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ADVANCED TOPICS ON APPLIED ELECTROMAGNETICS, WIRELESS AND OPTICAL COMMUNICATIONS

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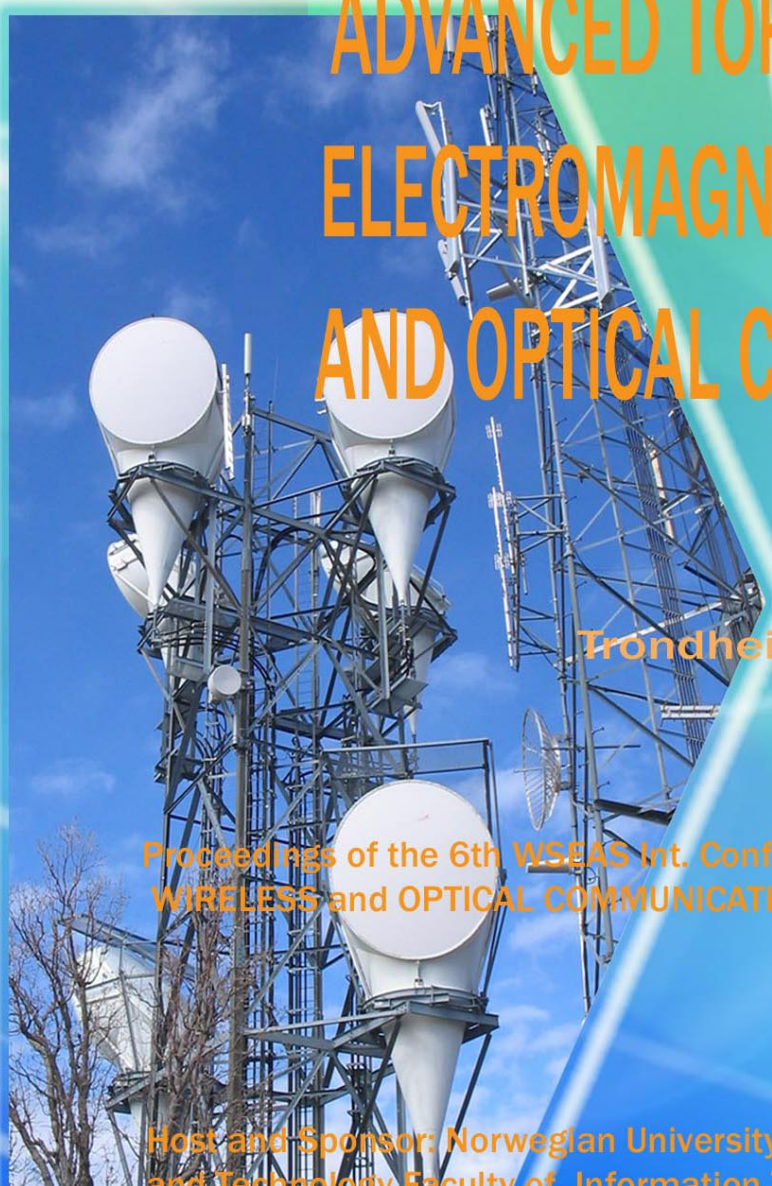
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Preface

This book contains the proceedings of the 6th WSEAS Int. Conf. on APPLIED ELECTROMAGNETICS, WIRELESS and OPTICAL COMMUNICATIONS (ELECTROSCIENCE '08) which was held in Trondheim, Norway, July 2-4, 2008. This conference aims to disseminate the latest research and applications in Applied Electromagnetics, Mathematical Methods for Problems of Electromagnetic Fields, Computational Techniques, Microwaves, Antennas, Radar, Satellite Communications, Optical Transmitters, Optical Receivers, Coherent Systems, Optical Switching and network elements, Telecommunications Standardization, Wireless LANS, Wireless Data Transmission, Wireless ATM, Solid State Electronics for Communications and other relevant topics and applications.

The friendliness and openness of the WSEAS conferences, adds to their ability to grow by constantly attracting young researchers. The WSEAS Conferences attract a large number of well-established and leading researchers in various areas of Science and Engineering as you can see from <http://www.wseas.org/reports>. Your feedback encourages the society to go ahead as you can see in <http://www.worldses.org/feedback.htm>

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In addition, papers of this book are permanently available to all the scientific community via the WSEAS E-Library.

Expanded and enhanced versions of papers published in this conference proceedings are also going to be considered for possible publication in one of the WSEAS journals that participate in the major International Scientific Indices (Elsevier, Scopus, EI, ACM, Compendex, INSPEC, CSA see: www.worldses.org/indexes) these papers must be of high-quality (break-through work) and a new round of a very strict review will follow. (No additional fee will be required for the publication of the extended version in a journal). WSEAS has also collaboration with several other international publishers and all these excellent papers of this volume could be further improved, could be extended and could be enhanced for possible additional evaluation in one of the editions of these international publishers.

Finally, we cordially thank all the people of WSEAS for their efforts to maintain the high scientific level of conferences, proceedings and journals.

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Keynote Lecture

Next Generation Broadband Access Networks: Metro-Access Integration and Optical-Wireless Convergence



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Abstract: Because of emerging multimedia applications, such as video-on-demand, video conferencing, interactive gaming, IPTV and e-learning, bandwidth demands from end users are constantly increasing. The copper wire technologies (e.g. cable and DSL) bridging users and the Internet have been stretched to their bandwidth limits, and become the so-called first/last mile bottleneck. To address current bottleneck of the Internet infrastructure, passive optical networks (PONs) and wireless mesh networks have been proposed as the most efficient approaches for broadband access services. Fiber is an ideal replacement for the copper wires in the access networks. TDM PONs are currently being deployed by service providers all over the world. Meanwhile, next-generation PONs are being investigated to provide better services for triple play (voice, data and video). To support more users and more bandwidth, next generation optical access will move toward higher bit rate and more wavelengths. The challenging issue is how to migrate from current TDM PONs to future WDM PONs in a scalable and cost-efficient manner. Meanwhile, the integration of metro and access networks will provide a transparent and efficient infrastructure for broadband service in metropolitan areas. Even though fibers can provide broadband services, PONs are constrained with a fixed infrastructure and limited coverage. For future mobile broadband applications, ubiquitous access networks are highly desirable. Due to recent advances in wireless technologies, wireless access such as wireless mesh networks (WMNs) becomes a promising solution to fulfill emerging mobile services. In the future, convergence of optical and wireless technologies is inevitable for quadruple play (voice, data, video and mobility). However, as the traffic behavior and channel quality of these two technologies are far from each other, seamlessly integrating PONs and WMNs presents a very challenging task. This talk discusses next generation broadband access networks, and in particular, the integration of metro and access networks and the convergence of optical and wireless technologies. The network architecture, routing algorithm and enabling technologies for next generation broadband access networks are presented in detail. This first part of this talk will review current TDM PON standards and next generation broadband optical access technologies. Evolutionary approaches to migrate from TDM to WDM PONs in a scalable and efficient manner are demonstrated with two SUCCESS (Stanford University Access Network) projects. The second part of this talk discusses the integration of optical metro rings with passive optical networks. A flexible metro-access architecture is proposed for resource sharing and dynamic bandwidth allocation in the integrated network. The third part of this talk presents a converged optical and wireless network for broadband, ubiquitous access services. The network consists of a passive optical backhaul and a wireless mesh, combining the advantages of both optical and wireless technologies – the high capacity of optical fibers and the flexibility of wireless mesh. Taking into consideration the hybrid network architecture, an integrated routing algorithm is developed to achieve load balancing and improved network performance. Finally, this talk concludes with a discussion of research issues in future optical and wireless access networks.

Short Biography of the Speaker: Dr. Leonid G. Kazovsky is a Professor in the Department of Electrical Engineering at Stanford University. He founded Photonics and Networking Research Laboratory (PNRL) at Stanford University in 1990 and has been leading the PNRL since then. Prior to joining Stanford, Prof. Kazovsky was with Bellcore (now Telcordia) doing research on WDM, high-speed and coherent optical fiber communication

systems. While on Bellcore assignments or Stanford sabbaticals, Prof. Kazovsky worked at the Heinrich Hertz Institute, Berlin, Germany; Hewlett-Packard Research Laboratories, Bristol, England; Scuola Superiore St. Anna, Pisa, Italy; and Technical University of Eindhoven, the Netherlands. Through research contracts, consulting engagements, and other arrangements, Prof. Kazovsky worked with many industrial companies and U.S. Government agencies including Sprint, DEC, GTE, AT&T, IVP, Lucent, Hitachi, KDD, Furukawa, Fujitsu, Optivision, and Perimeter on the industrial side; and NSF, DARPA, Air Force, Navy, Army, and BMDO on the government side. He also helped to launch several startup companies in the Silicon Valley. He was the author or coauthor of two books, 190 journal technical papers, and 260 conference papers. Prof. Kazovsky serves or served on Editorial Boards of leading journals (IEEE Transactions on Communications, IEEE Photonics Technology Letters, Wireless Networks) and on Program Committees of leading conferences (OFC, CLEO, LEOS, SPIE, and GLOBECOM). He also serves or served as a reviewer for various IEEE and IEE Transactions, Proceedings, and Journals; funding agencies (NSF, OFC, ERC, NRC, etc.) and publishers (Wiley, MacMillan, etc.).

Plenary Lecture I

Novel results in short-range visualization and vision systems based on gated imaging



Professor Andrzej Sluzek

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Abstract: The idea of visibility enhancement using gated images has been known and applied for at least 20 years. The majority of gated imaging systems are used for enhancing capabilities of human vision under highly difficult conditions (fog, turbid water, strong ambient light, etc.). In most of the reported applications the range of gated-imaging systems is long enough comparing to the duration of the illumination pulses so that a simplified model of gated imaging can be used. Secondly, the systems capture individual images only and no attempts have been reported on more sophisticated visualization methods using gated images. In this presentation, we focus on the above limitations of gated-imaging systems. First, we briefly discuss and explain the theory of short-range gated imaging. In vision-related applications, short-range gated imaging is needed only in very high turbidity conditions so that we focus on gated imaging in highly turbid media. The presented ideas are illustrated by exemplary results of simulated and physical tests. One of the conclusions is that in short-range applications of gated imaging the duration of the illumination pulses should be reduced so that the depth of visualization is very limited. We propose a technique for an automatic image fusion using a sequence of gated images captured by a precisely controlled pulsed laser. The fusion of several images can provide good quality of visualization over a wide range of depths. A feasibility study system build using this principle will be briefly discussed. The system is controlled by an FPGA device and controls the gated imaging operation with the accuracy limited by a single clock cycle duration. We believe that the proposed methods are a significant step towards system capable of providing visibility in extremely difficult scenarios (e.g. "inspecting areas of turbulent liquids, seeing through almost non-transparent liquids, etc.).

Short Biography of the Speaker: Dr. Andrzej SLUZEK received his MSc, PhD and DSc degrees from the Warsaw University of Technology (Poland) where he worked until 1992. In 1987 he was a visiting fellow with the Indian Institute of Science (Bangalore, India). In 1991-92 he was a research fellow at the University of Birmingham (UK). In 1992 he joined the Nanyang Technological University (Singapore) where he is currently an associate professor in the School of Computer Engineering (Division of Computing Systems). As a concurrent appointment, he is a deputy director of the Robotics Research Centre of NTU (from 1994). His research interests include machine vision, digital systems, intelligent robotics and (recently) visual information retrieval digital systems. Dr. Sluzek published over 120 research paper (mostly in machine vision and robotics).

Plenary Lecture II Chaotic Cryptosystems

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Abstract: One-dimensional chaotic maps have been used to construct private-key block/stream cryptosystem with or without error propagation property. The constructed cryptosystem is based on the main features of one-dimensional chaotic maps, mainly the sensitive dependence on initial conditions and the unpredictability of chaos. The ciphertext is obtained by iterating the inverse map with an initial condition, which represents the plaintext. The number of iterations N are determined by the plaintext's accuracy digits p , i.e., $N=p/\log_{10}2$ iterations. At that point, all information about the initial condition is lost. A proposed private-key stream cryptosystem, based on logistic map, has been introduced. Moreover, two-dimensional chaotic map has been used for compression as well as encryption. Various techniques for the construction of the Message Authentication Code (MAC) have been presented. The methods for resolving the problem of disputes have been discussed. A new signature scheme, based on chaotic map, has been presented. This signature scheme allows any receiver to recognise the sender's signature but not to forge it. The signature cannot be verified without cooperation of the signer.

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