Editors: Nikos Mastorakis, Valeri Mladenov, Zoran Bojkovic, Fragkiskos Topalis, Kleanthis Psarris, Alina Barbulescu, Hamid Reza Karimi, George J. Tsekouras, Abdel-Badeeh M. Salem, Luige Vladareanu, Aleksandar Nikolic, Dana Simian, Berenika Hausnerova, Stevan Berber, Nikolaos Bardis, Azami Zaharim, Chandrasekaran Subramaniam

# Recent Researches in Computer Science

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## Proceedings of the 15th WSEAS International Conference on Computers

(Part of the 15th WSEAS CSCC Multiconference)

Corfu Island, Greece, July 15-17, 2011

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**Preface**

This year the 15th WSEAS International Conference on Computers (Part of the 15th WSEAS CSCC Multiconference) was held in Corfu Island, Greece July 15-17, 2011. The conference provided a platform to discuss algorithms and theory of computation, artificial intelligence, graphics, computer networking, programming languages, quantum computing, internet, intelligent systems, digital speech processing, computational geometry, mobile computing, software testing, fault tolerance, data mining etc. with participants from all over the world, both from academia and from industry.

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

The accepted papers of this conference are published in this Book that will be 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.

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

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## Keynote Lecture 1

# Multihop Cellular Networks: Integration, Cooperation, Standardization, Research Challenges

**Professor Zoran Bojkovic**
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**Abstract:** Cellular networks have been developed for voice telephone service using circuit switched technology.They are usually complex and large in terms of their network scale and operational features,high speed mobility,low data rate, and wide area coverge..The aim of the process of cellular networks evolution is to have an all IP network architecture to provide high bit rate multimedia services including voice,audio, video and data. Multimedia services require multiple sessions over one physical channel which could be provided by packet switched networks. The common protocol is IP.The Internet and cellular systems have been designed and implemented by people with different backgrounds in computers and communications, respectively.Their integration can be considered a first step toward next generation networks, where heterogeneous nettworks must work together in order to provide differential services to users in seamless and transparent manner. Next generation cellular networks are expected to provide richer and more diverse multimedia services. However,the current cellular network architecture may not be economically feasible to cater to the requirements of future mobile communication services.As an alternative to cellular communications, ad hoc networking is a wireless communication technology distinguished
by communicating via multihop transmissions. The multihop cellular network(MCN) which combines the characteristics of ad hoc networking with these of a cellular network,has been drawing a lot of attention. Namely, MCN incorporates the flexibility of ad hoc networking,while preserving the benefits of using an infrastructure.The advantage of using MCN includes capacity enhancement,coverage extension,network scalability, and power reduction.The main motivation for integrating multihop transmission in cellular networks is to enhance coverage and network capacity. Relaying can be used to assist communications to and from mobile hosts (MHS) at the cell edge or MHs experiencing deep fading in their home base station (BS). This presentation starts with the background of the problem.Next,integration of cellular and internet services including a cooperation in multihop cellular networks will be analyzed.Some examples will be included,too. Finally, 4G cellular standards,together with research challenges conclude the lecture. It is pointed that there are still a number of open research issues that need to be solved in order to provide an efficient and effective multihop transmissions in cellular networks in the future.

**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.

## Keynote Lecture 2

# Program Analysis and Optimization for Multi-core Computing

**Professor Kleanthis Psarris**
Department of Computer Science
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San Antonio, TX 78249
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**Abstract:** As multi-core architectures become ubiquitous in modern computing, large scale scientific applications have to be redesigned to efficiently use the multiple cores and deliver higher performance. One major approach is the automatic detection of parallelism, in which existing conventional sequential programs are translated into parallel programs by optimizing compilers, in order to take advantage of the multiple processors. Optimizing compilers rely upon program analysis techniques to detect data dependences between program statements, perform optimizations, and identify code fragments that can be executed in parallel. In this work we study various program analysis and optimization techniques for multi-core computing and measure their impact in practice. We perform an experimental evaluation of several data dependence tests and program analysis techniques and we compare them in terms of data dependence accuracy, compilation efficiency, effectiveness in parallelization and program execution performance. We run various experiments using the Perfect Club Benchmarks, the SPEC benchmarks, and the scientific library Lapack. We present the measured accuracy of each data dependence test and explain the reasons for inaccuracies. We compare these tests in terms of efficiency and we analyze the tradeoffs between accuracy and efficiency. We also determine the impact of each data dependence test on the total compilation time. Finally, we measure the number of loops parallelized by each test and we compare the execution performance of each benchmark on a multi-core architecture.

**Brief Biography of the Speaker:**
Kleanthis Psarris is Professor and Chair of the Department of Computer Science at the University of Texas at San Antonio. He received his B.S. degree in Mathematics from the National University of Athens, Greece in 1984. He received his M.S. degree in Computer Science in 1987, his M.Eng. degree in Electrical Engineering in 1989 and his Ph.D. degree in Computer Science in 1991, all from Stevens Institute of Technology in Hoboken, New Jersey. His research interests are in the areas of Parallel and Distributed Systems, Programming Languages and Compilers, and High Performance Computing. He has designed and implemented state of the art program analysis and compiler optimization techniques and he developed compiler tools to increase program parallelization and improve execution performance on advanced computer architectures. He has published extensively in top journals and conferences in the field and his research has been funded by the National Science Foundation and Department of Defense agencies. He is an Editor of the Parallel Computing journal. He has served on the Program Committees of several international conferences including the ACM International Conference on Supercomputing (ICS) in 1995, 2000, 2006 and 2008, the IEEE International Conference on High Performance Computing and Communications (HPCC) in 2008, 2009, and 2010, and the ACM Symposium on Applied Computing (SAC) in 2003, 2004, 2005 and 2006.

## Keynote Lecture 3

# Biomimetic Human Modeling, Simulation and Control

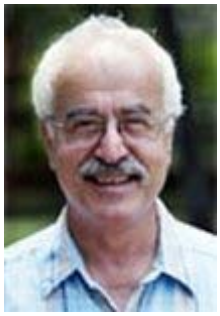
**Professor Demetri Terzopoulos**
Computer Science Department
University of California, Los Angeles
USA
E-mail: dt@cs.ucla.edu

**Abstract:** For use in the entertainment industry, computer graphics/animation has made significant strides over the past two decades through advances in physics-based simulation and control. In this context, one of the most difficult open challenges going forward is the biomimetic simulation and control of the human body. This talk will present our progress toward a comprehensive simulator that confronts the combined challenge of biomechanically modeling and neuromuscularly controlling more or less all of the relevant articular bones and muscles in the body, as well as simulating the physics-based deformations of the soft tissues. A significant component of our model is the neck-head-face complex, which addresses the important role that the neck plays in synthesizing the head movements that are essential to so many aspects of human behavior. Our anatomically consistent biomechanical model confronts us with many challenging motor control problems, even for the relatively simple task of balancing the mass of the head in gravity atop the cervical spine. I will present a neuromuscular control model that emulates the relevant biological motor control mechanisms. Employing machine learning techniques, the neural networks within our controllers may be trained offline to efficiently generate the pose and stiffness control signals needed to synthesize a variety of autonomous human movements. The talk will be richly illustrated with images and videos.

**Brief Biography of the Speaker:**
Demetri Terzopoulos (PhD '84 MIT) is the Chancellor's Professor of Computer Science at the University of California, Los Angeles. He is a Guggenheim Fellow, a Fellow of the ACM, IEEE and Royal Society of Canada, and a Member of the European Academy of Sciences. Among his many honors are an Academy Award for Technical Achievement from the Academy of Motion Picture Arts and Sciences for his pioneering work on physics-based computer animation, and the inaugural Computer Vision Significant Researcher Award from the IEEE for his pioneering and sustained research on deformable models and their applications. One of the most highly cited authors in engineering and computer science according to ISI and other indexes, his publications include more than 300 research papers and several volumes, primarily in computer graphics, computer vision, medical imaging, computer-aided design, and artificial intelligence/life. He has given over 400 talks internationally on these topics, among them about 100 distinguished, keynote, and plenary addresses. Before joining UCLA in 2005, Dr. Terzopoulos held the Lucy and Henry Moses Endowed Professorship in Science at New York University and was Professor of Computer Science and Mathematics at NYU's Courant Institute of Mathematical Sciences. Previously, he was Professor of Computer Science and Professor of Electrical and Computer Engineering at the University of Toronto, where he continues to hold status-only faculty appointments.

## Plenary Lecture 1

# Profile based Information System using Radio Frequency Identification STEM Courses with Virtual Reality based Course Delivery System



**Professor M. Nasseh Tabrizi**
Director of Graduate Studies
Director of Technology Innovation Lab
Department of Computer Science
East Carolina University
E-mail: TABRIZIM@ecu.edu

**Abstract:** This paper is a first step in describing theoretical foundations for use and application of the Profile based Information System using Radio Frequency Identification (PISR) as a tool designed to tailor learners' retrieval and access to information to their individual learning styles. The system has been designed to manage large caches of data, including user profile handling, while automating information extraction according to the user's preloaded personal profile. PISR manages the information assignment and retrieval processes more efficiently then current systems while dramatically reducing human involvement.

**Brief Biography of the Speaker:**
Tabrizi received his B.S. degree in Computer Science from Manchester University, UK. He then completed his M.S. and Ph.D. from Automatic Control and Systems Engineering Department, Sheffield University, UK. Tabrizi worked in Manchester University for two years prior to his appointment at East Carolina University in 1984. He is the Graduate Program Director of Computer Science and founder and director of Software Engineering program at East Carolina University. His research interests are in the areas of Cloud Computing, Virtual Reality, Modeling and Simulation, Computer Vision, Signal and Image Processing, Software Engineering, Internet and Multimedia, Assistive Technologies, and Computer Science Education. Tabrizi and his research team have prototyped different project in his Technology Innovation lab including Archival Data Extraction and Assessment (ADEAP) system, electronic medical records management, an agent and virtual reality-based course delivery system, RFID based learning assessment system, and virtual reality based home inspection and training system. Tabrizi has participated on several major grants. Tabrizi publications include diverse areas of research in computer science, technology, and software engineering. He was named ECU's scholar teacher in 2000 and has received best paper award.

## Plenary Lecture 2

# High-Performance Hybrid Computing Systems and their Application in Science and Engineering

**Professor Boris Chetverushkin**
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Russia, Moscow, 125047, Miusskaya Sq., 4A
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**Abstract:** High-performance multiprocessor computing systems are widely applied to the solution of many complicated scientific and engineering problems. However, one of the most significant problem associated with employment of the 1 PTFLOPS systems is their high cost and high power consumption. Therefore, the high-performance multiprocessor computing systems with hybrid architecture, using graphical processing units for acceleration, acquire much wider application. Such supercomputer with the specified architecture by 100 TFLOPS power has been created and installed in the Keldysh Institute of Applied Mathematics of RAS (Moscow). It has relatively low cost ? near to $2 million (together with the cooling system and UPS) and low power consumption ? near to 70-80 kW.
Computing systems based on the graphic cards have great potential for high performance computation. However, the realization of these opportunities is primarily determined by availability of software and by existence of computational algorithms that are compatible with the architecture of the graphic cards.
As an example of the hybrid supercomputing system application, the problems of radiation transfer modeling and hydro-and gas dynamics modeling are considered.
The gained experience has shown that the hybrid computing systems possessing the high peak performance under skillful adaptation of algorithms to their architecture can be successfully applied to effective modeling of many important scientific and engineering problems.

**Brief Biography of the Speaker:**
Boris Chetverushkin was born in Moscow on 26 January 1944.
Positions: Director of Keldysh Institute of Applied Mathematics Russian Academy of Sciences, Corresponding Member of the Russian Academy of Sciences, Professor.
Studies: Moscow Institute of Physics and Technology (MIPT) Faculty of Applied Mathematics and Control (1966), Master of Science Graduate school at the MIPT (1969). He has received PhD in 1971, Dr.Sc. in 1981, Professor in 1988. Since 1968 he is researcher at Keldysh Institute of Applied Mathematics.
Research fields: Numerical Methods, Computational fluid dynamics, Radiation gas dynamics, Parallel computations.
More than 330 publications including 4 books.
Leader of projects of Russian Foundation for Basic Research, INTAS, ISTC and others.
Chairman of the Russian national committee on applied and industrial mathematics. Member of ECCOMAS. Member of the scientific committee of Parallel CFD conference since its foundation.
Editor-in-Chief of Russian journal Mathematicheskoe Modelirovamie (Eng. Translation: Mathematical Models and Computer Simulations). Member of editorial boards of two others scientific journals.

## Plenary Lecture 3

# New Developments of Kernel Methods in Weather Prediction and Applications

**Professor Theodore B. Trafalis**
School of Industrial Engineering
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U.S.A
E-mail: ttrafalis@ou.edu

**Abstract:** The main objective of this talk is to present recent developments in the applications of kernel methods and Support Vector Machines (SVMs) to severe weather prediction. I will also discuss how kernel methods can be used to uncover physically meaningful, predictive patterns in weather radar data that alert to severe weather before the severe weather occurs. Specific indices related to the analysis of imbalanced weather data (for example tornado data) using kernel methods will be also discussed. In addition a family of learning algorithms, motivated by Support Vector Machines, capable of replacing traditional methods for assimilating data and generating forecasts, without requiring the assumptions made by the assimilation methods (Kalman filters) and an application of kernel methods to processing the states of a Quasi-Geostrophic (QG) numerical model will be presented. Extensions of those techniques to other areas of applications will be investigated.

**Brief Biography of the Speaker:**
Theodore B. Trafalis, PhD, is a Professor in the School of Industrial Engineering at the University of Oklahoma, USA and adjunct professor in the School of meteorology. He earned his BS in mathematics from the University of Athens, Greece, his MS in Applied Mathematics, MSIE, and PhD in Operations Research from Purdue University. He is a member of INFORMS, SIAM, Hellenic Operational Society, International Society of Multiple Criteria Decision Making, and the International Society of Neural Networks. He has been listed in several Who's Who biographies such as in the 1993/1994 edition of Who's Who in the World. He was a visiting Assistant Professor at Purdue University (1989-1990), an invited Research Fellow at Delft University of Technology, Netherlands (1996), a visiting Associate Professor at Blaise Pascal University, France, and at the Technical University of Crete (1998). He was also an invited visiting Associate Professor at Akita Prefectural University, Japan (2001). The academic year 2006-2007 was on a sabbatical at the National Center for Scientific Research "Demokritos", Institute of Informatics and Telecommunications, Computational Intelligence Laboratory (CIL), Athens, Greece. His research interests include: operations research/management science, mathematical programming, interior point methods, multiobjective optimization, control theory, artificial neural networks, kernel methods, evolutionary programming data mining, global optimization and weather applications. He has published more that one hundred articles in journals, conference proceedings, edited books, made over one hundred technical presentations, and received several awards for his papers. In 2004 he received the Regents Award at the University of Oklahoma for his research activities. He has been continuously funded through National Science Foundation (NSF) and received the NSF Research Initiation Award in 1991. In 2006 he was the editor of a special issue in Support Vector Machines for the journal of Computational Management Science. He also co-edited a special issue in "Learning from Data" for the same journal that is in press in 2008. Prof. Trafalis currently serves as chief editor of Intelligent Control and Automation and an associate editor for the Journal of Computational Management Science, the Journal of Heuristics, Technology and Investment and several other journals. In addition he has been on the Program Committee of several international conferences in the field of intelligent systems, data mining and optimization. He currently serves as chief editor of Intelligent Control and Automation and an associate editor for the Journal of Computational Management Science, the Journal of Heuristics, Technology and Investment. He was co-organizer of the International Conference on the Dynamics of Disasters, Athens, Greece, 2006.

## Plenary Lecture 4

# Knowledge Engineering for Medical Decision Support Systems

**Professor Abdel-Badeeh M. Salem**
Head of Medical Informatics and Knowledge Engineering Research Unit
Department of Computer Science
Faculty of Computer & Information Sciences,
Ain Shams University, Cairo, Egypt
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**Abstract:** In the last years various intelligent technologies and methodologies (ITM) have been proposed by the researchers in order to develop efficient intelligent Decision Support Systems for different medical tasks. ITM offer robust computational methods for accumulating, representing, changing, and updating knowledge (i.e. knowledge engineering) in intelligent systems. In particular they enable users with learning mechanisms that help to induce knowledge from raw data. ITM provide methods, techniques, and tools that can help solving diagnostic and prognostic problems in a variety of medical domains. ITM are used for the analysis of the importance of clinical parameters and their combinations for prognosis, e.g. prediction of disease progression; the extraction of medical knowledge of outcomes research; therapy planning and support; overall patient management.
This talk is devoted to discussion of current research of the knowledge engineering approaches and methodologies for developing intelligent Decision Support Systems .This paper presents some of the intelligent methodologies for managing and engineering knowledge in medical knowledge-based systems. Some of the results of the research that has been carried out by the author and his colleagues at the Medical Informatics and Knowledge Engineering Research Unit, Computer Science Department, Faculty of Computer and Information Sciences, Ain Shams University, Cairo, are discussed as well. The paper covers the following topics: (a) knowledge representation techniques from the knowledge engineering point of view; (b) expert systems methodologies, rule-based and case-based reasoning; (c) producing knowledge with intelligent data mining methodology; and (d) ontological engineering approach.

**Brief Biography of the Speaker:**
Prof. Dr. Abdel-Badeeh M Salem He is a Professor of Computer Science since 1989 at Faculty of Computer and Information Sciences ,Ain Shams University, Cairo-Egypt. He is a professor emeritus since October 2007 . He was a Director of Scientific Computing Center at Ain Shams University (1984-1990). His research includes intelligent computing, expert systems, medical informatics, and intelligent e-learning technologies. He has published around 200 papers in refereed journals and conference proceedings in these areas. He has been involved in more than 200 conferences and workshops as an Int. Program Committee , organizer and Session Chair. He is author and co-author of 15 Books in English and Arabic Languages.
He was one of the founders of the following events, First Egyptian Workshop on Expert Systems 1987, Int. Cairo Conference on Artificial Intelligence Applications in 1992 and Int. Conf. on Intelligent Computing and Information Systems 2002, and one of the main sustainers of annual Int. Romanian Internet Learning Workshop Project (RILW), 1997.
In addition he was Secretary of Egyptian Computer Society (1984-1990), Member of National Committee in Informatics-Academy of Scientific Research and Technology (1992-200), Member of Egyptian Committee in the Inter-Governmental Informatics Program, IIP-UNISCO, Paris (1988-1990) and Coordinator of the Annual International Conference for Statistics, Scientific Computing, and Social and Demographic Research (1983-1990). In addition he was a partner of a MEDCAMPUS Projects on Methodologies and Technologies for Distance Education in Mediterranean (1993-1995). In addition He is a Member of the Editorial Board of 15 international and national Journals in the following countries: Canada; Italy, Romania, Japan, Turkey, UK and Egypt. Also, He is member of many Int. Scientific Societies and associations in USA, UK, Switzerland, Austria, Canada and Egypt.