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## Recent Advances in Telecommunications & Circuits

- ▶ Proceedings of the 11<sup>th</sup> International Conference on Applied Electromagnetics, Wireless and Optical Communications (ELECTROSCIENCE '13)
- ▶ Proceedings of the 2<sup>nd</sup> International Conference on Circuits, Systems, Communications, Computers and Applications (CSCCA '13)
- ▶ Proceedings of the 1<sup>st</sup> International Conference on Solid State Circuits (SSC '13)
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## Plenary Lecture 1

### Authentication of Images via Noisy Channels



**Professor Nataša Živić**  
University of Siegen  
Institute for Data Communications Systems  
Germany  
E-mail: [natasa.zivic@uni-siegen.de](mailto:natasa.zivic@uni-siegen.de)

**Abstract:** Authentication of the origin of images cannot be supported when noisy channels are used for transmission, because Message Authentication Codes are very sensitive to any modification during transmission. The modification of one single bit only is sufficient to make that the verification fails. It would be acceptable for many applications, if a modification of only a few bits would be acceptable for a successful verification.

The subject of this talk is how to provide data integrity and authentication of origin of images protected with Message Authentication Codes, if they are transmitted via noisy channels. The approach for the solution is based on the usage of Soft Values of the channel (SISO-, Soft Input – Soft Output-) decoder and Soft Input Soft Verification techniques, which have been recently developed and successfully applied for data transmission. A new method of verification of Message Authentication Codes will be used here, resulting in the same Message Authentication Codes for images, which are only a little bit different before or after source coding.

**Brief Biography of the Speaker:** Dr.-Ing. Natasa Zivic was born in Belgrad, Serbia. She graduated from the Faculty of Electrical Engineering at the Department of Electronics, Telecommunications and Automatics, University of Belgrade in 1999 and defended her Master Thesis in 2002. She started her PhD Thesis at the Institute for Data Communication Systems, University of Siegen, Germany in 2004 and defended it in 2007. Since 2007 she is employed as a Professor Assistant at the University of Siegen where she works on her Postdoctoral thesis and gives lectures in Communication Technologies and Basics of Telecommunications. Her main research area is combination of channel coding and cryptography. She takes part at many international conferences and journals, as well as a paper reviewer. She is an author of about 90 conference and journal papers and 3 patents.

## Plenary Lecture 2

### Minimal-Time Algorithm for Analog Circuit Designing



**Professor Alexander Zemliak**  
Dept. of Physics and Mathematics  
Autonomous University of Puebla  
MEXICO  
&  
Institute of Technical Physics  
National Technical University of Ukraine  
UKRAINE  
E-mail: [azemliak@yahoo.com](mailto:azemliak@yahoo.com)

**Abstract:** The problem of reduction of time of designing of the complex analog systems can be defined as one of key tasks of modern electronics. This problem can be solved on the basis of a generalized approach to optimization of electronic circuits. The generalization of circuit optimization can be formulated as a problem of minimization of a functional in theory of control. A special vector of control serves in this case as a principal tool to redistributing the computer time between the circuit analysis and the procedure of parametric optimization. The process of circuit designing is formulated in this case as a controllable dynamic system. We need to construct the optimal structure of the vector of control for realization the minimal-time algorithm of designing. Obtaining the optimal sequence of switching points of the vector control in the process of designing can be based on the intrinsic properties of each optimization strategy. The Lyapunov function of the process of optimization serves as a principal function that separates the perspective strategies for the circuit designing. The process of designing of electronic circuit is formulated as a dynamic controllable system and this process corresponds to the transition process to bring the system in steady state. In this case, the main objective of the optimum designing is defined as the problem of minimization of the transient process for bringing the system in steady state. Stability analysis of each strategy of designing is based on direct method of Lyapunov and revealed a strong correlation between the time of designing and the main indicators of the process of designing, namely the Lyapunov function and its derivative. The strategies that have the greatest absolute value of the time derivative of Lyapunov function exhibit the greatest stability and have the least CPU time. This property is the basis for the constructing a minimal-time algorithm of designing. The total processor time gain for the optimal algorithm is equal to thousands in comparison with 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 2012 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, 2011 (Ukraine). 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, 2003–2012, USA.

## Plenary Lecture 3

### Adaptive Filter Combinations



#### Professor Tõnu Trump

Department of Radio and Telecommunication Engineering  
Tallinn University of Technology  
Estonia  
E-mail: tonu.trump@gmail.com

**Abstract:** In this talk we consider the combination of adaptive filters that are simultaneously applied to the same inputs. When designing an adaptive algorithm, one faces a trade-off between the initial convergence speed and the mean-square error in steady state. In case of algorithms belonging to the Least Mean Square (LMS) family this trade-off is controlled by the step-size parameter. Large step size leads to a fast initial convergence but the algorithm also exhibits a large mean-square error in the steady state and in contrary, small step size slows down the convergence but results in a small steady state error.

Recently there has been an interest in a combination scheme that is able to optimize the trade-off between convergence speed and steady state error. The scheme consists of two adaptive filters that are simultaneously applied to the same inputs. One of the filters has a large step size allowing fast convergence and the other one has a small step size for a small steady state error. The outputs of the filters are combined through a mixing parameter.

There are several ways to compute the combination parameter. In our treatment the combination parameter  $\lambda$  is computed from output signals of the individual filters. The scheme is optimal in the sense that it results from minimizing the mean square error of the combination.

The combination of two filters can be applied in different situations. The applications like line enhancement, system identification and beamforming will be examined in detail.

**Brief Biography of the Speaker:** Tõnu Trump received his Ph.D. degree from Tallinn University of Technology in 1993. He was from 1994 to 2006 with Ericsson AB in Stockholm Sweden, where he reached the position of expert in echo cancellation and voice enhancement devices. From 2002 to 2006 he was also the rapporteur of Question 17, Study Group 16 at International Telecommunication Union (ITU-T) in Geneva Switzerland. Since 2006 he has been the professor of Signal Processing at Tallinn University of Technology in Tallinn, Estonia.

Prof. Trump has published a number of scientific papers and is the author of more than 10 patents.

## Plenary Lecture 4

### **Recent Advances in Technologies, Protocols, Implementation and Simulation Tools of Sensor Networks towards Designing Scalable and Energy Efficient Architectures and Algorithms for Addressing Coverage, Localization and Information Fusion in Real World Applications Based on Low Cost Distributed Hardware Implementations and Open Source Simulators: A Layered Approach**



**Professor Dimitrios A. Karras**  
Dept. Automation, Hellas  
Chalkis Institute of Technology  
Greece  
E-mail: dakarras@ieee.org

**Abstract:** Wireless sensor networks (WSN) have been identified as one of the most important technologies for the 21st century. The idea of creating an automated network of intelligent agents that can interact with their environment and report unusual conditions has stimulated the efforts of many research groups. With the recent advances in wireless communication, and the proliferation of portable computer and micro-sensor devices, we are witnessing a growing interest in using wireless multimedia sensor networks and collaborative virtual environment technologies for safety and security class of applications.

However, it is widely known that sensor networks are difficult to program and even harder to debug, due to the distributed and layered nature of the network and the limited output resources and means of interaction of the devices themselves. An in depth analysis therefore, is needed in order to specify the basic components and their interaction of wireless sensor network layered architectures and corresponding simulation tools architectures. A major, also, issue is the definition of the open problems with respect to WSN research concerning their design as well as their simulation. We will focus upon the design of large-scale distributed simulation systems for applications that require critical condition monitoring using both location/context aware computing and wireless sensor technologies.

This plenary lecture will focus on overviewing the state of the art and presenting new designing methods of WSN to efficiently address the coverage, localization and information fusion issues based on low cost distributed hardware implementations and open source simulators. How well a given area can be monitored by wireless sensor networks is a critical issue whose solution is required for successful deployment of many important applications on such networks. Some new results on coverage mechanisms, and their effectiveness in identifying fully covered sensors, discovering blind holes and reaching reasonable coverage quality will be discussed.. In addition, the layered architectures of such WSN as well as the relevant simulation tools will be compared and analyzed.

Therefore, in this research we explore the nature of a Wireless Sensor Network, and the consequent tasks and restrictions concerning its design, simulation and implementation techniques. We present a framework as a base to evaluate the cutting edge (design and) simulation tools especially regarding the coverage, localization and information fusion issues mentioned previously. Finally, we examine other research fields that impact on design and implementation procedures of Wireless Sensor Networks regarding effective solutions of these issues.

The major goal of this plenary talk will be not only to overview but also, to explore open problems in sensor networks design related to localization, coverage and energy consumption, evaluating several proposed algorithms using model based simulators and emulators, as well as to propose the design of a suitable simulator for evaluating such algorithms extending the capabilities of already existing state of the art open source model based simulators.

More specifically, with regards to implementation concepts, based on this thorough investigation and design, we herein focus on the main sensor network design procedure, simulation. Our goal is to build a simulator able to simulate variable MCUs and mote setups, and actual code, MCU specific assembly language. We use an open standard, XML document, to describe MCU and mote features. The core of the simulator is the MCU emulator, able to emulate different MCUs and mote setups during simulation, providing an accurate energy consumption metric. Emulating the entire code running on MCU, is by default a cross layer simulation of the application, and the protocol stack. Works done so far, have proved the importance of emulation and time accuracy.

The MCU emulation engine is based on the fact that every instruction in the MCU's instruction set, actually modifies the contents of a type of memory (registers, special function registers, flags, ports etc) according to a set of Boolean or numeric functions. These functions are described as data in the XML file, and the emulation engine parses these

functions and stores changes (results) in virtual MCU memory accordingly. As a result we have the ability to use the same code to emulate any MCU instruction set, during the same simulation procedure, as long as its functionality is described with Boolean or numeric functions in XML format. Works using XML format describe MCU or processor details such as mnemonics, opcodes but not functionality. In concluding this talk, after elaboration of the above issues and overview, we will be able to support the feasibility of the whole WSN design.

**Brief Biography of the Speaker:** Dimitrios A. Karras received his Diploma and M.Sc. Degree in Electrical and Electronic Engineering from the National Technical University of Athens, Greece in 1985 and the Ph. Degree in Electrical Engineering, from the National Technical University of Athens, Greece in 1995, with honours. From 1990 and up to 2004 he has collaborated as visiting professor and researcher with several universities and research institutes in Greece. Since 2004, after his election, he has been with the Chalkis Institute of Technology, Automation Dept., Greece as associate professor in Digital Systems and Signal Processing as well as with the Hellenic Open University, Dept. Informatics as a visiting professor in Communication Systems (since 2002 and up to 2010). He has published more than 55 research refereed journal papers in various areas of pattern recognition, image/signal processing and neural networks as well as in bioinformatics and telecommunications and more than 155 research papers in International refereed scientific Conferences. His research interests span the fields of pattern recognition and neural networks, image and signal processing, image and signal systems, biomedical systems, communications, networking and security. He has served as program committee member in many international conferences, as well as program chair and general chair in several international workshops and conferences in the fields of signal, image and automation systems. He is, also, editor in chief of the International Journal in Signal and Imaging Systems Engineering (IJSISE), topics editor in chief of the International Journal of Digital Content Technology and its Applications (JDCTA) as well as associate editor in various scientific journals. He has been cited in more than 500 research papers, his h-index is 10 and his Erdos number is 5.

## Plenary Lecture 5

### The Electrical Circuits Theory and Groups of Algebraic Topology



**Professor Milnikov Alexander**

Faculty of Computer Technologies and Engineering  
International Black Sea University

&

Department of Informatics and Control Systems  
Technical University of Georgia

Georgia

E-mail: [alexander.milnikov@gmail.com](mailto:alexander.milnikov@gmail.com)

**Abstract:** The work is devoted to substantiation of the tensor point of view on the electric circuit that was first introduced in the classical works of G. Kron. It is proved that: geometrical structure of a circuit naturally generates groups of homologies and cohomologies. The conception of homologically and cohomologically independence was introduced. It is proved that the ranks of one-dimensional homologic group and the rank of the one-dimensional group of coboundaries are equal to the number of homologically independent loops and to the number of cohomologically independent nodes pairs, respectively. To the groups two pairs of vector spaces are assigned isomorphically. Also it is proved that the invariance of the input and output powers turns out to be a natural consequence of the topological nature of the circuit, which enables one to construct a tensor model of electric circuits: currents and voltages of the pure-loop and pure-node circuits can be regarded as the contravariant and covariant vectors of the conjugate spaces, and the passage from the primitive circuit to the pure-loop (pure-node) one is done by transforming the bases of the homological and cohomological spaces; the matrices of inductances, capacities, and conductances are of tensor nature, i.e., are the coordinate representations of the covariant and countervariant circuit invariants, and the kinetic and potential energies of the circuit are represented as the corresponding bilinear functionals.

**Brief Biography of the Speaker:** Prof. A. Milnikov holds a Bs/Ms in Electronic Engineering, a PhD in Electric Engineering (1978) and a Doctor of Sciences in Applied Mathematics (2002) from the Technical University of Georgia.

He works as a full professor of: International Black Sea University (Tbilisi, Georgia) (1994-present), Technical University of Georgia (1999-present), Georgian Academy of Sciences, Institute of Applied Mechanics (1980-present), Academician (1980-1988), Leading Academician (1989-2005), Principal Academician (2005-present). Also he worked as a Dean of the Computer Technologies and Engineering Faculty at the International Black Sea University (1994-2008). His research interests include: the Electrical Circuits Theory, Modern Geometry (Differential Geometry and Tensorial Analysis), Statistics, Random Processes, Signals Theory and Digital Processing, Filters Design. He has more than 80 publications, among them 10 in impact journals, 15 proceedings in WSEAS and Other International Conferences.



## Plenary Lecture 6

### Cerebellar Model Neural Networks and their Applications on Control, Signal Processing, and Image Classification



**Professor Chih-Min Lin**

Electrical and Communication Engineering College  
Yuan Ze University  
Taiwan

E-mail: [cml@saturn.yzu.edu.tw](mailto:cml@saturn.yzu.edu.tw)

**Abstract:** Based on biological prototype of human brain and improved understanding of the functionality of the neurons and the pattern of their interconnections in the brain, a theoretical model used to explain the information-processing characteristics of the cerebellum was developed independently by Marr (1969) and Albus (1971). Cerebellar model neural network (CMNN) or called as cerebellar model articulation controller (CMAC) was first proposed by Albus in 1974. CMNN is a learning structure that imitates the organization and functionality of the cerebellum of the human brain. That model revealed the structure and functionality of the various cells and fibers in the cerebellum. The core of CMNN is an associative memory which has the ability to approach complex nonlinear functions. CMNN takes advantage of the input-redundancy by using distributed storage and can learn nonlinear functions extremely quickly due to the on-line adjustment of its system parameters. CMNN is classified as a non-fully connected perceptron-like associative memory network with overlapping receptive-fields. It has good generalization capability and fast learning property and is suitable for a lot of applications. This speech will introduce several new CMNN-based adaptive learning systems proposed by me; these systems combine the advantages of CMNN identification, adaptive learning, control technique, signal processing and image classification. In these systems, the on-line parameter training methodologies, using the Lyapunov theorem, are proposed to guarantee the stability and convergence of these systems. Moreover, the applications of these systems in nonlinear systems control, biped robot control, signal processing of communication system, and computer-aided diagnosis of breast nodules are demonstrated.

**Brief Biography of the Speaker:** Prof. Chih-Min Lin is currently a Chair Professor and Dean of Electrical and Communication Engineering College, Yuan Ze University, Taiwan. He also serves as an Associate Editor of IEEE Trans. on Cybernetics; Asian Journal of Control; International Journal of Fuzzy Systems; International Journal of Electrical Engineering; and International Journal of Machine Learning and Cybernetics. He has been the Chair of IEEE Computational Intelligence Society Taipei Chapter, the Chair of IEEE Systems, Man, and Cybernetics Society Taipei Chapter; a Board of Governor of IEEE Taipei Section. He has been awarded as the Distinguished Research Professor from National Science Council in Taiwan, the Distinguished Engineering Professor from China Engineering Society in Taiwan, and the Distinguished Electrical Engineering Professor from Chinese Electrical Engineering Society in Taiwan. He has been invited to give 7 keynote speeches in the international conferences. He is now a Board of Governor of IEEE Systems, Man, and Cybernetics Society. His research interests include fuzzy systems, neural network, cerebellar model neural network, and intelligent control systems. He is an IEEE Fellow and IET Fellow. Till now he has published 132 journal papers and 155 conference papers.

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