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Recent Advances in Systems Science

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Proceedings of the 17th International Conference on Systems (part of CSCC '13)

Rhodes Island, Greece, July 16-19, 2013

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Preface

This year the 17th International Conference on Systems (part of CSCC '13) was held in Rhodes Island, Greece, July 16-19, 2013. The conference provided a platform to discuss systems theory, control systems, genetic algorithms, non-linear systems, information systems, remote sensing, environmental modeling, navigation and tracking systems, wavelets, optimization 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 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.

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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Keynote Lecture 1

Human-Machine Interface: A System of Systems Approach

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Abstract: This presentation is introducing a system of systems approach to to the important topic of how human operators interact and interface with modern complex systems such as aircraft, industrial and manufacturing processes. As modern systems/processes become more complex they are taxing severely the capabilities of human operators. We discuss the problem areas arising from the human-machine interface and how autonomy technologies can assist to resolve conflicts between system automated advisories and the human, reduce human errors and prevent severe machine failures. We will use typical examples from the aerospace and industrial arenas to demonstrate the efficacy of these emerging technologies.

Brief Biography of the Speaker: Dr. George Vachtsevanos is currently serving as Professor Emeritus at the Georgia Institute of Technology. He served as Professor of Electrical and Computer Engineering at the Georgia Institute of Technology from 1984 until September, 2007. Dr Vachtsevanos directs at Georgia Tech the Intelligent Control Systems laboratory where faculty and students began research in diagnostics in 1985 with a series of projects in collaboration with Boeing Aerospace Company funded by NASA and aimed at the development of fuzzy logic based algorithms for fault diagnosis and control of major space station subsystems. His work in Unmanned Aerial Vehicles dates back to 1994 with major projects funded by the U.S. Army and DARPA. He has served as the Co-PI for DARPA's Software Enabled Control program over the past six years and directed the development and flight testing of novel fault-tolerant control algorithms for Unmanned Aerial Vehicles. He has represented Georgia Tech at DARPA's HURT program where multiple UAVs performed surveillance, reconnaissance and tracking missions in an urban environment. Under AFOSR sponsorship, the Impact/Georgia Team is developing a biologically-inspired micro aerial vehicle. His research work has been supported over the years by ONR, NSWC, the MURI Integrated Diagnostic program at Georgia Tech, the U,S. Army's Advanced Diagnostic program, General Dynamics, General Motors Corporation, the Academic Consortium for Aging Aircraft program, the U.S. Air Force Space Command, Bell Helicopter, Fairchild Controls, among others. He has published over 300 technical papers and is the recipient of the 2002-2003 Georgia Tech School of ECE Distinguished Professor Award and the 2003-2004 Georgia Institute of Technology Outstanding Interdisciplinary Activities Award. He is the lead author of a book on Intelligent Fault Diagnosis and Prognosis for Engineering Systems published by Wiley in 2006.

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Plenary Lecture 1

Nonlinear Dynamic Systems, Bursting Oscillations of Neurons and Synchronization

Professor Milan Stork
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Abstract: There are several motivations to be interested in fast-slow dynamics. For instance, many physiological or biological systems display different time scales. The bursting oscillations which can be observed in neurons, β-cells of the pancreas and population dynamics are studied and analyzed as fast-slow systems. In lecture a natural generalization to the notion of bursting oscillations where, for instance, the active phase is chaotic and alternates with a quiescent phase. In the first part of the lecture, we introduce dynamics with bursting oscillations based on the Hindmarsh–Rose system and similar bursting systems. Next part describes the bursting chaotic synchronization of two or chain of bidirectional coupled neurons and these systems are simulated since the synchronization of individual neurons is thought to play a key role in Parkinson's disease, essential tremor, and epilepsies. In next part, the bursting discrete time systems are described and simulated. In the last part external periodic signal is used for neurons synchronization. Such kind of external stimulation of brain has been extensively studied with respect to potential application to the control of pathological rhythms. The dissipativity, instability and stability of the presented systems are also analyzed. The designed systems were simulated and partly constructed in digital versions.

Brief Biography of the Speaker: Milan Stork received the M.Sc. degree in electrical engineering from the Technical University of Plzen, Czech Republic at the department of Applied electronics in 1974. He specialized in electronics systems and control in research institute in Prague. Since 1977 he worked as lecturer on University of West Bohemia in Plzen. He received Ph.D. degree in automatic control systems at the Czech Technical University in Prague in 1985. In 1997, he became as Associate Professor. From 2007 he is full professor at the Department of Applied Electronics and Telecommunication, faculty of electrical engineering on University of West Bohemia in Plzen, Czech Republic. He has numerous journal and conference publications. He is member of editorial board magazine "Physician and Technology". His research interest includes analog/digital linear, nonlinear and chaotic systems, control systems, signal processing and biomedical engineering, especially cardiopulmonary exercise systems. From 2011 he also works in research centre: Regional Innovation Centre for Electrical Engineering (RICE).

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Plenary Lecture 2

A Mathematical Approach to Tensional Psychological Construction

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Abstract: The psychological construct, apparently extremely complex, has two essential components, materialized in an undetermined component, represented by the psychological tonus (psychological energy) and a mixed construct, comprising an area of potentiality and another one, material, of physiological nature. The mixed construct has the role to modulate the psychological tonus in a purely individualized manner. The adequacy is subdued to the satisfaction of an external sense of personality transformation, taking into account the experience of life transcendence.
The architecture of the psychological construct of the kind that has already been described above is justified by the existence of a unique consciousness responsible for the supply with essential liquid represented by the psychological energy. Thus, the reason for the existence of physiological construct is determined by the presence of a unique consciousness, capable to identify and value it through the supplied psychological energy.
But what is the reason of the generating of psychological tonus? The existence at the end of the explanatory chain of a super – consciousness without consciousness might appear bizarre, at least at the intuitive level.
The potentiality area holds patterns of manifestation of the tensional dynamics. The patterns describe models of unaltered dynamics of tensional states. In this register, the tensional state is switched off from the filter of analysis correlated with other tensional states.
Two questions need to be asked referring to the tensional states. Why are there tensional states? Have the tensional (potential) psychological states a consciousness?

Brief Biography of the Speaker: Alin Gilbert SUMEDREA, Ph.D in Psychology (1998), Ph.D in Statistics (1993), is Professor at the Faculty of Social-Human Sciences, Lucian Blaga University of Sibiu, ROMANIA. He is also Head of the Psychological Research Centre, Sibiu, ROMANIA.
The scientific activity is represented by 60 published scientific papers and 9 books. Research activity: 17 finalized research projects. He was director for 5 research projects.
Current research interests include: Applications of differential geometry in psychology; Mathematical modelling of psychological processes.

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Plenary Lecture 3

Automotive Hybrid Systems Used in Traction

Professor Carmen M. Lungoci
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Abstract: In order to ensure a good power supply of a vehicle, different energy sources - from classical to new- are putted together, forming automotive hybrid systems.
From batteries to supercapacitors, fuel cells and solar panels, researchers' efforts in power supply are directed towards achieving a more friendly environmentally vehicle, with high autonomy and reliability.
There are many ways to connect the fuel cells, solar panels, batteries, supercapacitors and vehicle motor to run the vehicle. For example, solar energy has advantages, but is not suitable to run a vehicle directly, on its own. It is needed a fuel, because the driver wants to be independent of the sunlight. Also, there are hybrid vehicles in development and in production that combine classical batteries and fast supercapacitors - as method of propulsion. This presentation deals with hybrid energy systems based on fuel cells and solar panels vs. alternative solution composed by batteries and supercapacitors. Main general parameters as: power, energy and efficiency are compared through theoretical and experimental studies for both hybrid systems. Specific parameters, as: heating value or thermal efficiency for fuel cell, power density for solar panel, life cycle for supercapacitors, state of charge for batteries are also computed and analyzed. Advantages of using both systems are discussed and results obtained trough simulations and experiments come to certify conclusions of each scenario.

Brief Biography of the Speaker: Carmen Mihaela Lungoci is graduated from Politehnica University, Bucharest, Romania, in Automation for Industrial Control field. In 2009 she received the Ph.D. degrees in Electrical Engineering from Transilvania University of Brasov. She is lecturer at this university, on the Electrical Engineering and Applied Psychics Department of the Electrical Engineering and Computers Science Faculty. Her current research area deals with applications of numerical methods in electrical engineering, energy management in automotive systems, hybrid systems used in traction, energy and environment. She published more than 30 articles in proceedings of internationals conferences and journals.

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Plenary Lecture 4

Analysis of Nonstationary Signals Generated by Nonlinear Dynamic Systems

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Abstract: Signals generated by nonlinear dynamic systems are nonstationary. To analyze such signals using linear methods such, for example spectral or time-frequency methods, one has to have long signals, free of artifacts, denoised etc. Nonlinear analysis using Higuchi's fractal dimension, Empirical Mode Decomposition, or symbolic methods is much better suited and should be used for such signals to extract important features of the nonlinear dynamic systems that generated analyzed signals. In particular, living organisma in general, and human organism is particular, are inherently nonlinear dynamic systems. That is why biosignals like EEG are inherently nonstationary, so our methods find application in medical diagnosis and in assessment of therapy results.

Brief Biography of the Speaker: Wlodzimierz Klonowski holds a Master of Science (M.S.) in Physics with specialization in Biophysics from the University of Warsaw (1968), Doctor of Philosophy (Ph.D.) from the Institute of Physics, Polish Academy of Sciences (1973), and Doctor of Science (D.Sc.) in Biophysics from Humboldt University, Berlin (1990). He has worked as a professor of Physics in the French-speaking l'Univesité National du Zaïre à Kinshasa, Republic of Congo, as a Max Planck Fellow at MPI fűr Biophysikalische Chemie in Goettingen, as a visiting professor at Brandeis University in Waltham, MA, as the President of Canadian Consulting and Tutoring Services at Halifax, NS, Canada. He has been a distinguished member of several organizations including Polish PhysicalSociety, European Physical Society, New York Academy of Sciences, American Association of University Professors, and American Association for the Advancement of Science. He is a Bio-Scientific Advisory Board Member of the International Brain Research Foundation Inc. New York, Vice-President and Board Member of the International Consortium for Nalecz Institute of Biocybernetics and Biomedical Engineering Polish Academy of Sciences in Warsaw, and is the Head of the Lab of Biosignal Analysis Fundamentals. He has been active for more than 40 years in the theory of complex nonlinear systems with applications in medicine and biology. He was an initiator and organizer of a series of European Summer Schools EUROATTRACTOR. He has contributed seriously to the theory of structureproperty relationships in crosslinked polymer materials through his topological theory of networks, so called Systems with Discrete Interactions. Currently, he is involved in the research on nonlinear methods of biosignal analysis and its applications for monitoring the depth of anesthesia and for assessment of medical therapies. Prof. Klonowski is the Founding Editor and an Editor-in-Chief of Nonlinear Biomedical Physics, an interdisciplinary open access journal (BioMed Central, London) that starting January 2013 is transformed into EPJ Nonlinear Biomedical Physics (Springer, Heidelberg) His biograms are included in several European and American Who's Who's, in Wikipedia, and he has a molecular informational structure named after him (Klonowski-Klonowska Conformon, term proposed by S.Ji in 'Molecular Theories of Cell Life and Death', Rutgers U. Press, 1991). W.Klonowski is also interested in philosophical problems, in particular in theory of consciousness, and emotions vs logical thinking, that he proposed to call Chaosensology.

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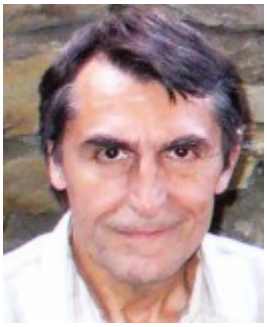
Plenary Lecture 5

Night Vision Systems for Pedestrian Safety from Road Traffic



Professor Aleksander Bekiarski
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Abstract: The significant increase in road traffic has lead to increased traffic accidents involving pedestrians. These accidents depend both from car drivers and pedestrians attentions in a road situation and are more dangerous and fatal in the night. Therefore the developments of the automatic warnings systems is of an important goal of the automotive industry. The development of technology for night vision and thermo vision created favorable conditions for their application as far-infrared (FIR) and near-infrared (NIR) night vision systems. In addition to protecting pedestrians night vision systems in vehicles are used in police and military security systems and traffic control. This paper describe first the main principles of night vision systems and then focus is directed to the development of the methods for processing night vision images which are generated by passively detecting thermal emissions from objects and surfaces in the road scene or actively illuminate the scene in the near infrared spectrum and capture the reflected radiation. The presented methods are for preprocessing, noise suppression, objects (pedestrians in the road) detection and tracking in night vision static or moving images. The results from these methods in form of information for existence of objects (pedestrians in the road) and also the space information of objects (pedestrians place in the road) are sending to the car computer system, which can pay attention of the car driver generating audio or visual alarm signals or take the automatic operations to prevent the accident of car with the pedestrian. For all of the method described hire are presented the suitable algorithms developed to present the main steps necessary for realization of these methods. Some results from simulations and real working night vision systems for pedestrians safety, conclusion and propositions for future works are added to the end of this paper.

Brief Biography of the Speaker: Born in 1944, Plovdiv, Bulgaria. He received M.S. degree in Communications in 1969 in Technical University, Sofia. Ph. D in Television and Image Processing in 1975, Assoc. Prof. since 1987 in the same University. Proffesor since 2010 in Technical University-Sofia University.Vice-Dean of Faculty on Life-Long Learning Center since 2005, Vice-Dean of French Language Faculty of Electrical Engineering since 2006. The author over 212 research papers in Image Processing Systems, Pattern Recognitions, Neural Networks etc. Currently the leader of courses in Basic of Television, Television Systems, Theory of Coding, Digital Signal Processors etc. His scientific iterests encompass Video and Audio Processing, Digital TV, Neural Networks, Artificial Intelligence in Video and Audio, Artificial Intelligence Programming Languages Lisp Prolog, Expert Systems, Robotics Camera Eye and Microphone Arrays, Signal Processors, Embedded Systems, Microcontrollers, Programming Languages C++, Java, Matlab etc.

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