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Recent Researches in System Science

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(Part of the 15th WSEAS CSCC Multiconference)

Corfu Island, Greece, July 14-16, 2011

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Preface

This year the Proceedings of the 15th WSEAS International Conference on Systems (Part of the 15th WSEAS CSCC Multiconference) was held in Corfu Island, Greece July 14-16, 2011. The conference provided a platform to discuss systems theory, dynamical systems, control systems, simulation, modelling, robotics, non-linear systems, hybrid systems, speech and image processing systems, human-machine systems, wavelets, systems techniques for wireless applications, optimization, finite elements 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

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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

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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

New Approach to Continuous and Discrete-Time Systems based on Abstract State Space Energy

Professor Milan Stork
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Abstract: Almost in any field of science and technology some sort of stability problem can appear. Instability is certainly the most important phenomena, which should be investigated before any other aspect of reality will be attacked. The stability and energy of the system are closely related. Simple linear and nonlinear continuous and discrete systems are investigated from the energy point of view. As an alternative to the method of Lyapunov functions a conceptually different approach can be based on the idea that, in fact abstract state space energy can be measured as distance from the system equilibrium to the actual state, what is needed also for stability analysis. Thus, instead of the physical energy a metric function will be defined in a proper way. The idea is based on based on a generalization of the well known Tellegen's principle.

Presented study deals with energy, stability and related structural properties of a relatively broad class of finite dimensional strictly causal continuous and discrete systems, which can be described in the state-space representation form. Dissipativity, instability, asymptotic stability as well as stability in the sense of Lyapunov is analyzed by a new approach based on an abstract state energy concept. The resulting energy metric function is induced by the output signal power and determines both, the structure of a digital system representation as well as the corresponding system state space topology.

A special form of physically correct internal structure of an equivalent state space representation has been derived for discrete time signals as a natural consequence of strict causality, signal energy conservation, dissipativity and state minimality requirements. New discretization approach of discrete systems based on energy preservations is presented. Results of simulation examples are shown for illustration of fundamental ideas and basic attributes of the proposed method.

Brief Biography of the Speaker:

Milan Stork received the M.Sc. degree in electrical engineering from the Technical University of Plzen, Czech Republic at the department of Applied electronics in 1974. He specialized in electronics systems and control in research institute in Prague. Since 1977 he worked as lecturer on University of West Bohemia in Plzen. He received Ph.D. degree in automatic control systems at the Czech Technical University in Prague in 1985. In 1997, he became as Associate Professor and in 2007 full professor at the Department of Applied Electronics and Telecommunication, faculty of electrical engineering on University of West Bohemia in Plzen, Czech Republic. He has numerous journal and conference publications. He is member of editorial board magazine "Physician and Technology". His research interest includes analog/digital linear, nonlinear and chaotic systems, control systems, signal processing and biomedical engineering, especially cardiopulmonary stress exercise systems.

Plenary Lecture 2

Hidden Oscillations in Dynamical Systems

Professor Gennady A. Leonov
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Abstract: The problem of hidden oscillations in nonlinear control systems forces to develop new approaches of nonlinear oscillation theory. During initial establishment and development of theory of nonlinear oscillations in the first half of 20th century a main attention has been given to analysis and synthesis of oscillating systems for which the solution of existence problems of oscillating regimes was not too difficult. The structure itself of many systems was such that they had oscillating solutions, the existence of which was "almost obvious". The arising in these systems periodic solutions were well seen by numerical analysis when numerical integration procedure of the trajectories allowed one to pass from small neighborhood of equilibrium to periodic trajectory. Therefore main attention of researchers was concentrated on analysis of forms and properties of these oscillations (the "almost" harmonic, relaxation, synchronous, circular, orbitally stable ones, and so on).
Further there came to light so called hidden oscillations – the oscillations, the existence itself of which is not obvious (which are "small" and, therefore, are difficult for numerical analysis or are not "connected" with equilibrium i.e. the creation of numerical procedure of integration of trajectories for the passage from equilibrium to periodic solution is impossible). So in the midpoint of twentieth century M.A.Aizerman and R.E.Kalman formulated two conjectures, which occupy, at once, attention of many famous scholars.
Similar situation is in attractors localization. The classical attractors of Lorenz, Rossler, Chua, Chen, and other widely-known attractors are those excited from unstable equilibria. From computational point of view this allows one to use numerical method, in which after transient process a trajectory, started from a point of unstable manifold in the neighborhood of equilibrium, reaches an attractor and identifies it. However there are attractors of another type: hidden attractors, a basin of attraction of which does not contain neighborhoods of equilibria.
In this presentation the application of special analytical-numerical algorithms for hidden oscillations and hidden attractor localization are discussed. Construction of counterexamples for Aizerman's and Kalman's conjectures, and existence of hidden attractor in Chua's systems are demonstrated.

Brief Biography of the Speaker:
Gennady A. Leonov received his PhD (Candidate Degree) in mathematical cybernetics from Saint-Petersburg State University in 1971 and Dr.Sci. in 1983.
From 1985 – he is full professor at the Mathematics and Mechanics Faculty. He has been vice-rector of Saint-Petersburg State University from 1986 to 1988.
Now Gennady A. Leonov is Dean of Mathematics and Mechanics Faculty (since 1988), Director of Research Institute of Mathematics and Mechanics of St.-Petersburg State University (since 2004), Head of Applied cybernetics Department (since 2007).
Professor G.A. Leonov was awarded Prize of St.-Petersburg State University (1985), State Prize of USSR (1986), Prize of Technische Universitet Dresden (1990).
He is member (corresponding) of Russian Academy of Science, member of the Russian National Committee of Theoretical Mechanics, member of Directorate of St.-Petersburg Mathematical Society.
Professor G.A. Leonov authored and co-authored 300 books and papers. His research interests, now in qualitative theory of dynamical systems, stabilization, nonlinear analysis of phase synchronization systems and electrical machines.

Plenary Lecture 3

Intelligent Robotic System with Fuzzy Learning Controller and 3D Stereo Vision

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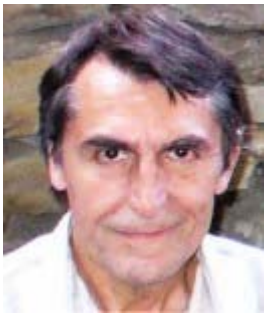
Abstract: It is well known that robotic manipulators are highly nonlinear coupling dynamic systems. It is difficult to establish an appropriate mathematical model for designing a model-based controller. The model-free feature of fuzzy logic control strategy was employed to design robotic motion controller. However, there is no guide rule for designing the fuzzy rule bank and parameters, it still needs time consuming trial-and-error work for rules bank and fuzzy parameters adjustment. We had developed self-organizing fuzzy control and adaptive fuzzy sliding mode control two intelligent learning mechanism for solving this implementation problem. In addition, a low cost stereo vision system is developed on chip processor. It can be integrated into robotic system for executing visual servo robotic motion control purpose. Both systems can be constructed on Nios II SOPC developing board with ALTERA FPGA chip to manipulate a retrofitted Mitsubishi robotic system. The 3-D position information between the target and stereo vision system can be extracted by stereo vision algorithm first. Then, the relative motion between the robotic end-effector and the target can be planned to guide robot arm to catch the object. The self-organizing fuzzy control and fuzzy sliding mode control algorithms are employed to monitor the trajectory motion of each joint. The experimental results show that this visual servo robotic system can track and catch a moving target in 3D space and execute some interaction functions with player.

Brief Biography of the Speaker:
Shiuh-Jer Huang received received the B.Sc. degree from National Cheng-Kung University, Tainan, Taiwan, the M.Sc. degree from National Taiwan University, Taipei, Taiwan, and the Ph.D. degree from the University of California, Los Angeles, USA, in 1978, 1980, and 1986, respectively, all in mechanical engineering. In 1986, he joined the faculty of the Department of Mechanical Engineering, National Taiwan University of Science and Technology, Taipei, Taiwan, where he is currently a Professor. From 1999 to 2000, he was a Visiting Professor with the Department of Mechanical Engineering, University of Manchester Institute Technology, England. During 2005-2009, he was the Chairman of the Department of Vehicle Engineering in the National Taipei University of Technology and awarded with outstanding professor. His research interests are precision mechatronics control, intelligent control system, robotic system control and advanced vehicle components development and applications. He had published more than 80 well-known International journal papers and 60 conference papers. He has much experience for implementing a couple of fuzzy learning mechanisms on machine tools, robotic system and vehicle control systems.

Plenary Lecture 4

Infrared Image Processing Methods and Systems



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Abstract: Infrared image processing methods are applied with success in the varieties of important areas of science, medicine, surveillance and observation etc. Thermo or infrared vision systems are very popular now and are used in a wide spread areas like military, police custom traffic control, undestructive control, industrial control and other specific applications. The main reasons for the fast and permanent increasing of the popularity of infrared vision system are not only the need for using these systems in variety of applications, but also the development of the compact with the excellent characteristics infrared video cameras. There are also a lot of methods and software tools helping the development and testing application algorithms for thermal or infrared image processing, infrared spectroscopy etc. Despite many existing developments of hardware infrared cameras and software development tools, there is a need mainly in practical applications of thermo vision systems for real time thermal or infrared image processing. In this article is proposed first a brief review of the existing and popular infrared image processing method and algorithms, their characteristics, comparison and possible areas of applications. The implementation of the infrared image processing methods and algorithms in some suitable architectures and modules of infrared systems are discussed in sense of their practical application in real working systems. The important characteristics of infrared image processing systems are considered for the possibility of real time infrared images processing and implementation of some effective algorithms in examples and concrete practical applications. In this article are presented some results of the proposed algorithms demonstrating the work of a real time working infrared image processing module in a thermo vision system for motion objects and people detection for customs control and combating terrorism.

Brief Biography of the Speaker:
Born in 1944, Plovdiv, Bulgaria. He received M.S. degree in Communications in 1969 in Technical University, Sofia. Ph. D in Television and Image Processing in 1975, Assoc. Prof. since 1987 in the same University and Professor since 2010 in the same University. Vice-Dean of Faculty on Life-Long Learning Center since 2005, Vice-Dean of French Language Faculty of Electrical Engineering since 2006. The author over 190 research papers in Image Processing Systems, Pattern Recognitions, Neural Networks etc. Currently the leader of courses in Basic of Television, Television Systems, Theory of Coding, Digital Signal Processors etc. His scientific iterests encompass Video and Audio Processing, Digital TV, Neural Networks, Artificial Intelligence in Video and Audio Robot Systems, Thermo Vision Systems and Infrared Image Processing, Artificial Intelligence Programming Languages Lisp Prolog, Expert Systems, Robotics Camera Eye and Microphone Arrays, Signal Processors, Embedded Systems, Microcontrollers, Programming Languages C++, Java, Matlab etc.