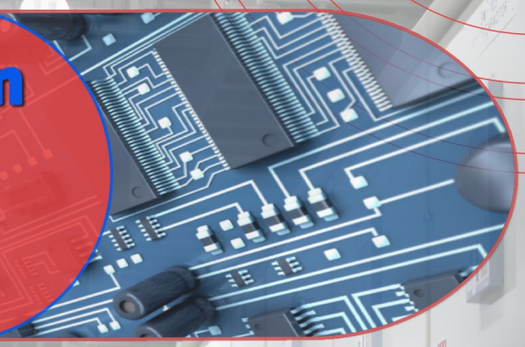
Editors: Vincenzo Niola, Michel Kadoch, Alexander Zemliak

Recent Researches in Automatic Control and Electronics



- Proceedings of the 14th International Conference on Automatic Control, Modelling & Simulation (ACMOS '12)
- Proceedings of the 11th International Conference on Microelectronics, Nanoelectronics, Optoelectronics (MINO '12)

Saint Malo & Mont Saint-Michel, France, April 2-4, 2012

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Preface

This year the 14th International Conference on Automatic Control, Modelling & Simulation (ACMOS '12) and the 11th International Conference on Microelectronics, Nanoelectronics, Optoelectronics (MINO '12) were held in Saint Malo & Mont Saint-Michel, France, April 2-4, 2012. The conferences provided a platform to discuss large scale systems, digital control, cybernetics, human-machine systems, fault tolerance, microprocessors, microelectronics, nanoelectronics, quantum electronics, biomolecular electronics, optoelectronics etc. with participants from all over the world, both from academia and from industry.

Their 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 these conferences are published in this Book that will be sent to international indexes. They will be also available in the E-Library of the WSEAS. Extended versions of the best papers will be promoted to many Journals for further evaluation.

Conferences such as these 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

On the Application of New Fuzzy Technologies in the Methods of Expert Knowledge Engineering and Decision Making for the Modelling and Prediction of Weakly Structurable Processes

Professor Gia Sirbiladze
Department of Computer Science
Faculty of Exact & Natural Sciences
Iv. Javakhishvili Tbilisi State University, Georgia.
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Abstract: In this speech we will perform the analysis of Dempster-Shafer temporalized structure and finite possibilistic Extremal Fuzzy Dynamic System (EFDS) for the construction of more precise decisions based on the expert (or decision making person - DMP) knowledge stream. The process of decision precision consists of two steps. On the first step the relation of information precision is defined on a monotone sequence of bodies of evidence; Negative inaccuracy is defined as the stream of rational expert knowledge in Dempster-Shafer temporalized structure; The principle of negative inaccuracy is developed, as the maximum principle of knowledge ignorance measure of a body of evidence. Corresponding mathematical programming problem is constructed. On the output of the 1-st step we receive the expert knowledge precision stream of the criteria with respect to any decision. On the 2-nd step the constructed stream is an input trajectory for the finite possibilistic model of EFDS. The fuzzy recurrent process with possibilistic uncertainty, the source of which is expert knowledge reflections on the states of evolutionary complex system, is constructed. The dynamics of possibilistic EFDS is described and the constructed model is converted to the finite model. The modeling process gives us the more precise decisions as a prediction of a temporalization procedure, where possible alternatives - decisions are ranked by their possibility levels. The prediction is regularized in the fuzzy time moments. A genetic algorithm approach is developed for identifying of the transition operation of the EFDS finite model.
For the illustration of the constructed approach two examples will be considered: 1. The constructed technology is applied in the Utility Theory (non-probabilistic, dissonant body of evidence). An example on the optimal choice of the master's degree students project's versions is presented. 2. Dempster-Shafer temporalized structure and finite possibilistic EFDS are used for the construction of more precise decisions in the well known A. Kaufmann's theory of expertons based on the experts' intellectual activities and their knowledge presentations. As an example we use the temporalized theory of expertons in the problem of risk valuations (dissonant body of evidence).

Brief Biography of the Speaker: Dr. Gia Sirbiladze is a full professor at the Department of Computer Science of Faculty of Exact & Natural Sciences of Iv. Javakhishvili Tbilisi State University, Georgia. He received his Ph.D. degree in 1991 from the Computational Mathematics Institute of the Georgian Academy of Sciences. He received his D. Sci. degree from the same institute in 2005. His scientific interests include areas such as Intelligent Fuzzy Technologies and General Systems, Fuzzy Technologies in Decision-making Support Systems, Intelligent Simulation Modeling, Fuzzy Extremal Dynamic Systems - Control, Filtration and Identification, Fuzzy Discrete Optimization Problems and Modeling Decisions. Dr. Gia Sirbiladze has published over 65 scientific papers on the above-listed topics and participated in many scientific conferences. He has participated in many WSEAS conferences, including as a Plenary Speaker. He is an author of one monograph on Decision Making Problems in General Environment. Dr.Gia Sirbiladze is a member of the National Union of Mathematicians in Georgia. He serves as a reviewer for Mathematical Reviews. He has reviewed papers for more then 15 international and local journals and conferences. He serves as Information Technology expert for Georgian National Scientific Fund. Dr.Gia Sirbiladze has participated in several national and international research projects.

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Plenary Lecture 2

Modeling and simulation complex dynamical systems in Rand Model Designer

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Abstract: Rand Model Designer (for short RMD - www.rand-service.com) is a commercial MvStudium's version (www.mvstudium.com). RMD is a mathematical model based graphical environment for object-oriented modeling and designing of complex real world or technical systems. It is adjusted to special mathematical models called hybrid systems.
Hybrid systems are the best for modeling multiple-mode or event driven systems. Multiple-mode systems have mixed continuous and discreet behavior. Just these base components contain hybrid system. That are local continuous behaviors (modes) and discrete actions (an algorithmic form of momentary actions needed to start a new current continuous mode). Visual form of hybrid system is called hybrid automation. RMD's hybrid automation is extended UML state-machine or state chart. A continuous component is described by algebraic-differential equations written in usual (symbolic) mathematical form. Discreet component algorithms are written in modeling language named Model Vision Language (MVL).
MVL supports component modeling with oriented and not-oriented components. A RMD component is an open hybrid system. Open hybrid system has a set of special different kind variables (oriented: inputs, outputs, non-oriented: contacts, flows) that may be used in coupling equations. A layout chart is a set of components and couples between them. A final system of equations to be solved for simulation or a total model contains component equations and coupling equations. Availability of hybrid systems leads to dependence of current layout chart and its current system of equations on events. RMD forms, analyses and reduces a current system on run-time. "To form, analyze and reduce" means to build automatically equations set using the current layout chart, analyze its structure, decrease its dimension, reduce them in compliance with chosen numerical or symbolic method.
RMD builds two sorts of executable models:
- A visual model that is Windows stand along application with multiple instrument set for testing, visual debugging, carrying out computational experiments, and processing results;
- An embedded model that is Windows dynamical linked library (dll), which may be used as an embedded interactive application.
RMD has its own distinguishing characteristics:
1. It is oriented on well-defined mathematical models, which may be called event-driven set of algebraic-differential equations. A dimension, type, and numerical properties of such systems depend on current model mode.
2. Algebraic-differential equations may be written not in well-behaved for tool but human-transparent form.
3. It has universal modeling language for causal and non-causal modeling technologies of multi-component systems.
RMD is used for scientific research and teamwork computer-aided design of large-scale systems. In both cases object-oriented modeling renders assistance. Workable or present library classes commonly corresponded to subsystems of real world object are used as building material for a complex model. Instances encapsulate information, may have parameters for customization, inherit properties of parents, and demonstrate polymorphous.
RMD numerical software with different variants of numerical methods allows taking in account specific entities of a model what usually leads to acceleration of accuracy and calculating speed. RMD has a special visual language for planning computational experiments, set of instruments for analyzing model numerical properties and comparison experimental results.
It is important for teamwork computer-aided design of large-scale systems to have easy-to-use instruments for debugging, testing, and multiple checkouts taking in account introduced improvement. RMD is permanently supplemented by visual tools for these purposes. Special attention is attended for designing a tools controlled model building and simulation.
RMD has user-friendly interface depended on project complexity. It makes possible to use it by schoolboys, scientists, and development staffs for learning, teaching, research and designing.

Brief Biography of the Speaker: Yuri Borisovitch Senichenkov is a Professor of Distributed Computing and

Networking Department at Technical Cybernetics Faculty of Saint Petersburg Polytechnic University (http://dcn.ftk.spbstu.ru).
He received his degree “Candidate of Science” in the field of Numerical Mathematics from St. Petersburg University in 1984, Docent Diploma from St. Petersburg Polytechnic University (1992), degree “Doctor of Science” in the field of Numerical software from St. Petersburg Polytechnic University (2004).
Yu. B. Senichenkov is
- co-author of Model Vision Studium (www.MvStudium.com) and Rand Model Designer (www.rand-service.com), that are tools for modeling and simulation of complex dynamical systems
- a member of editorial boards of Computer Instruments in Education Journal (www.ipo.spb.ru) and Simulation News Europe Journal (www.sne-journal.org/)
- co-author of books (in Russian) “Visual Modeling” , “Practical modeling of complex dynamical systems”, “Numerical modeling”, “Modeling of systems. Dynamical and hybrid systems”, “Modeling of systems. Object-Oriented approach.” (www.bhv.ru)
- chairman of Annual Computer Modeling Conference (http://dcn.ftk.spbstu.ru)
- a CoLoS member (www.colos.org)
His fields of scientific interest are: Mathematical and Computer Modeling, Numerical software and Numerical Analysis, Computer modeling in Education.

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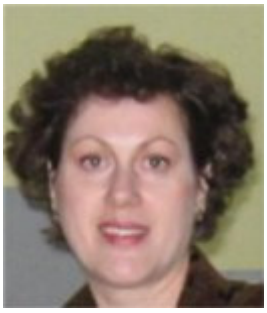
Plenary Lecture 3

Modelling the Deterioration of the Polluting Emission Factor for the Internal Combustion Engines



Associate Professor Krisztina Uzuneanu
Thermal Systems and Environmental Engineering Department
"Dunarea de Jos" University of Galati
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Abstract: The emission coefficient is defined as a factor which, when multiplied by the quantity of polluting products discharged by the new engine, allows the estimation with a satisfactory degree of precision of the pollutant quantity (CO, HC, NOx) sent off by the engine after a certain number of years and a certain mileage covered. The emission deterioration factor was determined by disposing of a rich database on the polluting emissions of certain cars grouped according to their cylinder capacity and the treatment degree of the combustion gas, in accordance with the European norms (Euro I….Euro VI).

Brief Biography of the Speaker: Dr. Krisztina Uzuneanu graduated Faculty of Mechanical Engineering of University "Dunarea de Jos" of Galati in 1984 and she obtained the title of Doctor Engineer in 1998.
Since 1987 she followed the academic carrier at Dunarea de Jos University of Galati as assistant, lecturer and associate professor. Dr. Uzuneanu is a visiting professor at different universities: Universidade do Minho, Portugal, Universita degli Studi di Genova, Italy, Universita degli Studi di Salerno, Italy, Pannon University Veszprem, Hungary, Erciyes University Kayseri, Turkey and visitor scientist of of Universidade do Minho Guimaraes, Portugal where she was awarded with a post-doc NATO grant in 2002 - 2003.
Research fields are connected with applied thermodynamics, alternative fuels for internal combustion engines, modeling the thermal stresses of different parts of internal combustion engines, renewable energy and pollution.
Dr. Uzuneanu published over 100 articles in national and internationals conferences proceedings and she is author of 3 books.
The research work was done as member of 20 research contracts financed by European Commission and Romanian Ministry of Education and Research and director of 5 research contracts financed by industry.
Dr K. Uzuneanu is member of Romanian Society of Thermodynamics since 1990 and member of Balkan Environmental Association since 2011.

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Plenary Lecture 4

Problem of Analog Circuit Optimization as Controllable Dynamic System

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National Technical University of Ukraine,
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Abstract: One of the principal problems for designing of large electronic circuit is the problem of significant reducing of processor time for parametric circuit optimization. The solution of this problem can be obtained by means of a generalized approach to the process of optimization of electronic circuits. The generalized methodology of circuit optimization can be constructed on the basis of theory of control. In this case a special vector of control serves as a principal tool to redistributing the computer expenses between circuit analysis and the procedure of parametric optimization. The optimization of analog circuit is formulated in this case as a controllable dynamic system. The optimal structure of the vector of control gives the minimal-time algorithm of circuit optimization. The optimal sequence of switching points of the vector of control solves the problem of minimal-time algorithm construction. The conception of the Lyapunov function of the process of optimization serves as one of the productive ideas to study the main properties of the time-optimal algorithm. Stability analysis of each strategy of designing based on Lyapunov's direct method revealed a strong correlation between the time of designing and the main indicators of the design process, namely the Lyapunov function and its time derivative. This function gives us the possibility to separate the perspective strategies for the optimization of circuits. Analysis of behavior of the Lyapunov function during the optimization process shows a strong correlation between some characteristics of this function and a processor time. The strategies that have the greatest absolute value of the time derivative of Lyapunov function on the initial phase of the trajectory of optimization exhibit the greatest stability and have the least CPU time. This property is the basis for the constructing a minimal-time algorithm of designing. This algorithm provides gain of processor time in hundreds and thousands times as compared to the traditional approach.

Brief Biography of the Speaker: Alexander Zemliak received the M.S. degree in electronic engineering from the Kiev Polytechnic Institute (KPI), Kiev, Ukraine, in 1972 and in mathematics from the Kiev University in 1975, and Ph.D. in electronic engineering from KPI in 1976. He is currently a Professor of Physics and Mathematics Department, Autonomous University of Puebla, and a Professor of the National Technical University of Ukraine “KPI” too. His research interests are in computer-aided RF and microwave circuit analysis, optimal design methodologies, computational electromagnetics and numerical techniques in the simulation, analysis and optimization of microwave devices. He has authored of two books, 7 chapters of books and over 250 papers in refereed journals and conference proceedings. From 1986 to 1994 he held some research grants from Ministry of Superior Education of Ukraine and industry. From 1998 to 2010 he held some grants from Mexican National Council of Science and Technology. He is a member of Ukrainian Scientific Society, National System of Investigators of Mexico, Senior Member of IEEE, member of IEICE, WSEAS and New York Academy of Sciences. He was a chairman of some international conferences in Mexico, member of technical program committee of some conferences around the world and invited lecturer of more than 10 international conferences. He obtained best paper award at National SOMI Conference, 1999 (Mexico), International conference IBERCHIP, 2002 (Mexico), International WSEAS Conference, 2009 (Turkey), International Conference IEEE EWDTS, 2010 (Russia). He was a Reviewer of International Design Automation Conference-DAC, 2001–2003, USA; International Conference on Computing, Communication and Control Technologies-CCCT, 2004–2008, USA; World Multi-Conference on Systemics, Cybernetics and Informatics, 2003–2011, USA.

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Plenary Lecture 5

Analytical Synthesis Method in Analog Circuit Design

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Abstract: Analytical Synthesis Method (ASM) has been presented in several papers published in the IEEE Transactions on Circuits and Systems since 2003. It is one of the powerful design methods in the field of analog circuit design. It is the method using a succession of innovative algebra manipulation operations to decompose a complicated transfer function representing the relationship between the output and the input signals of a design project into many simple equations feasible by using the corresponding simple sub-circuitries. The simple sub-circuitries can be constructed by the desired configuration of the element such as the single-ended-input operational transconductance amplifiers (OTAs) and the grounded capacitors, both of which are used for absorbing and reducing the shunt parasitic capacitance and lead to have more precise output responses. In addition to this, the ASM can control the number of the terms in the complicated decomposition process such that the number of both active and passive components used in the circuit is the least compared to the previously reported ones. Then, the ASM is the only one method which can simultaneously achieve the three important criteria for the design of OTA-C circuits without trade-off. Due to the flexibility of the ASM, the simple sub-circuitries used in the circuit design can be changed and chosen according to different necessities for the target of the circuit design. For example, if the reduction of the number of the active and passive components used in the circuit is more important than the type of the element configurations like single-ended-input/differential-input OTAs and grounded/floating capacitors due to the consideration about power consumption, chip area, noise, and total parasitics..., etc., the minimum component OTA-C circuit can also be investigated and developed successfully using the ASMs. The fully flexible characteristic and the real demonstration in the literature of the ASM may make it be one of the most prospective methods in the field of analog circuit design in the near future.

Brief Biography of the Speaker: Chun-Ming Chang received the B.S.E.E. and M.S.E.E. degrees from National Cheng Kung University, Tainan, Taiwan, R. O. C. in 1975 and 1977, respectively, and the Ph.D. degree from the University of Southampton, Southampton, U.K., in 2004.
In 1979, he joined the Department of Electrical Engineering, Taipei Institute of Technology, Taipei, Taiwan, R. O. C., as a Lecturer. After one year, he transferred to the Department of Electronic Engineering, Fu Jen Catholic University, Taipei Hsien, Taiwan, R.O.C. In 1982, he joined the Department of Electrical Engineering, Chung Yuan Christian University, Chung-Li, Taiwan, R.O.C., where he became an Associate Professor and a Full Professor in 1985 and 1991, respectively. He is currently a Professor of Electrical Engineering and leader of the Electronic Circuits Group in the Department of Electrical Engineering, Chung Yuan Christian University. He is also a departmental teacher promotion committee member and a college teacher promotion committee member. He was the chairman of the Department of Electrical Engineering of Chung Yuan Christian University from 1995 to 1999. His research interests are divided into two parts: network synthesis and analog circuit design before and after 1991, respectively. The improvement for the approach technique to factorize a paramount matrix used in network synthesis and proposed by Professor I. Cederbaum let him be promoted to a Full Professor in 1991. He has published over 70 SCI papers, in which the most famous is the invention of a new analytical synthesis method for the design of analog circuits which can, for the first time, simultaneously achieve three important criteria for the design of OTA-C filters without trade-offs. Using a succession of innovative algebra manipulation operations, a complicated nth-order transfer function can be decomposed into a set of simple equations feasible using the single-ended-input OTAs and grounded capacitors. Several IEEE Transaction papers on Circuits and Systems with analytical synthesis method have been published in the literature since 2003. Recently, he was invited as the Plenary Speaker of the (i) 7th WSEAS International Conference on Instrumentation, Measurement, Circuits and Systems (IMCAS '08), Hangzhou China, April 6-8, 2008; (ii) 8th WSEAS International Conference on Electronics, Hardware, Wireless and Optical Communications

(EHAC'09), University of Cambridge, UK, February 21-23, 2009; and (iii) 11th WSEAS International Conference on Mathematical and Computational Methods in Science and Engineering (MACMESE'09), Baltimore USA, November 7-9, 2009. He was invited as a Visiting Professor by Peking University and National Taiwan University in the summer of 2008 and 2009, respectively. He is in the process of writing his professional textbook: "Analog Circuit Design---Analytical Synthesis Method".
Prof. Chang is a senior member of the IEEE Circuits and Systems Society.

Plenary Lecture 6

Integration of High-Power Light Emitting Diodes (LED's) and High-Resolution Colour Camera into Endoscopes for Medical Applications

Professor Noel Y. A. Shammas
Faculty of Computing, Engineering and Advanced Technology
Staffordshire University
UK
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Abstract: The increasing number of minimally invasive procedures is likely to increase the demand for long lasting, easy to use, efficient and reliable endoscopes. In addition to this there is an urgent need for a portable, lightweight endoscope using LED technology to be used in the field in disaster and war zones, and for training medical students. A compact and low-cost endoscope would be highly sought after by surgeons all over the world. It is the desired outcome of this work to develop a low-cost, portable system to fulfil these needs. Not only will a low-cost instrument find usage in the medical field it can also be applied to many others including engineering, the built environment, aerospace and many others when access for visual inspection is difficult. The portability of the device and its lack of reliance on a connection to a mains power source means that it can be applied virtually anywhere in the field thus making minimally-invasive surgery possible in otherwise impossible regions. This should lead to speedier procedures which are not only good for the patient but also have better economic viability.
Because it is proposed to use LED's in the design to replace bulky, inefficient and expensive light sources which have colour-mixing features, the endoscope will also have enhanced capability as a light source. Added to this, endoscope will also incorporate a miniature camera, it then becomes possible to transmit images over a wireless network (local or global) for assisted remote diagnosis.

Brief Biography of the Speaker: Noel Shammas is currently a Professor of Microelectronics and Solid-State Semiconductor Devices in the faculty of Computing, Engineering and Advanced Technology, Staffordshire University. He received the MSc and PhD degrees from Salford University in 1972 and 1975 respectively. Since then he lectured and researched at different universities and industry (GEC). Research work is primarily focused on Semiconductor Devices which includes mainly Power diodes, Light Emitting Diodes (LED's), Insulated Gate Bipolar Transistors, Thyristors, and Energy Harvesting Devices. Other related areas of research work includes Power Module Packaging technologies (Both Conventional Press-pack and Smart pack designs) and Series/Parallel operation of high power semiconductor devices and their interaction with external circuits.
Professor Shammas has extensive experience in both experimental and theoretical research work and is recognised internationally for his significant contribution to research in the field of Semiconductor Devices. He has published over 120 journal and conference research papers as well as several invited Keynote and Plenary Lectures, and has held several research grants from funding councils, Advantage West Midland (AWM), as well as from industry. He is a regular reviewer for many journals (including IET Proceeding Electronic devices and systems, IEEE Transactions on power electronics, and Microelectronic Reliability) and international conferences (including the European Power Electronic conference - EPE, Microelectronic conference - MIEL, Universities Power Engineering Conference-UPEC, International Symposium Power Semiconductors-ISPS, etc…). He is a member of scientific committee for many international conferences (including MIEL, EPE, WCE, WSEAS, and Microtherm) and a steering committee member for EPE, UPEC, and ISPS international conferences. He is also a book reviewer for Prentice Hall International and McGraw Hill.

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