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RECENT ADVANCES IN COMMUNICATIONS

Proceedings of the 13th WSEAS International Conference on COMMUNICATIONS

13th WSEAS CSCC Multiconference
Rodos (Rhodes) Island, Greece, July 23-25, 2009

Recent Advances in Electrical Engineering
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Preface

This year the 13th WSEAS International Conference on COMMUNICATIONS was held in Rodos, Greece, in July 23-25, 2009. The Conference remains faithful to its original idea of providing a platform to discuss microwave theory and techniques, cad design for microwave systems, antennas and radars, lightwave technology, microwave acoustics, filter and passive components, microwave and antennas measurements, reflectors and lens antennas, arrays, scattering, propagation, diffraction 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

Embedded Systems Design – Scientific Challenges and Work Directions

Professor Joseph Sifakis
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Abstract: The development of a satisfactory Embedded Systems Design Science provides a timely challenge and opportunity for reinvigorating Computer Science. Embedded systems are components integrating software and hardware jointly and specifically designed to provide given functionalities, which are often critical. They are used in many applications areas including transport, consumer electronics and electrical appliances, energy distribution, manufacturing systems, etc. Embedded systems design requires techniques taking into account extra-functional requirements regarding optimal use of resources such as time, memory and energy while ensuring autonomy, reactivity and robustness. Jointly taking into account these requirements raises a grand scientific and technical challenge: extending Computer Science with paradigms and methods from Control Theory and Electrical Engineering. Computer Science is based on discrete computation models not encompassing physical time and resources which are by their nature very different from analytic models used by other engineering disciplines.
We summarize some current trends in embedded systems design and point out some of their characteristics, such as the chasm between analytical and computational models, and the gap between safety critical and best-effort engineering practices. We call for a coherent scientific foundation for embedded systems design, and we discuss a few key demands on such a foundation: the need for encompassing several manifestations of heterogeneity, and the need for design paradigms ensuring constructivity and adaptivity.
We discuss main aspects of this challenge and associated research directions for different areas such as modeling, programming, compilers, operating systems and networks.

Brief Biography of the Speaker: Joseph Sifakis is a CNRS researcher and the founder of Verimag laboratory (http://www-verimag.imag.fr/), in Grenoble, France. He holds the INRIA-Schneider endowed industrial chair since September 1st 2008. He studied Electrical Engineering at the Technical University of Athens and Computer Science at the University of Grenoble. Verimag is a leading research laboratory in the area of critical embedded systems. It developed the underlying theory and technology for the SCADE tool, used by Airbus for the design and validation of its critical real-time systems, and is becoming a de facto standard for aeronautics. Verimag has a lasting and strategic collaboration with ST Microelectronics, France Telecom R&D, and Airbus, through which numerous results on validation and testing have been transferred. Joseph Sifakis is recognized for his pioneering work on both theoretical and practical aspects of Concurrent Systems Specification and Verification. He contributed to emergence of the area of model-checking, currently the most widely-used method for the verification of industrial applications. His current research activities include component-based design, modeling, and analysis of real-time systems with focus on correct-by-construction techniques (http://www-verimag.imag.fr/~sifakis/). Joseph Sifakis has broad experience with industry, notably though joint projects with partners such as Astrium, the European Space Agency, France Telecom, ST Microelectronics and he has also been active for many years in consulting. Joseph Sifakis is the Scientific Coordinator of the European Network of Excellence ARTIST2 on Embedded Systems Design. (http://www.artist-embedded.org/). This network gathers 35 of the best European teams in the area, and aims to produce innovative results for cost-effective design of dependable embedded systems. It will also promote innovative methods safe and secure systems, notably through cooperation with key European industrial partners such as Thales, Airbus, Ericsson, Philips, and ST Microelectronics. Joseph Sifakis is the director of the CARNOT Institute "Intelligent Software and Systems" in Grenoble (http://www.carnot-lsi.com/). Joseph Sifakis is a member of the editorial board of several journals, co-founder of the International Conference on Computer Aided Verification (CAV) and a member of the Steering Committee of the EMSOFT (Embedded Software) conference. He is a member of Academia Europea (http://www.acadeuro.org/) and a member of the French National Academy of Engineering (http://www.academie-technologies.fr/).
Joseph Sifakis has received with Ed Clarke and Allen Emerson for their contribution to Model Checking, the Turing Award for 2007 (http://awards.acm.org/homepage.cfm?srt=all&awd=140). He is also the recipient of the CNRS Silver Medal in 2001.

Keynote Lecture 2
Quantum Cryptography and Chaos Functions: The Ultimate for Network Security

Professor Stamatios Kartalopoulos
Williams Professor in Telecommunications Networking
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Abstract: As the sophistication of intruders' increases, so does the incidents of information integrity breaches and network attacks. In response, very complex cryptographic processes have started being employed, such as chaos theory and quantum theory, in an effort to create the "holy grail" of cryptographic systems and network security.
Quantum theory defines the non-classical qubit, which is the superposition of quantum states having no classical analog. In addition, it is based on the "no cloning" or "no copying" theorem and on Heisenberg's uncertainty. Both, the qubit and the no-cloning theorem, along with the quanto-mechanical properties of photons, have been applied to a new breed of cryptography and secure optical communication networks known as quantum cryptography and quantum networks, respectively.
Chaos is based on the particular behavior of certain non-linear functions, which for a minute change of parameters produce a very large and unstable output, known as the "chaotic regime". However, this chaos is reproducible, which also makes it attractive to secure communications.
In this talk we explain quantum cryptographic protocols as well as chaos and chaotic processes with simple examples. We then describe how chaos functions are used in quantum cryptography in order to increase efficiency and speed of the quantum key establishment.

Brief Biography of the Speaker: Stamatios V. Kartalopoulos, PhD, is currently the Williams Professor in Telecommunications Networking at the University of Oklahoma. His research emphasis is on optical communication networks (FSO, long haul and FTTH), optical technology including optical metamaterials, and optical communications security including quantum cryptography and key distribution. Prior to this, he was with Bell Laboratories where he defined, led and managed research and development teams in the areas of DWDM networks, SONET/SDH and ATM, Cross-connects, Switching, Transmission and Access systems. He has received the President's Award and many awards of Excellence.
He holds nineteen patents in communications networks, and has published more than hundred fifty scientific papers, nine reference textbooks important in advanced fiber optic communications and security, and has also contributed several chapters to other books.
He has been an IEEE and a Lucent Technologies Distinguished Lecturer and has lectured at international Universities, at NASA and conferences. He has been keynote speaker of major international conferences, has moderated executive forums, has been a panelist of interdisciplinary panels, and has organized symposia, workshops and sessions at major international communications conferences.
Dr Kartalopoulos is an IEEE Fellow, chair and founder of the IEEE ComSoc Communications & Information Security Technical Committee, member at large of IEEE New Technologies Directions Committee, and has served editor-in-chief of IEEE Press, chair of ComSoc Emerging Technologies and of SPCE Technical Committees, Area-editor of IEEE Communications Magazine/Optical Communications, member of IEEE PSPB, and VP of IEEE Computational Intelligence Society.

Keynote Lecture 3

Content-Adaptive Efficient Resource Allocation for Packet-Based Video Transmission

Professor Aggelos K. Katsaggelos
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Abstract: Supporting video communication over lossy channels such as wireless networks and the Internet is a challenging task due to the stringent quality of service (QoS) required by video applications and the many channel impairments. Two important QoS characteristics for video are the degree of signal distortion and the transmission delay. Another important consideration is the cost associated with transmission, for example, the energy consumption in the wireless channel case and the cost for differentiated services in the Internet (with DiffServ) case.
In this presentation we consider the joint adaptation of the source coding parameters, such as the quantization step-size and prediction mode, along with the physical layer resources, such as the transmission rate and power. Our goal is to provide acceptable QoS while taking into account system constraints such as the energy utilization. We discuss a general framework that allows a number of "resource/distortion" optimal formulations for balancing the requirements of different applications. We conclude the presentation with some of the grand opportunities and challenges in designing and developing video communication systems.

Brief Biography of the Speaker: Aggelos K. Katsaggelos received the Diploma degree in electrical and mechanical engineering from the Aristotelian University of Thessaloniki, Greece, in 1979 and the M.S. and Ph.D. degrees both in electrical engineering from the Georgia Institute of Technology, in 1981 and 1985, respectively. In 1985 he joined the Department of Electrical Engineering and Computer Science at Northwestern University, where he is currently professor. He is also the Director of the Motorola Center for Seamless Communications and a member of the Academic Affiliate Staff, Department of Medicine, at Evanston Hospital.
Dr. Katsaggelos is a member of the Publication Board of the IEEE Proceedings, the IEEE Technical Committees on Visual Signal Processing and Communications, and Multimedia Signal Processing, the Editorial Board of Academic Press, Marcel Dekker: Signal Processing Series, Applied Signal Processing, and Computer Journal. He has served as editor-in-chief of the IEEE Signal Processing Magazine (1997-2002), a member of the Publication Boards of the IEEE Signal Processing Society, the IEEE TAB Magazine Committee, an Associate editor for the IEEE Transactions on Signal Processing (1990-1992), an area editor for the journal Graphical Models and Image Processing (1992-1995), a member of the Steering Committees of the IEEE Transactions on Image Processing (1992-1997) and the IEEE Transactions on Medical Imaging (1990-1999), a member of the IEEE Technical Committee on Image and Multi-Dimensional Signal Processing (1992-1998), and a member of the Board of Governors of the IEEE Signal Processing Society (1999-2001). He is the editor of Digital Image Restoration (Springer-Verlag 1991), coauthor of Rate-Distortion Based Video Compression (Kluwer 1997), co-editor of Recovery Techniques for Image and Video Compression and Transmission, (Kluwer 1998), and co-author of Super-Resolution for Images and Video, (Morgan and Claypool, 2007), and co-author of Joint Source-Channel Video Transmission (Morgan and Claypool 2007). He was the holder of the Ameritech Chair of Information Technology (1997-2003), and he is the co-inventor of twelve international patents, a Fellow of the IEEE (1998) and SPIE (2009), and the recipient of the IEEE Third Millennium Medal (2000), the IEEE Signal Processing Society Meritorious Service Award (2001), an IEEE Signal Processing Society Best Paper Award (2001), an IEEE ICME Best Paper Award (2006), and an IEEE ICIP Paper Award (2007). He was a Distinguished Lecturer of the IEEE Signal Processing Society for 2007-2008.

Keynote Lecture 4

Computer Aided-Visual Perception : Challenges and Perspectives

Professor Nikos Paragios
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Abstract: Computer aided human perception aims at developing intelligent algorithms towards understanding visual cues coming from images, video, or other means of gathering visual information. Such a process often consists of three stages, initially the problem of perception is parameterized through a mathematical model where the estimation of its parameters will lead to visual understanding. Then, the model is associated with the available observations through the definition of an objective function and last, this function is optimized using computational methods. The main challenges that one has to address in this context is the curses of dimensionality, non-linearity, non-convexity and modularity. In simple words, even the simplest possible perception problem could involve too many parameters where the association between the data and them is not straightforward and is done through non-convex functions. In this talk, we will present a generic mathematical framework that exploits recent advances in discrete optimization to address computational visual perception. Numerous image processing, computer-aided diagnosis and computer vision applications will be considered to demonstrate the potentials of this method.

Brief Biography of the Speaker: Nikos Paragios (http://vision.mas.ecp.fr) obtained his B.Sc. (highest honors, valedictorian) and M.Sc. (highest honors) in Computer Science from the University of Crete (Greece) [1994,1996] , his Ph.D. in electrical and computer engineering from I.N.R.I.A. [2000] and his D.Sc. (Habilitation a Diriger de Recherches) from the University of Nice/Sophia Antipolis (France) [2005)]. He is professor of applied mathematics at the Ecole Centrale de Paris - one of most exclusive engineering schools "Grande Ecoles" - leading the Medical Imaging and Computer Vision Group. He is also affiliated with INRIA Saclay Ile-de-France, the French Research Institute in Informatics and Control heading the GALEN group. Prior to that he was professor/(2004-2005) at the Ecole Nationale de Ponts et Chaussees, affiliated with Siemens Corporate Research (Princeton, NJ, 1999-2004) as a project manager, senior research scientist and research scientist. In 2002 he was an adjunct professor at Rutgers University and in 2004 at New York University. N. Paragios was a visiting professor at Yale University in 2007.
Professor Paragios has co-edited four books, published more than hundred papers (DBLP server) in the most prestigious journals and conferences of medical imaging and computer vision, gave more that hundred invited lectures, and has twelve US issued patents and more than twenty pending. His work has approx 3,500 citations in googlescholar and approx 2,000 in scopus, and and his H-number according to scholar is 28 and 24 according to scopus. He is a Senior member of IEEE, associate editor for the IEEE Transactions on Pattern Analysis and Machine Intelligence (PAMI), area editor for the Computer Vision and Image Understanding Journal (CVIU) and member of the Editorial Board of the International Journal of Computer Vision (IJCV), the Medical Image Analysis Journal (MedIA) and the Journal of Mathematical Imaging and Vision (JMIV). Professor Paragios is one of the program chairs of the 11th European Conference in Computer Vision (ECCV'10, Heraklion, Crete). In 2008 N. Paragios was the laureate of one of Greece's highest honor for young academics and scientists of nationality or descent (world-wide), the Bodossaki Foundation Prize in the field of applied sciences. In 2006, he was named one of the top 35 innovators in science and technology under the age of 35 from the MIT's Technology Review magazine. He and his collaborators were the recipients of numerous scientific rewards, like for example the Francois Erbsmann prize for the IPMI'07 conference. His research interests are in the areas of computer vision, medical image analysis and human-computer interaction.

Keynote Lecture 5

Control and Estimation Theory: Current Trends, New Challenges, & Directions for the Future

Professor Lena Valavani
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Abstract: Despite the tremendous strides witnessed in the Control and Estimation of lumped parameter systems , whether linear or nonlinear, the issue of stability and performance robustness under simultaneous structured and unstructured uncertainty still remains largely unresolved. When fault tolerance, autonomy and reactivity are added to the requirements, this presents an additional challenge. 'Closed form' solutions are in most cases not possible and computational methods (optimization based, search, etc.) do not provide the necessary guarantees.
The challenges become even greater in the case of distributed systems and networks, such as large industrial/manufacturing plants, environmental applications (CO2 sequestration), communications networks, traffic networks (aeronautical, highway), space networks (satellite constellations), biomedical applications(CNS studies) which, by their nature, require control and estimation in a distributed setting. Requirements and specifications can also be widely variable between safety critical and socially/economically significant systems.
It becomes increasingly evident that control, communications and computation need to be synergistically combined through a 'universal formalism' and novel paradigms that combine logical operations (symbolic reasoning and decision making) with analytical constructs (mathematical algorithms)and continuous quantities(throughput, subsystem interconnections), in order to handle heterogeneity, asynchronicity , real time functionality, properties that typically characterize distributed systems/networks.
We focus on some representative examples to elucidate key issues that arise in modeling, algorithm design, computation, in order to ensure robustness , fault tolerance, autonomy and even reactivity of distributed systems/networks, that point to the need for total synergy of Control, Communications , and Computation/Computer Science- to meet today's and future challenges.

Brief Biography of the Speaker: Lena Valavani holds her B.S. in Physics, from Barnard College, Columbia University, and the M.S., M.Phil. and Ph.D degrees in Engineering and Applied Science from Yale University. After postdoctoral positions at Yale and MIT's Laboratory for Information and Decision Systems, she joined the Department of Aeronautics and Astronautics, MIT, where she was Boeing Associate Professor. She also served as Chief Scientist, Systems Engineering, U.S. D U.S. Department of Transportation for four years. She is currently president of Hellenic Space Systems , S .A.
Dr. Valavani served as Associate Editor of IEEE Transactions of Automatic Control, Automatica , AIAA Journal of Guidance, Navigation and Control, and the International Journal on Robust and Nonlinear Control. She was elected to the Board of Directors, AIAA, N.E., and served as General Secretary. She also was for a long time a member of the steering committee of the International Physicians for the Prevention of Nuclear War, GBPSR, (1985 Nobel Peace Prize).
Her research interests are in modeling for, and the analysis and synthesis of control systems, estimation and identification, with emphasis on robustness to structured and unstructured uncertainty, fault tolerance and reconfiguration, currently in distributed systems and networks . Her research in the U.S. was supported by NASA, NSF, AFOSR,ONR ,and by private industry , resulting in innovative designs of prototype systems currently in operation in the U.S; in Europe by ESA and EC. She has supervised 27 Ph.D and 29 M.S theses at MIT , and 22 M.S. theses at NTUA and UoA.
Dr. Valavani was consultant to Lincoln Laboratory, C.S.Draper Laboratory , and Bell Helicopter while in the U.S. She received the Best Research Paper Award (1991) from the International Gas Turbine Institute and holds three U.S. Patents in the area of controlling unsteady aerodynamic processes in compressors. She is an Associate Fellow of AIAA.

Plenary Lecture 1
Effect of Atmospheric Parameters on Satellite Link in Tropical Climates

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Abstract: The possibility of predicting rain attenuation statistics on earth-to-space paths from rainfall rate data has been a common interest in the past years and has expectant an extensive series of theoretical and experimental studies. Rain attenuation is dominant in earth-to-space using frequencies above 10 GHz, reliability of the links depends greatly on the rainfall rate. In order to secure adequate link reliability, it is necessary to weaken the attenuation by establishing two earth stations and diverting the signal waves to the path of least rain attenuation. Attenuation is a linear function proportional to distance in guided media describing the efficiency of a particular guided media. However, this is not the case in unguided media. Generally, attenuation in unguided media increases as the signal frequency increases. It is the interference caused by raindrops on electromagnetic signals traveling through atmosphere. When this phenomenon occurs, the transmission is weakened by absorption and scattering of the signal by raindrops. Therefore, transmissions at frequencies, especially in Ku-band range are extremely susceptible to attenuation due to atmospheric conditions such as rain fade.
Since majority of the studies on earth-to-space propagation have been conducted in temperate regions, the existing prediction models may not be sufficiently accurate to characterize the effects of attenuation on tropical and equatorial climates. This speech aims to increase the available database on earth-to-space propagation at Ku-band.

Brief Biography of the Speaker: J. S. Mandeep received his B.E. (with honors) and Ph.D. degrees in electrical and electronic engineering from the University of Notrhumbria, UK, in 1998, and Universiti Sains Malaysia in 2006, respectively. Since 2006, he has been affiliated to Universiti Sains Malaysia as a Lecturer. His areas of specialization are radiowave propagation in satellite communication system, radar, antenna design, RF, and microwave. His current research collaboration is with the Association of Radio Industries and Business (ARIB), Japan, to analyze the rain fade at Ku-band in tropical climate using satellite, involving countries such as Thailand, Philippines, Indonesia, and Fiji. Mandeep has published 30 papers in journals, most in his special field: radiowave propagation. He has also reviewed more than 30 articles in IEEE and PIERS Journals.

Plenary Lecture 2

The Satellite Telecommunication System Performances in the Presence of Rayleigh Fading on Satellite and Earth Station

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Abstract: In this lecture satellite communication system consisting the earth transmitting station and the satellite transponder is considered. SSC diversity technics are used on receiving satellite and receiving earth stations to reduce fading influence to the system performances. The presence of Rayleigh fading on receiving satellite and receiving earth stations is observed. For this model and phase modulated signals (PSK) the system error probability is determined.

Brief Biography of the Speaker: Dragana S. Krstic was born in Pirot, Serbia. She received the BSc, MSc and PhD degrees in electrical engineering from Faculty of Electronic Engineering, Department of Telecommunications, University of Nis, Serbia, in 1990, 1998 and 2006, respectively. Her field of interest includes telecommunications theory, optical communication systems, wireless communication systems, satellite communication systems etc. She works at the Faculty of Electronic Engineering in Nis since 1990. She participated in more Projects which are supported by Serbian Ministry of Science. She has written or co-authored almost 90 papers, published to International/National Conferences and Journals.

Plenary Lecture 3

Basic Characteristics (Characterization) of Mobile Processes and Ways of Describing and Supporting Mobile Processes by Present Means of ICT

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Abstract: At present the change from wire communication to wireless communication and from the immobile localization of the communication centre to the localization which is not determined by concrete place, time and person proceeds. Distributed attitudes and systems successfully prevail in the area of information systems which are recently based on service oriented architectures (SOA). Some firms and companies make use of mobile devices for the access to their information systems.
In the paper will be given and contrasted specific features and properties of mobile processes, discusses main assumptions for process transformation into mobile process and some ways of making this transformation. There will be discussed expansion of present means and methodological tools by new parts able to model mobile processes. Their will be given assessment of present tools and methodologies from the point of view of their applicability for modeling of mobile processes and systems.

Brief Biography of the Speaker: He was born in 1951 in Prague, Czech Republic. In 1974 finished his studies of scientific mathematics at Charles University in Prague, Faculty of Mathematics and Physics. Gradually received the following titles - Master degrees RNDr., PhDr., doctoral degree Ph.D., associate professorship and professorship at Charles University in Prague and University of life Sciences in Prague
For more then 10 years he has been the vice rector for science and foreign relations of UHK He was a coordinator of large international projects. He is the author or co author of three monographs, more then 80 contributions in international scientific journals and more then 100 papers in proceeding from international scientific conferences. His scientific interest includes ICT and their applications, software architectures, object oriented approach and design of distributed applications.
He is a member of scientific boards of several Czech universities, guarantee of several Ph.D. programs, program committees of several scientific conferences editorial boards of several journals and magazines.

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