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Recent Advances in Electronics, Hardware, Wireless & Optical Communications

Proceedings of the 9th WSEAS International Conference on Electronics, Hardware, Wireless and Optical Communications (EHAC '10)

University of Cambridge, UK, February 20-22, 2010

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ISBN: 978-960-474-155-7
ISSN: 1790-5117

Published by WSEAS Press
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World Scientific and Engineering Academy and Society

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Preface

This year the 9th WSEAS International Conference on ELECTRONICS, HARDWARE, WIRELESS and OPTICAL COMMUNICATIONS (EHAC '10) was held at the University of Cambridge, UK, February 20-22, 2010. The conference remains faithful to its original idea of providing a platform to discuss electronics, hardware engineering, wireless and optical communications, wireless networks, broadband access networks, optical networks, service aspects, network technologies and architectures, microwaves, antennas, radar systems 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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Plenary Lecture 1

Wireless FSO WDM Mesh Networks for Ultra-Broadband and Super-Computing

Professor Stamatios Kartalopoulos
Williams Professor in Telecommunications Networking
The University of Oklahoma
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Abstract: Electromagnetic-based wireless technology provides two major advantages to the end user, mobility and freedom from wired medium connectivity. However, it has a major disadvantage that limits high-quality and high-bandwidth service applicability, small product {(bit rate) x (distance)}. As such, the applicability of this technology has been limited to short range access. A wireless technology that delivers very high bandwidth is free space optical or FSO. FSO technology was initially deployed in point-to-point topologies, but recently FSO has become more pervasive in mesh topology, promising better survivability, ultra-high bandwidth and longer reach for communications and data. When FSO is combined with WDM technology, then the transportable bandwidth is yet higher and WDM-FSO becomes suitable to disperse-grid super-computing. In such case, WDM FSO combined with short-distance E-M wireless clusters, allows for a large product {bit rate} x {distance} which can be several orders of magnitude than pure E-M technology. In this talk, we describe the FSO and the WDM technologies as well as the mesh WDM-FSO applicable to communications, data and grid supercomputing, and we make comparisons between EM-based and mesh WDM FSO technologies.

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 chaotic functions. 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 two hundred scientific papers, ten reference textbooks in advanced fiber optic communications and security, and has contributed several chapters to other books.
He has been an IEEE and a Lucent Technologies Distinguished Lecturer and has lectured at universities, NASA and conferences internationally. 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, series editor of IEEE Press/Wiley, 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.

Plenary Lecture 2

Signal Processing in DS-CDMA Downlink Wireless Communication Systems with Fading Channel Employing the Generalized Detector

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Abstract: Generalized receiver (GR) constructed in accordance with the generalized approach to signal processing (GASP) in noise is employed in direct-sequence code-division multiple access (DS-CDMA) downlink wireless communication system with frequency-selective channels. We consider four avenues: linear equalization (LE) with finite impulse re-sponse (FIR) beamforming filters; channel estimation and spatially correlation; optimal combining; and partial can-cellation. We investigate the GR with simple LE and FIR beamforming filters. Numerical results and simulation show that the GR with FIR beamforming filters surpasses in performance the optimum infinite impulse response be-amforming filters with conventional receivers, and can closely approach the performance of GR with infinite impul-se response beamforming filters. Channel estimation errors are taken into consideration in order to DS-CDMA wire-less communication system performance will be not degraded under practical channel estimation. GR takes an esti-mation error of maximum likelihood (ML) multiple-input multiple-output (MIMO) channel estimation and GR spa-tially correlation into account in computation of minimum mean square error (MMSE) and log-likelihood ratio (LLR) of each coded bit. Symbol-error rate (SER) performance of DS-CDMA employing GR with quadrature subb-ranch hybrid selection/ maximal-ratio combining (HS/MRC) scheme for 1-D modulations in Rayleigh fading is obta-ined and compared with that of the conventional HS/MRC receivers. Procedure of selecting a partial cancellation fa-ctor (PCF) for the first stage of a hard-decision partial parallel interference cancellation (PPIC) of the GR employing in DS-CDMA wireless communication system is proposed. A range of the optimal PCFs is derived based on the Pri-ce's theorem. Computer simulation results show superiority in bit error rate (BER) performance that is very close to the potentially achieved and surpasses the BER performance of the real PCF for DS-CDMA systems discussed in li-terature.

A transmitted signaling technique using orthogonal unified complex Hadamard transform spreading sequences is in-vestigated when the GR is employed in DS-CDMA downlink wireless communication system to maintain the ortho-gonality between users and reduce the effect of multipath fading and interference from other users. A general multi-path-fading model is assumed. System performance is evaluated by means of signal-to-interference-plus-noise ratio (SINR) at the GR output. It is shown that the SINR of the DS-CDMA downlink wireless communication system em-ploying the orthogonal unified complex Hadamard transform spreading sequences and the GR is independent of the phase offsets between different paths, while the SINR of the same system using the Walsh-Hadamard (WH) spread-ing sequences is related to the squared cosine of path phase offsets. As a result, the bit-error ratio (BER) performan-ce of the DS-CDMA downlink wireless communication system employing the GR is better than that of the system with the WH spreading sequences at high SINRs. Comparative analysis of BER performances of DS-CDMA down-link wireless communication systems using the GR and Rake receiver, which consists of a bank of correlation recei-vers, with each individual receiver correlating with a different arriving multipath component, shows a superiority of the GR over the Rake receiver both at high SINRs and at low SINRs.

Brief Biography of the Speaker:
Vyacheslav Tuzlukov is currently a Full Professor of the School of Electrical Engineering and Computer Science at the Kyungpook National University, Daegu, South Korea. His research emphasis is on signal processing in wireless communications, wireless sensor networks, radar/sonar, remote sensing, satellite communications, mobile communications, and underwater signal processing, and so on. Prior to this, he was Full Professor of the School of Electronic Engineering, Communications Engineering and Computer Science at the Yeungnam University, Gyeongsan, South Korea (2007-2008) and invited Full Professor of the Electrical and Computer Engineering Department of Ajou University, Suwon, South Korea (2003-2007), where he managed research teams in the area of

signal processing in CDMA wireless communications and in wireless sensor networks. He is an author over 150 journal and conference papers and of the following books in signal processing area: Signal Processing in Noise: A New Methodology, IEC (1998); Signal Detection Theory, Springer-Verlag, New York (2001); Signal Processing Noise, CRC Press, Boca Raton, New York, Washington, D.C. London (2002); Signal and Image Processing in Navigational Systems, CRC Press, Boca Raton, New York, Washington, D.C., London (2004); Signal Processing in Radar Systems, CRC Press, Boca Raton, New York, Washington, D.C., London (2010, in press) and has al-so contributed the chapters “Underwater Acoustical Signal Processing” and “Satellite Communications Systems: Applications” to Electrical Engineering Handbook: 3rd Edition, CRC Press, Boca Raton, New York, Washington, D.C., London (2005). He serves as a Keynote Speaker, Chair of Sessions, Tutorial Instructor, and Plenary Speaker at major International Conferences on Signal Processing.

Dr. Tuzlukov was highly recommended by U.S. experts of Defense Research and Engineering (DDR&E) of the United States Department of Defense as a recognized expert in the field of humanitarian demining and minefield sensing technologies and had been awarded by Special Prize of the United States Department of Defense in 1999. Dr. Tuzlukov is distinguished as one of the leading achievers from around the world by Marquis Who’s Who and listed in the Who’s Who in the World, 2006-2010 and Who’s Who in Science and Engineering, 2006-2009, Marquis Publisher, NJ, USA.

Plenary Lecture 3

ELIN Logarithmic Circuits: Synthesis, Analysis and Applications in Bioengineering

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Abstract: In general implantability and portability of biomedical or not devices is underpinned by the need for low power circuit consumption while preserving high performance. Contrary to conventional circuit design flow techniques which emphasise on the realisation of input-output linear building blocks or elements, unconventional "externally-linear-internally-non-linear" (ELIN) design techniques do not spend power in linearising individual blocks. ELIN logarithmic techniques allow the individual transistors to operate in accordance to their exponential non-linear I-V characteristics dictated by physics. Consequently, such a radical approach increases the mathematical complexity of the design effort but can lead to high dynamic range performance. Moreover, when weakly-inverted MOS devices are employed, ultra low power and high dynamic range designs can be realised. This talk will elaborate on the articulation and validation of a complete transistor-level theoretical framework suitable for the synthesis, analysis and performance evaluation of logarithmic ELIN filters. We will explain how high dynamic range topologies with power consumption ranging from a few nWs to a few Ws can be realised in a systematic manner. We will present results from such state-of-art fabricated and tested microelectronic chips targeting the following bioengineering applications: high- and low-order filters for biosignal acquisition front-ends, biomimetic cochlear implant channels with AGC, current sensing and amplification blocks suitable for amperometric biosensors and Hodgkin-Huxley-type silicon neurons.

Brief Biography of the Speaker:
Dr. Emm. Mic. Drakakis is a Senior Lecturer in the Department of Bioengineering at Imperial College London where he joined in October 2001. Dr. Drakakis has studied Physics (4-year degree - 1st Class Honours) at Aristotle University of Thessaloniki- Macedonia -Greece, Electronic Physics and Radioelectrology (2.5 year MPhil-1st Class Honours) at the same university and earned his PhD in Analogue IC design from the Dept. of Electrical and Electronic Engineering at Imperial in 2000 under the supervision of Dr.A.Payne. In the Dept. of Bioengineering Dr. Drakakis has founded the "Bioinspired VLSI Circuits and Systems Group". The Group's research focuses on circuits and systems "for and from" biology. Dr. Drakakis has been awarded Performance Scholarships from the Foundation of State Scholarship (IKY) -Greece, a Prize by the Hellenic Army's Research & Technology Center (1995) whereas between 1996-1998 he held a scholarship by the Micro-Electronics Research Center (MERC) of LM Ericsson -Kista - Stockholm. His Group have received an IEEE MWSCAS Finalist Award in 2005 and an IEEE ISCAS Live Demo Special Session Award in 2007. In 2006 he received the Imperial Rector's Award for Research Excellence whereas in 2008 he received a Human Frontier Science Program Award. Dr.Drakakis (MIEEE) is a member of the BIOCAS and CNNA IEEE Technical Committees, is past Associate Editor for IEEE Transactions on Circuits and Systems Parts I and II, past Guest Assistant Editor for IEE Electronics Letters and past Subject Editor for the International Journal of Electronics - Taylor & Francis. He has authored or co-authored more than 80 peer-reviewed publications.

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