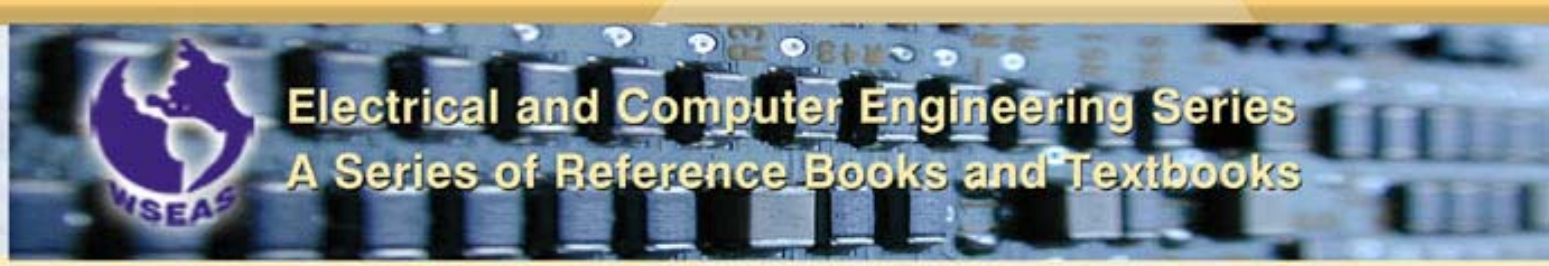

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SELECTED TOPICS on CIRCUITS, SYSTEMS, ELECTRONICS, CONTROL & SIGNAL PROCESSING

Proceedings of the 6th WSEAS International Conference on CIRCUITS, SYSTEMS, ELECTRONICS, CONTROL & SIGNAL PROCESSING (CSECS '07)

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for SCIENCE and ENGINEERING

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Preface

The book you are currently holding contains the proceedings of the 6th WSEAS International Conference on CIRCUITS, SYSTEMS, ELECTRONICS, CONTROL & SIGNAL PROCESSING (CSECS '07) which was held in Cairo, Egypt, December 29-31, 2007

The WSEAS CSECS Conference was held in Singapore (2002 and 2003), in Rethymno, Crete, Greece (2004), in Rio de Janeiro, Brazil (2005), in Dallas, USA (2006) and this year in Cairo, Egypt. The Society (WSEAS) has also organized many other separate or joint conferences on Circuits, Systems, Electronics, Control & Signal Processing and the relevant titles could be retrieved from the web site: www.worldses.org/history.htm

The biggest conference of the society is the CSCC (Circuits, Systems, Communications and Computers) that takes place each year in July and received approximately one thousand papers. Look for example:

http://www.wseas.org/conferences/2008/greece/

Browsing this volume you can enjoy new, original, fresh ideas on Circuits, Systems, Electronics, Control, Signal Processing, Communications, Computers with several theoretical results and applications, new numerical schemes, new efficient algorithms from many laboratories from important universities and research centers.

The Book is composed by seven parts. In part I, you can read very interesting topics and applications on Circuits and Electronics, while in Part II we have selected important papers on Systems Theory. In Part III, we have very strong contributions in Control Theory and Advanced Control Applications. The Part IV is dedicated to modern Signal and Image Processing. Part V and part VI are dedicated to Communications and to Computer Science correspondingly.

The 6th CSECS (Cairo, Egypt, December 2007) aims to disseminate the latest research and applications in the afore mentioned fields. 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**

We would like to address to each of you a warm invitation for the WSEAS Conferences of February 2008 (that will be held in the University of Cambridge) where our "father" Prof. **Lotfi A. Zadeh** will be for 4th time Plenary Speaker in a WSEAS Congress presenting the Plenary Lecture: *"Toward Human-Level Machine Intelligence"*. Details:

http://www.wseas.org/conferences/2008/cambridge/aiked/Plenary1.htm

The contents of this Book are also published in the CD-ROM Proceedings of the Conference. Both will be sent to the WSEAS collaborating indices after the conference: **www.worldses.org/indexes**

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 these 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, 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).

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

The Editors

Plenary Lecture I

Security and Biometrics in Modern Communications Networks

Prof. Stamatios Kartalopoulos
University of Oklahoma, USA
E-mail: kartalopoulos@ou.edu

Abstract: Recently there has been an augmented need to authenticate a person in order to grant authorized access to public buildings, homes, airports, cars, and so on. Current reliable authentication methods use biometric data, which range from a simple signature to eye iris or even to a person's DNA. Authentication is granted by matching previously obtained biometric data that are stored in a database with biometric data obtained at the authentication point. Therefore, a critical part in the authentication process is the communications network itself and the security mechanisms of the bio-database, which may be colocated or be remote. Imagine the various scenarios that can be developed if a malicious person gains access to the bio-database or to the communication network during the authentication process. Therefore, in addition to the sophistication of the biometrics methodology, information security and network security are of serious importance. This presentation highlights aspects of biometrics methods, modern intelligent networks, information security and possible vulnerabilities during the authentication process.

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 he has published more than hundred scientific papers, seven reference textbooks important in advanced fiber optic communications, and has also contributed 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 he has served as 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 II

Multi-Time Optimal Control

Professor Constantin Udriste
University Politehnica of Bucharest
Faculty of Applied Sciences
Department of Mathematics, Splaiul Independentei 313
Bucharest 060042, Romania

Abstract: This lecture joins some concepts (adjointness, Hamiltonian systems, duality, Riemannian manifolds) that appears in Mechanics, Field Theory, Differential Geometry, and Control Theory in order to create a multi-time maximum principle.Near the classical theory we introduce new types of Euler-Lagrange or Hamilton PDEs for optimal control problems with performance criteria involving curvilinear or multiple integrals and evolutions of multidimensional flow type. The main novel feature of the anti-trace multi-time Euler-Lagrange or Hamilton PDEs is that they are connected to the multi-time maximum principle. The topics include: variational calculus with gradient variations and curvilinear or multiple integral functionals, properties of multi-time Euler-Lagrange operator (changing of the Lagrangian by addition and multiplication, anti-trace multi-time Euler-Lagrange PDEs and new conservation laws), the conversion to multi-time Hamilton PDEs (canonical variables, first kind and second kind of anti-trace multi-time Hamilton PDEs), the multi-time maximum principle approach of anti-trace multi-time Euler-Lagrange or Hamilton PDEs.

Brief Biography of the speaker: Constantin Udriste was born in Turceni, Gorj, Romania on January 22, 1940. He earned his professor title from University of Timisoara in 1963 and his PhD from University Babes-Bolyai from Cluj-Napoca in 1971. Now he is Full Professor of Mathematics and Dean of the Faculty of Applied Sciences at University Politehnica of Bucharest. Also it is President of Balkan Society of Geometers.

Professor Udriste has served on many advisory committees and editorial boards, and was the main organizer of over 10 International Mathematical Meetings. He is author and contributor of over 40 books, over 200 articles to mathematical journals and over 200 papers to mathematical meetings. Topics: group of motion, properties of the tangent bundle, almost coquaternion metric manifolds, variational calculus on Riemannian manifolds, Finsler-Lagrange-Hamilton manifolds, Riemannian convexity and optimization, magnetic dynamical systems, geometric dynamics and optimal control, the theory of spatial mechanisms, solar tower concentrator. A person of incredible energy and entusiasm, Udriste has trained 12 PhD students, many of whom are now faculty members. Prof. Udriste has been the recipient of the following honors and awards: Dragomir Hurmuzescu Prize, Academy of Romania, 1985; Award for Distinguished Didactic and Scientific Activity, Ministry of Education and Instruction of Romania, 1988; Correspondent Member of the Academia Peloritana dei Pericolanti, 1997-; Member Research Board of Advisors, ABI, 1999-. Prize COPIRO - 2000 for Exact Sciences; Premio Anassilaos International 2002, Arte Cultura Scienze.

Plenary Lecture III
Recent Developments In The Fluctuation Expansion Of Univariate Functions' Matrix Representations

Professor Metin Demiralp
Informatics Institute
Istanbul Technical University
ITU Bilisim Enstitusu Ayazaga Yerleskesi
Maslak, 34469, Istanbul, Turkey

Abstract: The matrix representations of univariate or multivariate functions play important roles in many mathematical applications of sciences and in many engineering problems. They are mostly employed to truncate infinite dimensional problems for approximations. The residual terms can be, in principle, suppressed as long as there is convergence which depends on the choice of the basis set of the Hilbert space constructed for the problem under consideration. The best basis set choice, of course, is the one which diagonalizes the matrix representation. However it is the main difficulty in these problems. Hence, a new way is needed to reflect the omitted terms'

contributions to the truncated matrix representation. This has been done, at least, in one way which is called “Fluctuation Expansion”. A very important practical fact is revealed through this new concept: “A truncated matrix representation of a univariate function can be efficiently approximated, within quite high precision, by a matrix which is the image of the independent variable’s same type truncated matrix representation under the considered univariate function”. This is called Fluctuationless Approximation. The fluctuationless approximation can also be improved by adding correction terms which contain certain type universal matrices, fluctuation matrices. The construction of these terms was quite cumbersome and containing infinite series which cause new trun- cation errors. Our recent efforts have changed this undesirable structures to compact analytical ones by using Cauchy theorem of complex analysis through certain appropriate operator argumented contour integrals. The geometric series expansion of the kernels of these integrals, and, the separation to rather simple matrix inverses and the going back via Cauchy theorem again enable us to get compact formulae for the fluctuation involving correction terms. This presentation focuses on certain level details of this procedure.

Brief Biography of the speaker: Metin Demiralp was born in Turkey on 4 May 1948. His education from elementary school to university was all in Turkey. He got his BS, MS, and PhD from the same institution, Istanbul Technical University. He was originally chemical engineer, however, through theoretical chemistry, applied mathematics, and computational science years he is working on methodology for computational sciences. He has a group (Group for Science and Methods of Computing) in Informatics Institute of Istanbul Technical University (he is the founder of this institute). He collaborated with the Prof. H. A. Rabitz's group at Princeton University (NJ, USA) at summer and winter semester breaks during the period 1985--2003 after his 14 months long postdoctoral visit to same group in 1979--1980.Metin Demiralp has roughly 70 papers in well known scientific journals and is the full member of Turkish Academy of Sciences ince 1994. He is also a member of European Mathematical Society and the chief--editor of WSEAS Transactions on Mathematics currently. He has also two important awards of Turkish scientific establishments.

Plenary Lecture IV
Extended Surfaces Heat Transfer Processes – Class of Approximate and Exact Solutions

Professor Andris Buikis
Institute of Mathematics and Computer Science
University of Latvia, Raina bulv. 29, Riga, LV1459, LATVIA
E-mail: buikis@latnet.lv

Abstract: Systems with extended surfaces (with fins and/or spines) have very broad field of applications: from space apparatus, engines, conditioners, fridges etc. to cooling systems for microchips of PC. From praxis point of view the mathematical description (mathematical models) must be formulated as conjugated problem. In other words, the determination of temperature fields in solid system with extended surfaces can’t be disconnected from the calculation of the temperature and hydrodynamic fields in the flowing around of the system media (gas or fluid). It means that the boundary conditions on the surface of the system are essentially non-

homogeneous. In this talk there is presented an original (based on the Green function's method) approach for the determination of the exact solutions in the systems with extended surfaces of quite complicated geometrical and thermal structure. This approach is applicable for both - steady-state and transient processes and it reduces the problem for the partial differential equations to the system of the 2nd kind Fredholm integral equations (the number of integral equations is equal to the number of canonical elements in the systems with extended surfaces).

Brief Biography of the speaker: From **http://www.lza.lv/scientists/buikis.htm** Experience: Junior Researcher, Senior Researcher, Computing Centre, University of Latvia, 1962 - 1972 . Assistant Professor and Head of Chair of Applied Mathematics, Faculty of Physics and Mathematics, University of Latvia, 1972 - 1976 . Assistant Professor and Head of Chair of Differential Equations and Numerical Methods, Faculty of Physics and Mathematics, University of Latvia, 1976 - 1984 . Senior Researcher, Faculty of Physics and Mathematics, University of Latvia, 1984 - 1986 . Assistant Professor, Chair of Differential Equations and Numerical Methods, Faculty of Physics and Mathematics, University of Latvia, 1986 - 1988 . Senior Researcher, Head of Laboratory of Mathematical Physics, Institute of Physics, Latvian Academy of Sciences, 1988 - 1991 . Director, Institute of Mathematics, Latvian Academy of Sciences and Latvian University, 1991 - 1996; 2003 - . Head of Laboratory of Mathematical Physics and Head of Scientific Council, Institute of Mathematics, 1996 - . Director, Science and Dialogue Centre of Latvia, 1993 - . Head of Laboratory of Mathematical Physics (1996 -) and Head of Scientific Council (1996 – 2003), Institute of Mathematics, Latvian Academy of Sciences and Latvian University . Honours and Awards: Corresponding Member, Latvian Academy of Sciences, 1992 - 1997 . Full Member, Latvian Academy of Sciences, 1997 . The Latvian Academy of Sciences Piers Bohl Prize for a cycle of papers "Method of Conservative Averaging, Theory and Applications", 2005 . Member of Board, Soros Foundation - Latvia, 1997 . Head of "Spidola" Council, Culture Foundation of Latvia, 1987 - 1992 . Member of Board, Vidzemes University College, 1996 - 1998 . Professional Activties and Memberships: Member, Senate of the Latvian Academy of Sciences, 1994 - , Member, Vidzeme University College Advisory Board, 1997-2002, Vice-Chairman (in Mathematics), Latvian Council of Science Expert Committee on "Physics, Mathematics & Astronomy", 1991 - 1993 . Chairman, Promotion Council for Mathematics, 1992 - . Member, Editorial Advisory Board for Proceedings of the Latvian Academy of Sciences, 1988-1995 . Member, Editorial Advisory Board for Mathematical Modelling and Analysis, 1999- . Member, Editorial Advisory Board for Computational Methods in Applied Mathematics, 2000- . Member of Editorial Advisory Board, journal Mathematical Modelling and Analysis (The Baltic Journal on Mathematical Applications, Numerical Analysis and Differential Equations), Lithuania, 1999- . Editor, Progress in Industrial Mathematics at ECMI 2002 , Springer . Member, Editorial Board for International Journal of Applied Mathematical Sciences (IJAMS), 2004 - . Member, Gesellschaft Angewandte Matematik und Mechanik, Germany 1991 - . Member, International Sociological Association, 1998-2002 . Member, Americal Mathematical Society, 1999 . Holder of state capital share at The Latvian Institute, 1998 -2004 . Member, American Mathematical Society, 1999 -

Plenary Lecture V
A Novel Modeling Approach for the Design and Optimization of Advanced Solid State Devices Using Genetic Algorithms

Prof. Sherif Michael
Electrical and computer Engineering Dept.
Space Systems Academic Group
Naval Postgraduate School, Monterey, California, 93943 USA

Abstract. A new method for developing a realistic physical model of any type of solid state device is presented. Application to model advanced multi-junction solar cells; Thermophotovoltaics; sensors; as well as other novel solid state devices are introduced in this presentation. Taking into account the high cost of research and experimentation involved with the development of these devices, we present here this novel methodology. An example model of an InGaP/GaAs/Ge multi-junction cell is prepared and is fully simulated. The major stages of the process will be explained and the simulation results are compared to published experimental data. An example of cell parameters optimization is also presented. The use of Genetic Algorithm to optimize this model parameter is demonstrated in a two-part process to refine a given multi-junction solar cell design at near-optimal output power for a desired light spectrum. The flexibility of the proposed methodology is demonstrated and example results are shown throughout the whole process.

Brief Biography of the speaker: PhD - West Virginia Univ, 1983, MS - West Virginia Univ, 1980, BS - Cairo Univ (Cairo), 1974. NPS EXPERIENCE: 2005-Present: Professor, Department of Electrical and Computer Engineering, 1983-2005: Associate Professor, Department of Electrical and Computer Engineering, 1985-Present: Associate Professor, Space System Academic Group TEACHING INTERESTS: Analog and Mixed Mode VLSI , Advanced microelectronics and ASIC digital design, Space Power and Radiation Effect courses (more than 95 courses taught) . RESEARCH INTERESTS: Radiation effects on Hardened, Mil. Spec. devices and design of radiation tolerant ASIC, Gallium Arsenide (GaAs) and BiCMOS VLSI Design Analog circuits design: high speed, high accuracy op amps and applications in A/D converters and digitally controlled programmable active filters, Signal processing: Mixed Mode VLSI design and switched capacitor filters, Radiation and Space effects on Photovoltaic devices, Multi-junction, Gallium Arsenide (GaAs) and Indium Phosphide (InP) solar cells, and Spacecraft power system design, Minority Carrier and Laser Annealing of GaAs and InP Solar Cells Digital circuit design and microprocessor applications BOARDS/MEMBERSHIPS: Registered as a Professional Engineer, Senior member of IEEE, Member of the following IEEE societies: Circuits & Systems Society, Nuclear & Plasma Sciences Society, Solid-State Circuits Society, Member of the Board of Governors of the CAS Society

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