcare Reform in Romania</b>	582
<i>Alexandru Balescu, Laurentiu Nedelcu, Liliana Rogozea, Codruta Nemet</i>	
<b>Dental Management of Patients with Organ and Bone Marrow Transplants – Preventive and Therapeutic Aspects</b>	588
<i>Corina-Mona Buzea, Marian Cuculescu, Elena Podoleanu, Cristina Teodora Preoteasa, Roxana Ranga</i>	
<b>Multi-Objective Optimization Technique for Simulated Active Body Control with Frictional Contacts</b>	594
<i>Livia Sangeorzan, Mircea Parpalea, Cezar Podasca, Milan Tuba</i>	
<b>Digital Radiography using High Dynamic Range Technique</b>	599
<i>Dan Ciurescu, Sorin Barabas, Livia Sangeorzan, Ligia Neica</i>	
<b>Development during Infancy in Relation with Nourishment in Children from a Romanian Nursery</b>	604
<i>Cristina Petrescu, Laurentiu-Marius Zavoianu, Oana Suciu</i>	
<b>Experimental Study on Improving the Quality of Life through the Standardization of an Aerobics Program and of Effort Parameters Control using the Pulse Tester</b>	610
<i>Dana Badau, Alin Larion, Adela Badau, Dana Alexandrescu</i>	
<b>Communication Problems at Implementing Information Systems in the Management of Romanian State Forests</b>	616
<i>Eugen Iordache, Rudolf Derczeni</i>	
<b>Online Patient Record in an Emergency Room Based on WEB 2.0 Technologies</b>	622
<i>Livia Sangeorzan, Anisor Nedelcu, Camelia Mazgaciu, Liliana Rogozea, Cezar Podasca</i>	
<b>Software Project Tracking Metrics Analysis Model Based on Project Requirements</b>	627
<i>Evangelos Markopoulos, Georgios Alexopoulos, Nikolitsa Bouzoukou, Javier Bilbao</i>	



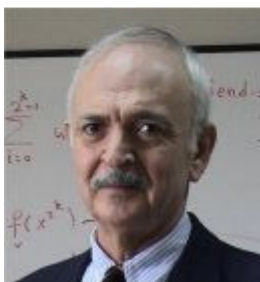
<b>Software Project Volume Sizing for Tracking Software Intensive Investments and Business Initiatives</b>	633
<i>Evangelos Markopoulos, Nikolitsa Bouzoukou, Georgios Alexopoulos, Javier Bilbao</i>	
<b>Web Services for Supporting Health Managers in the Assessment of the Impact of Local Policies on the Health Status of the Population</b>	639
<i>C. Domnariu, I. Moisil</i>	
<b>A Software Tool for Students' Evaluation</b>	644
<i>Ligia Neica, Flavius Sarbu, Carmen Domnariu, Rudolf Derczeni</i>	
<b>Application of Reductive Decomposition Method for Multilinear Arrays (RDMMA) to Animations</b>	648
<i>Emre Demiralp</i>	
<b>Quantum Mechanical Matrix Ordinary Differential Equations and their Solutions by Characteristic Evolutions</b>	657
<i>Metin Demiralp</i>	
<b>A Mobile Agents System for Intelligent Data Analysis</b>	663
<i>Claudiu Ionut Popirlan, Laura Stefanescu</i>	
<b>Optical Coherence Tomography System Optimization using Simulated Annealing Algorithm</b>	669
<i>Mohammad-Reza Nasiri-Avanaki, S. A. Hojjatoleslami, Maria Paun, Simon Tuohy, Alexander Meadway, George Dobre, Adrian Gh. Podoleanu</i>	
<b>Optimal Distribution of Fluxes in Complex Topological Network</b>	675
<i>Paata Kervalishvili, Badri Meparishvili</i>	
<b>The Analysis of OFDM Constellations for Digital Terrestrial Television</b>	680
<i>Iulian Udroi, Ioan Tache, Nicoleta Angelescu, Ion Caciula</i>	
<b>The Impact of Scholar Stress on the Core Temperature of the Pupil</b>	685
<i>Carmen Domnariu</i>	
<b>Concepts and Design of an Interoperability Reference Model for Scientific - and Grid Computing Infrastructures</b>	691
<i>Morris Riedel, Achim Streit, Thomas Lippert, Felix Wolf, Dieter Kranzmueller</i>	
<b>An Optimal Algorithm for General Array Geometrical k-Cut Problem</b>	699
<i>Sang-Young Cho</i>	
<b>A Location Tracking by RFID to Assist the Transportation Vulnerable in Subway Stations</b>	704
<i>Min-Hwan Ok</i>	
<b>Security Diagnosis of u-Weather Forecasting Service using Information Security Pre-Evaluation Model</b>	707
<i>DongHoon Shin, Wan S. Yi</i>	
<b>Sturdy of Security Reference Model of u?City Integrated Operating Center</b>	713
<i>Chansuk Jung, Yongtae Shin, DongHoon Shin, Yunmook Nah</i>	
<b>A Bayesian Framework for Parameters Estimation in Complex System</b>	719
<i>Adriana Calapod, Luige Vladareanu, Radu Adrian Munteanu, Dan George Tont, Gabriela Tont</i>	

<b>The Implementation of a Unidirectional Topology Using Hall Gyator</b> <i>Dan George Tont, Luige Vladareanu, Radu Adrian Munteanu, Gabriela Tont</i>	725
<b>Antireciprocal Two-Ports based on Equivalent Circuits</b> <i>Luige Vladareanu, Radu Adrian Munteanu, Dan George Tont, Gabriela Tont</i>	731
<b>The Operating Risk Assessment for Dependable Systems</b> <i>Gabriela Tont</i>	737
<b>New Constructive Solution for Vertical Machining Center Made by Feeler with FANUC</b> <i>Doru Bardac, Mihaiela Iliescu</i>	743
<b>Input Equivalent Impedance Optimization for Antireciprocal Quadripols</b> <i>Radu Adrian Munteanu, Luige Vladareanu, Dan George Tont, Gabriela Tont</i>	747
<b>Educational Platform GUI for Modeling and Simulation of DC-DC Resonant Converters</b> <i>Emilian Ceuca, Adrian Tulbure, Lucia Cabulea, Ioan Ileana</i>	753
<b>Transmission Error Correction Based on the Weighted Checksum</b> <i>Nikolaos G. Bardis, Nikolaos Doukas, Oleksandr P. Markovskiy</i>	758
<b>Innovation: Mobile Social Networking and Web 2.0 Online-Communities</b> <i>Cheng-Jung Lee, Chang-Chun Tsai, Shung-Ming Tang</i>	764
<b>Ear Recognition by using Neural Networks</b> <i>Hazem M. El-Bakry, Nikos Mastorakis</i>	770
<b>Studying the Relationship between Network Measurement Parameters and Available Bandwidth for Accurate Estimation</b> <i>Hazem M. El-Bakry, Nikos Mastorakis</i>	805
<b>An Integrated e-Service to Support the Realization of Local Agenda 21 Plans</b> <i>Nikolaos V. Karadimas, Giorgos E. Tsakalidis, Theofanis A. Alexandridis, Nikolaos P. Papastamatiou</i>	817
<b>Authors Index</b>	823



## Keynote Lecture

### High Dimensional Model Representation(s) as Multilinear Array Decomposition Method(s)



**Professor Metin Demiralp**  
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**Abstract:** The multilinear array decomposition is an intensely investigated area today. Although it is mostly used for three index arrays some other higher dimensional applications are also encountered. There are different approaches to this end although the most preferable one is the singular value decomposition's multilinear counterpart. It aims to decompose the multilinear array under consideration to a sum over outer products composed of more than two factors. The construction is based on the suppression of the Euclidean distance between the approximant and the target array by finding optimal values for the proposed unknown entities. The decomposition attempts to additively represent the target array in terms of lower rank arrays. This type methods present quite nonlinear problems as long as the products appearing in additive representation contain more than two unknown factors. This happens when the multilinear dimensionality (the number of the indexes) is at least three. However, by keeping the number of each product's unknown factors in the representation equal to two one can use the standard linear algebraic spectral tools to determine the unknowns. The author and Emre Demiralp (author's son, PhD student in cognitive neuroscience program of the Psychology Department in University of Michigan at Ann Arbor) started to deal with the development of such decomposition methods in last two years. The purpose was and still is to find some ways which bypasses certain technical and sometimes conceptual difficulties encountered in the employment of the standing methods. Their inspiration resources were basically high dimensional model representation which was developed in last two decades and the fluctuation free matrix representation as a recently developed efficient approximation tool. Their efforts take the fruits in certain applications and now new openings seem to be appearing in the horizon. High dimensional model representation (HDMR) and its quite new extension, Enhanced Multivariate Product Representation (EMPR) developed by the author can also be used as a decomposition method if the target function is considered as a data set given on the nodes of an orthonormal hyperprismatic grid and discrete geometry is utilized. HDMR can be considered as a particular case of an additive representation over the single factor products. The terms are ordered in ascending multivariate. EMPR, on the other hand, uses products, each of which contains same number of univariate factors within a one-to-one relation to the independent variables (indexes in the discrete case). However, this increasing number of factors is balanced by keeping the number of unknowns in each product just as 1 for easy determination. The given factors have certain common properties also and we call them "supports" since one can control the approximation quality even in the very crude cases of constant or univariate level truncations. Speech focuses on certain details of these issues by referring the original findings of the author and his group.

#### 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 70 papers in well known and prestigious scientific journals, and, more than 110 contributions to the proceedings of various international conferences. He has given many invited talks in various prestigious scientific meetings and academic institutions. He has a good scientific reputation in his country and he is the full member of Turkish Academy of Sciences since 1994. He is also a member of European Mathematical Society and the chief–editor of WSEAS Transactions on Mathematics currently. He has also two important awards of Turkish scientific establishments.

**Plenary Lecture 1****Formal Testing Approach for the Conformance and Interoperability|  
of MANET Routing Protocols**

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**Abstract:** Conformance and interoperability testing activities are crucial to the validation of real implementation. The challenges are nowadays well known and solutions for wired environments may be provided. Nevertheless, issues still remain for ad hoc routing protocols especially to check the reliability of Wireless Mobile Ad Hoc Networks. Most of the works related to the validation of such protocols are based on simulation and emulation analysis of simulated/emulated implementations without taking into account formal specifications. Indeed, inherent constraints from these networks raise new problems and research targets. Moreover, for many reasons, it has often been shown that the results obtained from simulator studies are far from the real case studies. In this talk, first I propose to establish a state of the art of that purpose and the existing solutions. Then I will focus on the testing issues related to conformance and interoperability of MANET routing protocols. Finally a nodes' self similarity technique devoted to the protocol specification and the testing process is illustrated especially to optimize the testing coverage as well to deal with unexpected and unpredictable topologies, messages and verdicts. Interesting results are by the way provided and illustrated through experiments.

**Brief Biography of the Speaker:**

Dr Stephane Maag obtained his MSc in 1999 and his PhD degree in 2002 from the University of Evry. He is an Assistant Professor since 2002 at the INSTITUT TELECOM (Paris) and more precisely into the Software for Networks department and the VPS (Validation of Protocol and Services) research team. He is also involved as a researcher in the CNRS research group Samovar (UMR 5157) since 2003.

His current research activities are the testing of protocol and services from formal or semi-formal models in the MANET area. The application domains are especially the routing protocols (DSR, OLSR, etc.) testing phases, from the specification, the verification, validation and test sequences execution regarding the conformance and interoperability of the protocols.

Dr. Stephane Maag is involved in several projects such as the FP6/FP7 IST calls, Eureka projects ( $\Sigma!$ ), ICT Asian projects and national ones. He also participates to the program committees of numerous national and international conferences. He published more than 30 papers in conference proceedings, books and journals. More details could be found on his webpage <http://www-lor.int-evry.fr/~maag>.

## Plenary Lecture 2

### Immune Network and Adaptive Control



#### **Professor Marius-Constantin Popescu**

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**Abstract:** This paper describes an attempt to spread further the inspiration gained from the knowledge of biological systems for engineering applications. New lessons addressed to the control of complex processes might derive from elements of the immune system comprehension. Important points inherent to the immune functions are transposed, re-interpreted and analysed in an adaptive control perspective. They are: viability, distribution, reinforcement learning, optimization, adaptability and memory. Several resemblances will be pointed out with the Q\_learning method as well as with classifiers system principles.

#### **Brief Biography of the Speaker:**

Marius-Constantin Popescu is currently an Associate Professor in Automatics and Computers, in the Faculty of Electromechanical, Environmental Engineering and Industrial Informatics, University of Craiova, Romania. He is graduate from the Faculty of Automatics-Computers and Informatics-Mathematics in Craiova, he received the Ph.D degree from University of Craiova. In Publishing House he is author of fifteen books in automatics, computers and mathematics area. Research work is focused on improved solutions for computer networks on basis of new telecommunication equipment and automatics systems. He has extensive experience in both experimental and theoretical research work, certified by over 90 journal and conference research papers and 16 research projects from industry. He is invited keynote lecture for automatics engineering courses organized by Faculty of Engineering from University of Targu Jiu. Due to WSEAS recognition as huge scientific Forum he participated in five WSEAS International Conferences, presenting papers and chairing sessions. He participated in the WSEAS International Conference on MATHEMATICAL and COMPUTATIONAL METHODS in SCIENCE and other sections, held in Venice, Tenerife, Heraklion, Bucharest and Cambridge. He is very proud of her 12 papers published in the WSEAS Conferences Books and 5 papers published in WSEAS TRANSACTIONS on SYSTEMS AND CONTROL.

### Plenary Lecture 3

## Monte Carlo Cellular Automaton Simulation in Biomedical Science: Cancer Research and Min Protein Dynamics



### Professor Yongwimon Lenbury

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**Abstract:** It has become well known that simulation can be used to investigate complex biomedical systems in situations where traditional methodologies are difficult or too costly to employ. Once the model, constructed to represent important aspects of the system under evaluation, has been validated, it may be used to investigate the effects of differences in the system inputs, changes in initial conditions, or its environment, and alterations in the system structure. Many recent advances in technology, such as the Next Generation Internet, high bandwidth communication, object oriented software, distributed and parallel processing, and visualizing techniques, have greatly enhanced the power and expressiveness of simulation. We give two examples where Monte Carlo cellular automaton simulation is applied to study cancer growth and Min protein dynamics.

## Plenary Lecture 4

### Visualization and Interaction of the Virtual Human Organs for the Pre-operative Planning



#### Professor Lucio Tommaso De Paolis

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 SPACI Consortium, Italy  
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**Abstract:** The visualization of 3D models of the patient's body emerges as a priority in surgery both in pre-operative planning and during surgical procedures and the introduction of new modalities of interaction with the 3D models of the human organs could also be required.

In this paper is present a virtual interface and a low cost multi-touch screen. Both systems are able to interpret in real-time the user's finger movements and can be used in the pre-operative planning for the navigation and manipulation of 3D models of the human body built from real patient's CT images.

The developed virtual interface, based on the use of an optical tracking system, is the first prototype of a system designed to avoid contact with the computer so that the surgeon will be able to visualize models of the patient' organs more effectively.

In particular, the surgeon will be able to rotate, to translate and to zoom in on the 3D models simply by moving his finger in the free space; in addition, it is possible to choose to visualize all of the organs or only some of them.

In the system have been utilized the NDI Polaris Vicra as optical tracker and two open-source and multi-platform programs for the construction of the graphic environment (OpenSceneGraph toolkit) and for the building of the 3D models (3D Slicer package).

A 3D model of the abdominal area has been reconstructed from CT images using segmentation and classification algorithms.

All of the interactions with the models happen in real-time using the virtual interface which appears as a touch-screen suspended in the free space and situated in a location chosen by the user at the starting up of the application. The finger movements are detected by means of the optical tracker and are used to simulate the touch with some buttons present in the developed virtual interface.

The doctor, using this system, is able to rotate, to translate and to zoom in on the 3D models of the patient's organs simply by moving his finger in free space and he can select the visualization of all of the organs or only some of them. The optical tracker has already been used in computer aided systems and, for this reason, it is easy to integrate the described virtual interface with these systems.

The introduction of other functionalities of interaction with the models is in progress, after further investigation and consideration of surgeons' requirements.

The developed multi-touch screen provides a user interface customized for doctor requirements. It is possible to use one or more fingers in order to interact with the complete 3D models of the human body or with some parts of these; in addition it is provided the possibility to visualize the CT slice sets used to build the virtual models.

The interaction results very simple and evident for the user and the system can be a helpful tool for the diagnosis and the surgical operation planning.

#### Brief Biography of the Speaker:

Lucio Tommaso De Paolis is an Assistant Professor of Information Processing Systems at the Department of Innovation Engineering of the Salento University (Italy).

He received a Degree in Electronic Engineering from the University of Pisa (Italy) and since 1994, first at the Scuola Superiore S. Anna of Pisa and then at the University of Salento, his research interest has concerned the study of the interactions in the virtual environments and the physical modelling of the objects for applications of the Virtual Reality and the Augmented Reality in medicine and surgery.

He is a member of the Society for Medical Innovation and Technology (SMIT), member of the SPACI Consortium (Southern Partnership for Advanced Computational Infrastructure) and member of the Italian Movement of Modelling and Simulation (MIMOS).

He teaches Computer Science at the Faculty of Sciences of the Salento University.



## Plenary Lecture 5

### Potential Method in the Performance Evaluation of a Network Node



**Assistant Professor Andrzej Chydzinski**  
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**Abstract:** The advantages of packet-switching networking over circuit switching made the packet-switching technology very successful (e.g. Internet). However, the cost of packet switching is that in each network node, packets are queued, resulting in delay and packet losses during buffer overflow periods. The queues in network nodes used to be modeled by a classic FIFO queue with Poisson arrivals. Since the beginning of 90's we have known that traffic in packet-switching networks is strongly autocorrelated and therefore we have to use much more advanced models for it. Markovian models like MMPP, MAP and BMAP were adopted for this purpose with good results. On the other hand, when modeling a queue in a network node, it is important that the finite size of the buffer is assumed, as finite buffer is responsible for packet losses.

The subject of this lecture is the performance analysis of a finite-buffer queue fed by Markovian arrival process. The lecture is particularly focused on a relatively new method of analysis of such queues - so called "potential method". At first, the method uses the Laplace transform technique in order to reduce a large system of integral equations to a system of linear equations. Then, with the help of a recurrent sequence called "potential", the large system is solved and the results are obtained in an explicit form. The method has some important advantages. It enables finding almost all queueing characteristics of interest. It gives results in a closed, easy to use form and this is a unique property among methods of analysis of finite-buffer queues. Moreover, both steady-state and transient performance characteristics can be obtained by means of the method.

#### **Brief Biography of the Speaker:**

Andrzej Chydzinski received his MSc (in applied mathematics), PhD (in computer science) and Habilitation (in computer science) degrees from the Silesian University of Technology, Gliwice, Poland, in 1997, 2002 and 2008, respectively. He is currently an Assistant Professor in the Institute of Computer Sciences of this university. His academic and professional interests include modeling and simulation of computer networks, active queue management in Internet routers, queueing theory and discrete-event network simulators. Dr. Chydzinski authored and co-authored more than fifty journal and conference papers and two books. His work is well recognized - Thomson Scientific reports that his publications were cited about 100 times (excluding self-citations) in ISI indexed journals. He was also awarded for his work by a major Polish magazine and was given (with R. Winiarczyk) the best paper award in modeling and simulation during the IEEE Symposium on Computers and Communications in 2006. He has been involved in several scientific projects, in some of them as a project leader.

## Plenary Lecture 6

### Simulation of Power Plants and Energy Conversion Systems



**Professor Reinhard Leithner**  
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**Abstract:** Since the 60ies and 70ies also power industry started to use computers for special calculations e.g. thermodynamic calculations of the main components of power plant cycles like steam generators, turbines, heat exchangers, etc. The interest to assess complete cycles was low because usually power plants were not delivered by one single company but the components were designed and manufactured by different companies. So each company used its own simulation program and developed it separately. Sometimes therefore funny mistakes occurred, when the components did not fit properly.

Increasing computer capacity and velocity led to increasing computing applications reducing also engineering labour. Today several commercial programs are available on the market. But they still have different foci due to their different origin and task. E.g. on the combustion and flue gas side CFD-programs like FLUENT, CFX, etc. are used, for the water steam cycle EBSILON, KRAWAL, APROS, etc., for flue gas cleaning, etc. ASPEN, FACTSAGE, etc.

At the Institute of Heat and Fuel Technologies a CFD-program FLOREAN and a cycle calculation program ENBIPRO was developed and is still further developed. The latter one is an object orientated program, which enables the user to design a thermodynamic cycle, i.e. to get information on the geometry of a component, etc., what is quite new because usually the design of the components is the input. But ENBIPRO is also capable of stationary part load calculations for a given geometry and in addition also dynamic simulations including control systems can be performed. Finally, with given geometry it can also be used for validation of measurements especially also for acceptance tests.

In the presentation a lot of examples of furnace calculations including pollutant's emissions and slagging and fouling as well as a variety of cycle calculations, e.g. Coal Fired Rankine Cycle Power Plant, Gas Fired Combined Cycle Power Plant and in addition the following cycles will be shown: Calciumoxide – Calciumcarbonate Cycle (CaO – CaCO<sub>3</sub>) for CO<sub>2</sub> separation from flue gases without losses in efficiency, Solar Thermal Power Plant, SOFC Solide Oxide Fuel Cell System, an Alstom Gas Turbine (GT-26), ORC Organic Rankine Cycles for the Use of Geothermal Energy, RDF (Refuse Derived Fuel) Power Plants and Compressed Air Energy Storage Combined Cycle Power Plants with Heat Storage.

In combination with CAD the so-called "Virtual Power Plant" i.e. a power plant only existing in the computer as a full model, with full virtual functionality and including virtual accessibility becomes gradually reality.

#### **Brief Biography of the Speaker:**

Prof. Dr. techn. R. Leithner (born in 1945 in Scharding, Austria) is head of the IWBT (Institute of Heat and Fuel Technologies) of Technical University Braunschweig, Germany. He has graduated as Dipl.-Ing. (Mechanical Engineering) from the Technical University in Vienna in 1970 with a diploma thesis about measurement and simulation of a heat exchanger.

From 1971 till 1983 he was working in different positions with Energie- und Verfahrenstechnik GmbH (now Alstom Power Boiler GmbH), Stuttgart, one of the leading steam generator manufacturers in Germany. During his work at EVT he wrote a doctoral thesis on the mass flow from an equally heated tube at constant pressure and was graduated as Dr. techn. from the Technical University in Vienna in 1976. His last position in this company was head of the "main department for steam generator design, development and commissioning" including stress analyses and control systems; also procuracy was granted him.

In 1983 he was appointed professor and director of the IWBT - TU BS. During all these positions he was always involved in power plant simulations and design.

## Plenary Lecture 7

### Electronic Health Record from an Australian Perspective

**Mr. Eugene Lutton**

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**Abstract:** This lecture will outline the Australian experience with implementing an Electronic Health Record (EHR). Since the early 1990's the Australian Government has been investing resources into a comprehensive electronic health record. These projects have been undertaken at a pilot level, while a full scale implementation has not occurred. On a global stage, patients require efficient and timely responses from health care professionals. Response time relies upon the interaction of a complex set of objects, which require an ability to interact and exchange data and information. Currently in Australia, a patient can visit a general practitioner or a health care facility, and undergo multiple tests performed by various internal and external providers. These providers can include a radiologist, pathology collection, mental health intervention and auxiliary services such as home care. The number of providers involved in this process is such that the complete medical history of a patient is not held in one central location, and will most likely be recorded upon a mixture of electronic and paper based formats. This disjointed system has meant that analysis of patient history not been a simple task. Constructing a history based upon this jigsaw puzzle has not resulted in an end product which is interchangeable between different health providers nor is it easily accessed or transportable for the patient.

#### **Brief Biography of the Speaker:**

##### Academic Studies:

Undergraduate and post graduate studies in information technology at The University of Newcastle.

##### Academic Teaching:

Delivering courses at Australian and Singaporean campuses of The University of Newcastle. These courses are for students (undergraduate and postgraduate) who are completing an information technology stream as part of their degree.

##### Research Interests:

The rationale and deployment of Radio Frequency Identification Technologies.

Member of the CASE research group.

The relationship between social, economic and technology impacts on society.

## Plenary Lecture 8

### Decision Precising Technologies in Decision Making Systems



#### Professor Gia Sirbiladze

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**Abstract:** To ensure the effectiveness of decision-support computer systems it is essential to solve such problems as identification, filtration, precision etc. of information streams, as well as modeling and simulation of decision-making problems which are based on them. When working with information streams of expert knowledge, as a complex systems, in parallel with classical approaches of their modeling, the most important matter is to assume fuzziness. All these is connected to the complicity of study of incomplete, abnormal and extreme processes in nature and society, which are caused by lack or shortage of objective information and when expert data streams are essential for constructing credible decisions. Such problems include solutions of business problems in extreme environments, analysis of management and investment risks, problems of conflictology, sociology, medical diagnosis, etc. With the growth of complexity of information our ability to make credible decision about process development reduces to some level, below which some characteristics such as accuracy and certainty become mutually conflicting. Our research is concerned with quantitative-fundamental analysis of this uncertainty and its use for precision of informational processes and decision modeling. Consequently one of main objects of our attention is the analysis of structures of expert data and measures of its uncertainty. The most important of such analysis methods are the theory of the body of evidence.

The precision of decisions first of all means improvement of representation of decision making factors by Dempster-Shafer data structures. Of course, there are many methods for knowledge representations and decision making, which use the Dempster-Shafer structures. The novelty of our research in this direction is the technology for precision of the structure of body of evidence, which we call the temporalization of body of evidence. Temporalization means the construction of inclusion relation on the bodies of evidence. This approach is completely novel in study of expert knowledge representations and structuring. It will cause many heuristic methods of decision-making based on the expert knowledge representation to be modified. All above listed means the following: 1. representation of data which is an input of considered methods using Dempster-Shafer structures, so called pessimistic-optimistic representations. This will better exhibit the knowledge and intellectual activities of an expert. 2. the possibilities of representing of expert information streams in triangular or trapezioform fuzzy numbers will be considered. 3. the cases where focal elements in Dempster-Shafer structure are represented by fuzzy sets, and focal probabilities are represented by triangular or trapezioform fuzzy numbers will be considered separately, 4. in methods' decision-making criteria represented in knowledge base of decision support technologies of inaccuracy and uncertainty aggregations will be used such as: Choquet integral, Sugeno integral, Dempster upper and lower expected values, positive and negative discriminations, OWA operators, etc. 5. in selected methods these aggregations will give us new criteria supporting more precise decision. Thus existing heuristic methods will obtain fundamental basis, final purpose of which will be to model more precise decision in the cases of expert knowledge streams input. 6. The decision support system will obtain higher credibility, which can be measured in new modified methods using the informational measures, such as confusion and chaos constructed on more precise decisions, inaccuracy and non-specificity measures etc. Finally the process of precising decisions will be demonstrated based on Discrimination method which is one of the popular methods of decision making using fuzzy set theory.

#### Brief Biography of the Speaker:

Dr. Gia Sirbiladze is a full professor at the Department of Computer Science of Faculty of Exact & Natural Sciences of Iv. Javakhishvili Tbilisi State University, Georgia. He received his Ph.D. degree in 1991 from the Computational Mathematics Institute of the Georgian Academy of Science. He received his D. Sci. degree from the same institute in 2005. His scientific interests include areas such as Intelligent Fuzzy Technologies and General Systems, Fuzzy Technologies in Decision-making Support Systems, Fuzzy Extremal Dynamic Systems - Control, Filtration and Identification, Fuzzy Discrete Optimization Problems and Modeling Decisions.

## Plenary Lecture 9

### Iterative Numerical Methods for Simulation of Coupled Engineering Problems



**Associate Professor Ion Carstea**

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Romania

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**Abstract:** Any electromagnetic device is the house of two or more physical fields that interact by a number of parameters as the material properties, the field sources etc. In other words we have not separate problems for engineers from different science branches although for economic reasons in terms of computer resources, each physical field is considered as though it was separate field and generates a problem which is solved independently. The subsystems and numerical solutions are finally coupled together in such way that interactions are satisfied with an "acceptable" degree of accuracy. This is a natural approach for the analysis of large or complex structures but the accuracy of the analysis is not good.

The technique of dividing a large physical system into a system of components is very old and is still used extensively although the reasons of this approach are not valid nowadays. We have an increased computing power with advanced computer architectures so that it is an antisocial fact to ignore this real computing power.

In our lecture we intend to review the state-of-the-art of iterative methods for solving large sparse systems such as arising in coupled engineering problems. The solution of practical problems of mathematical physics ultimately relies on solving a system of partial derivative equations and this is only achieved by iterative numerical methods. Iterative solution methods proceed by adding successive corrections to some arbitrary initial approximation, but unfortunately these methods are very sensitive to specific features of the system to be solved. A procedure call preconditioning is possible but is not always used.

We limit our presentation to a large class of systems defined by elliptic-parabolic mathematical models that represents the basis of the electromagnetic-thermal problems. The numerical models are obtained by the finite differences and finite element methods. The motivation is simple: for parabolic problems we use an explicit scheme for temporal discretization, and for elliptic problem we use the finite element method. As target example we use an electromagnetic-thermal coupled problem from electrical engineering.

In the algorithmic skeletons for this class of problems we are guided by the implementation of the algorithms on the parallel computers with emphasis on parallel computers (MIMD architectures).

#### **Brief Biography of the Speaker:**

The speaker is an Assoc. Professor at the Computer Engineering and Communications Department, Faculty of Automatics, Computers and Electronics, University of Craiova, Romania.

He has a BSc and MSc in Automatics from the University of Craiova, Romania. He has a Ph.D. in Automatics from the University of Ploiesti, Romania. Also, he has a BSc and MSc in Mathematics from the Natural Sciences Faculty, University of Craiova, Romania.

He was director of the research projects supported by international grants at University of Houston (USA)- 6 months (Fulbright Grant), at the University of Coimbra, Portugal – 9 months (NATO grant), at the Polytechnics of Milano, Italy- 4 months (a CNR-NATO grant). In 2004 he was invited at the Mathematics Department, University of Trento, Italy, for 2 months.

Ion Carstea published 10 books in the area of programming languages advanced computers and CAD of the electromagnetic devices. He is the co-author of the book FINITE ELEMENTS in WSEAS Press, 2007.

He is the author of more than 160 papers in revues, scientific journals and international conference proceedings. He is a reviewer for several WSEAS International Conferences and was a member in many international scientific committees. In the year 2007, he was a Plenary speaker and chair at the WSEAS Conferences from Arcachon (France) and Venice (Italy). In 2008 he was Plenary speaker to two WSEAS Conferences from Bucharest (June 2008, November 2008).

His research interests include parallel algorithms for numerical simulation of the distributed-parameter systems, software products for coupled and inverse problems in engineering, domain decomposition method in the context of the finite element method.

## Plenary Lecture 10

**Campus Web based Information System for Monitoring Quality of Life:  
A Case Study Applied to the University of Minho**



**Assistant Professor Rui Antonio Rodrigues Ramos**

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**Abstract:** Universities have been recognised as an active agent in the society development and evolution. One of the marks of this acknowledgement was the Magna Charta Universitatum. This document sustains that their role is to promote cultural, scientific and technical development of new generations, as well as the whole society, providing permanent training. It also says that such education should teach and train future generations to respect the great harmonies of their natural environment and of life itself. Joining that relevance to campi extension and to the university community dimension, the quality of life in campi became a critical feature for the management and sustainable development of that type of urban areas.

In addition, there is a consensus about the fact that Portuguese Universities are leaving a period of continuous building growth, incoming in a cycle of stabilization and consolidation. The demand tends to be satisfied. So, a new process shall emerge where the physical expansion will be substituted by a quality and sustainable process where the equity will become more relevant. Also, the quality of teaching and research activities in Universities are somehow related to the quality of the spaces where they take place, either when considering the buildings' facilities, or when taking into account the campus area. Some authors have concluded that the students' perception of their overall academic experience and the campus environment is related to academic accomplishment. Furthermore, keeping and increasing the quality of life in public spaces is also recognised as a critical aspect concerning the urban sustainable development perspective.

When analysing characteristics, form, dimension and organisation of university campi, it can be concluded that they can be seen as urban spaces. This fact is often enhanced by their location: in urban areas or even merged in the city. In this context, a model for the evaluation of the quality of life based on concepts for urban spaces is presented. Its main purpose is to provide conceptual bases for the implementation of a decision support system that evaluates the campus quality of life and its sustainable development. The process integrates the users' perception and provides the ability to assess the impact of future interventions on the campus quality of life using scenarios. Those scenarios can be created by a tool included in the system and enabled to measure, through indicators, changes in campus. The evaluation of the quality of life variation that would result from the scenario execution will serve as a decision support tool for campus management when studying several possibilities.

The case study explores and shows the web based information system for monitoring the quality of life of the Gualtar Campus of the University of Minho, located in Braga, Portugal. Basically, the model aims at determining a global index of the Quality of Life in the Campus (QIC) variation, comparing different moments in time. The system embodies two main functions related to its sustainable development process: (i) to inform the community, allowing any user to know which are the considered indicators and their actual values, and how the QIC has evolved; (ii) to serve as a decision support tool, mainly in facilities planning and management, thus allowing to compare the impact of several scenarios on several quality of life dimensions, through an evaluation that integrates the users' perception.

**Brief Biography of the Speaker:**

Rui Ramos is an assistant professor of Civil Engineering Department, Engineering School, University of Minho, Portugal. His area of expertise is Urban and Regional Planning and he is a PhD Researcher at Territory, Environment and Construction Centre from University of Minho. In 1993, at University of Minho, he started his regular work as a lecturer and researcher. Since then he published as author or co-author over 40 scientific papers in reviewed journals or presented at international conferences. Moreover, since 2000, he had the opportunity to be an invited Professor at the Department of Transportation of the School of Engineering of Sao Carlos, University of Sao Paulo, Brazil.

## Plenary Lecture 11

### The Operating Risk Assessment for Dependable Systems



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**Abstract:** The lecture proposes an axiomatic characterization of the measure risk in a systemic vision and framework for quantifying variability of exposure and risk in dependable systems via probabilistic approach by means of Monte Carlo method.

Identifying the hierarchy of risks associated with hazardous activities provides a basis for analytic, deliberative decision-making in the business process, where stakeholders have to select a variant of several possible on the basis of multiple (sometimes contradictory) criteria. Due to the random, collateral factors, the risk is present in any sociotechnical system. The risk regarded as a potential danger is a result of action which has the probability to not fulfill the proposed function of the system.

In a systemic interpretation, the risk is characterized by a set of uncertain events consisting of independent input and dependent output elements variables of the system components. Independent events are sources of disturbance for the dynamic system, acting as generators of uncertainty. Using virtual-reality tools, the simulation that validates the effectiveness of the model can assist human operators in different phases of system.

**Brief Biography of the Speaker:**

Gabriela Tont is an Associate Professor at the Department of Electrical Engineering, Measurements and Electric Power Use, Faculty of Electrical Engineering and Information Technology, University of Oradea. She has earned her Ph.D from the Technical University Cluj Napoca, Faculty of Electrical Engineering. Her research areas relate to applied statistics in the complex systems, currently focusing on the aspects of error analysis and optimal control of safety critical systems. She has published 7 books in the field of reliability of systems and quality management. Gabriela Tont is the author of more than 110 papers in revues, scientific journals and international conference proceedings in those areas. She is participant and reviewer for several WSEAS International Conferences.

## Authors Index

Ahmed, E. G.	48	Chimmanee, S.	270	Herescu, A. C.	478
Alexandrescu, D.	563, 569, 610	Chirita, A.	390	Hojjatoleslami, S. A.	669
Alexandridis, T. A.	817	Chirita, V.	438	Hung, W.-L.	150
Alexandru, M.	557	Chiru, M.	384	Idomir, M. E.	531
Alexopoulos, G.	627, 633	Cho, S.-Y.	699	Ifteni, P.	435, 438, 511
Al-Omar, K.	300, 322	Choudhuri, A.	54	Ileana, I.	753
Angelescu, N.	680	Chydzinski, A.	276, 282	Ilie, F.	195
Ayad, K.	220, 226	Ciurdariu, A. L.	328	Iliescu, M.	743
Ayvaz, M.	419	Ciurescu, D.	599	Ionescu, F.	384
Badau, A.	610	Coelho, P. S.	144	Ionescu, M.	384
Badau, D.	541, 563, 610	Constantinescu, N.	115	Iordache, E.	616
Balaz, T.	347	Cosma, C.	478	Ivanovici, M.	535
Balescu, A.	579, 582	Cristea, L.	551	Jaklic, J.	144
Barabas, S.	599	Cuculescu, M.	588	Jakovljevic, B. B.	43
Bardac, D.	743	Cumani, A.	126	Jeffrey, D. J.	103
Bardis, N. G.	758	Da Costa, K. A. P.	33	Jelicic, Z. D.	37
Baritz, M.	458	Decean, H.	535	Jin, J. S.	317
Baykara, N. A.	394, 400	Della Corte, G.	313	Jung, C.	713
Bilbao, J.	627, 633	Demiralp, E.	648	Kaisar, E. I.	334
Boldea, C.	115	Demiralp, M.	394, 400, 406	Kanovic, Z.	37
Borza, P.	535	Demiralp, M.	413, 419, 657	Karadimas, N. V.	817
Borzan, C. M.	452, 458, 463	Derczeni, R.	616, 644	Karagianni, E. A.	252
Borzan, C. M.	467, 473, 520	Di Mauro, M.	311	Kervalishvili, P.	675
Borzan, C. S.	520	Diaconescu, E.	379	Kim, D.-S.	317
Borzan, Ma.	473	Dicu, T.	478	Kim, J.-J.	367
Borzan, Mi.	473	Dobre, G.	669	Kokkalellis, H. P.	252
Bouzoukou, N.	627, 633	Dobrescu, M.	138	KranzlmueLLer, D.	691
Brachman, A.	293	Domnariu, C.	639, 644, 685	Krougly, Z. L.	103
Bradford, R. B.	359	Doukas, N.	758	Kwon, T.-K.	367
Bulucea, C. A.	189, 195	Drighiciu, A.	202	Larion, A.	541, 610
Burtea, D. V.	507	El-Bakry, H. M.	770, 805	Lazic, L.	73, 231
Burtea, V.	435, 438, 503	Ene, H.	390	Leasu, F.	503, 547
Burtea, V.	507, 511	Faka, A.	373	Lee, A. R.	367
Buzea, C.-M.	588	Falup, C.	535	Lee, C.-J.	62, 764
Cabulea, L.	753	Feng, D.-G.	182	Lenbury, Y.	119
Caciula, I.	680	Filip, L.	458	Leoveanu, C.	138
Calapod, A.	719	Fleancu, A.	516, 551	Lippert, T.	691
Calina, A.	214	Gabor-Harosa, F. M.	452	Longo, M.	313
Calina, M. L.	214	Gevat, C.	541	Lotrean, L.	458, 463
Carstea, A. A.	351	Ghvaberidze, B.	163	Lupu, D.	441, 446, 525
Carstea, D.	351	Guarnaccia, C.	241	Lutton, E.	258, 264
Carstea, I.	351, 390	Guiducci, A.	126	Macko, M.	347
Cem, G.	68	Guizzi, G.	427	Malcangi, M.	288
Ceuca, E.	753	Gulpinar, C.	406, 413	Man, M. A.	563, 569
Chalkias, C.	373	Gulpinar, M. T.	406, 413	Manea, A. C.	575
Charnkeitkong, P.	270	Gurvit, E.	394, 400	Manea, L.	575
Chen, D.-H.	150	Ha, S. H.	317	Manolea, G.	202
Chen, X.-F.	182	Hashem, M.	48	Markopoulos, E.	627, 633



Markovskiy, O. P.	758	Petrescu, C.	604	Skinner, G.	264
Mastorakis, N. E.	73, 109, 231	Piao, Y.-J.	367	Solak, E.	68
Mastorakis, N. E.	241, 770, 805	Podasca, C.	594, 622	Stefanescu, L.	663
Mazgaciu, C.	622	Podoleanu, A. G.	669	Steri, S.	241
McTavish, D. J.	54	Podoleanu, E.	588	Stoenescu, E.	189
Meadway, A.	669	Pop, C. G.	467	Stoian, M.	138
Meparishvili, B.	675	Popescu, M. C.	189, 195, 202	Streit, A.	691
Miclaus, R.	569	Popescu, M. C.	208, 214	Suciu, O.	604
Miere, D.	463	Popirlan, C. I.	663	Sumedrea, A. G..	493, 507, 511
Mircea, G.	328	Popovic, A.	144	Szekely, I.	535
Miu, N.	452	Popovic, S.	231	Tache, I.	680
Mocean, F.	452, 458, 463	Preoteasa, C. T.	588	Tang, S.-M.	62, 764
Mocean, F.	473, 520	Pusatli, T.	258	Teegavarapu, R.	334
Modchang, C.	119	Quartieri, J.	241	Tint, D.	547
Moisil, I.	639	Racek, F.	347	Todea, D. A.	478
Moleavin, I.	483, 489	Radoi, M.	547	Toev, R.	557
Monsakul, A.	270	Ranga, R.	588	Tong, J.	171, 176
Mosoiu, C.	435, 439, 503	Rapaic, M. R.	37, 43	Tont, D. G.	719, 725
Mosoiu, C.	507, 511	Ratiu-Duma, B.	569	Tont, D. G.	731, 747
Mrozowski, P.	276, 282	Regan, B.	258, 264	Tont, G.	719, 725, 731
Munteanu, R. A.	719, 725	Repanovici, A.	551	Tont, G.	737, 747
Munteanu, R. A.	731, 747	Riedel, M.	691	Triampo, D.	119
Murino, T.	427	Rigas, D.	220, 226, 300	Triampo, W.	119
Nah, Y.	713	Rigas, D.	306, 322	Tsai, C.-C.	62, 764
Nasiri-Avanaki, M.-R.	669	Robustelli, A.	311	Tsakalidis, G. E.	817
Neagoe, N.	478	Roda, V. O.	33	Tuba, M.	594
Neamtu, M.	328	Rogozea, L.	483, 531, 579	Tulbure, A.	753
Nedelcu, A.	622	Rogozea, L.	582, 622	Tuohy, S.	669
Nedelcu, L.	535	Romanca, M.	535	Turcanu, M.	463, 516
Nedelcu, L.	579, 582	Romanca, M.	557	Udroiu, I.	680
Nedelcut, N.	467	Romano, E.	427	Unlusu, B.	68
Neica, L.	599, 644	Rosca, L. E.	478	Usaci, D.	441, 446, 525
Nemet, C. G.	531, 582	Sabbagh-Yazdi, S.-R.	109	Varciu, M.	503
Nicolescu, B.	390	Sallam, M.	306	Veregut, C.-E.	483, 489
Niculescu, R. M.	441, 446	Sampranpiboon, P.	270	Vincze, L.	520
Niculescu, R. M.	497, 525	Sandulescu, V.	384	Vladareanu, L.	719, 725
Norel, M.	441, 446, 525	Sangeorzan, L.	594, 599, 622	Vladareanu, L.	731, 747
Ok, M.-H.	704	Sarbu, F.	644	Voinea, I.	483
Okouneva, G.	54	Scarlatos, P. D.	334	Wisitorsasak, A.	119
Opris, D.	328	Scarneciu, C.	579	Wolf, F.	691
Pamfil, G.	547	Scutaru, M.	557	Won, Y.	367
Panahkhahi, M.-A.	109	Sechel, G.	516, 551	Xu, J.	182
Panian, Z.	132	Shaaban, E.	48	Yang, M.-S.	150
Papastamatiou, N. P.	817	Shin, D.	707, 713	Yi, W. S.	707
Parpalea, M.	594	Shin, Y.	713	Zavoianu, L.-M.	604
Paun, M.	669	Sikharulidze, A.	156, 163	Zhan, M.	171
Perescu-Popescu, L.	202, 208, 214	Silva, J. L. E.	33	Zhao, Y.	171, 176
Petkovic, M. R.	43	Sirbiladze, G.	156, 163		