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Control, Modelling and Simulation

Control, Modelling & Simulation

Proceedings of the 11th WSEAS International Conference on AUTOMATIC CONTROL, MODELLING and SIMULATION (ACMOS '09)

Istanbul, Turkey, May 30 - June 1, 2009

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Zhijin Zhao, CHINA
Ina Taralova, FRANCE
Zhige Zhou, CHINA
Yuanguo Zhu, CHINA

Preface

This year the 11th WSEAS international conference on Automatic Control, Modelling and Simulation (ACMOS '09) was held in Istanbul, Turkey. The Conference remains faithful to its original idea of providing a platform to discuss circuits and electronics for control, electrical and electronic measurement, large scale systems, hierarchical control, hybrid systems, digital control 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 indexed by ISI. Please, check it: www.worldses.org/indexes as well as in the CD-ROM Proceedings. They will be also available in the E-Library of the WSEAS. The best papers will be also promoted in many Journals for further evaluation.

A 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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Plenary Lecture 1

Methods to Design Fuzzy Controllers

Professor Constantin Volosencu
Department of Automatics and Applied Informatics
"Politehnica" University of Timisoara
Timisoara, Romania

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Abstract: Fuzzy logic is used to develop so-called fuzzy PID controllers, which are non-linear controllers with large applications in process control. The advantages of fuzzy control are better quality control criteria and robustness at error in parameter estimation and at disturbance influence. The paper presents some general methods to design PID fuzzy controllers using families of input-output transfer characteristics of fuzzy blocks and gain characteristics. Based on these transfer characteristics we may do a pseudo-equivalence of PID fuzzy controllers with linear PID controllers. Also, the paper presents the way of fuzzy controller design to assure absolute global internal stability of fuzzy control system. Some applications are presented with modeling and simulations for a large class: PI, PD and PID fuzzy controllers. Results of simulation demonstrate the viability of the design methods.

Brief Biography of the Speaker: Prof. Constantin Volosencu graduated in 1981 the Faculty of Electrotechnics, "Traian Vuia" Polytechnic Institute of Timisoara, Romania, as an engineer in automatics and computers and he is doctor in control systems at "Politehnica" University of Timisoara. In present he is professor at "Politehnica" University of Timisoara, Faculty of Automatics and Computers, Department of Automatics and Applied Informatics. His research interest is in linear control systems, fuzzy control, neural networks, control of electrical drives, modelling, simulation, identification and sensor networks. He is author of 9 books and more then 100 scientific papers, published at international conferences and journals. He was manager of over 30 national an international research projects.
Constantin Volosencu worked from 1981 to 1990 at "Electrotimis" Enterprise Timisoara, in the field of the control systems for industrial machines, where he developed control equipments for a large scale of machineries, which are the objects of 27 patents.

Plenary Lecture 2

Network Optimization as Controllable Dynamic Process

Professor Alexander Zemliak
Puebla Autonomous University, MEXICO,
National Technical University of Ukraine "Kiev Polytechnic Institute",
UKRAIN

E-mail: azemliak@yahoo.com

Abstract: The problem of the computer time reduction of a large system design is one of the essential problems of the total quality design improvement. The size and the complexity of the systems grow constantly. One of the main problems of a large system design is the excessive computer time that is necessary to achieve the final point of the design process. There are some powerful methods that reduce necessary time for network analysis. Besides the traditionally used ideas of sparse matrix techniques and decomposition techniques some another ways were proposed to reduce the total computer design time. Nevertheless, the time of a large-scale circuit analysis and the time of any optimization procedure increase when the network scale increases.
Meanwhile, it is possible to reformulate the total network design problem to generalize the design process. The main conception of this approach is the introduction of special control functions, which, on the one hand generalize the design process and, on the other hand, they give the possibility to control the design process to achieve the optimum of the design cost function for the minimal computer time. This possibility appears because of infinite number of different design strategies that exist within the bounds of the new theory. In this case a new quality appears due to the possibility of controlling the design process by redistributing computational burden between the circuit's analysis and the procedure of parametric optimization.
The problem of minimal-time network design strategy is formulated as the typical problem for some functional minimization of the control theory. The network optimization process in this case is defined as a controllable dynamic system. An additional acceleration effect was discovered and permits us to reduce the computer design time more and serves as one of the fundamental notions for constructing the optimal or quasi-optimal design algorithm. This effect can be realized by means of changing of one design strategy to other with a special selection of initial point of optimization process. Analysis of the different electronic systems shows that the potential computer time gain of the optimal strategy increases when the size and complexity of the system increase. The Lyapunov function of the design process and its time derivative include the sufficient information to select more perspective design strategies from all different design strategies that exist in limits of generalized design methodology. Analysis of behavior of Lyapunov function shows a strong correlation between some characteristics of this function and a processor time. It means that the study of Lyapunov function helps us to construct the preliminary structure of a minimal-time system design algorithm. The special function has been proposed to predict an optimal structure of control vector. This function is a key to construct the minimal-time system design algorithm.

Brief Biography of the Speaker:
Important Career Positions:
Professor, Dept. of Physics and Mathematics, Puebla Autonomous University, Puebla, Mexico;
Professor, Institute of Physics and Technology, National Technical University of Ukraine "KPI", Kiev, Ukraine

Number of MSc and PhD Students: over 60 MSc and 7 PhD.

Membership of Associations:
Ukrainian Scientific Society,
IEEE (Senior Member),
IEICE,
National System of Investigators of Mexico,
New York Academy of Sciences,
WSEAS.

Publications: 8 books, 7 guidebooks for students, 6 chapters of books, over 200 papers.

Honors: Best paper award SOMI Conf. 1999, best paper award IBERCHIP Conf. 2002.

Organizer:
- General Chairman of the WSEAS Int. Multi Conference: 2002, 2004, 2005, Cancun, Mexico;
- General Chairman of the WSEAS Int. Multi Conference 2008, Acapulco, Mexico;
- Chairman of sections in conferences: WSEAS 1999, Athens, Greece; WSEAS 2001, Malta; Int. Conf. on Fundamentals of Electronics, Commun. and Computer Sciences, 2002, Tokyo, Japan; ISCAS2003, 2003, Bangkok, Thailand.

Editorial activity:
Editor-in-Chief of the WSEAS Transactions on Systems;
Member of the Editorial Board of the WSEAS Transactions on Circuits and Systems;
Member of the Editorial Board of the WSEAS Transactions on Electronics;
Reviewer of the journal “Temas de Ciencia y Tecnologia”, Mexico
Reviewer of the International Design Automation Conference-DAC, 2001, 2002, 2003, USA
Reviewer of the World Multi-Conf. on Systemics, Cybernetics and Informatics, 2003 – 2007, USA
Reviewer of the Int. Conf. on Computing, Communication and Control Technologies-CCCT, 2004 – 2007, USA

Plenary speaker:
CONIELECOMP Int. Conf., Puebla, Mexico, 1997;
WSEAS Int. Conf., Cancun, Mexico, 2002;
3er Congreso Internacional en Computación Aplicada, Tlaxcala, Mexico, 2003;
WSEAS Int. Conf., Miami, USA, 2005;
Int. Conf. On Electronics, 2006, CINVESTAV, Queretaro, Mexico, 2006;
Int. Conf. CADSM2007, 2007, Lviv-Polyana, Ukraine;
WSEAS Int. Conf., Cancun, Mexico 2008.

Fields of Interest:
Computer-aided RF and microwave system analysis and design,
Optimal design methodology,
Computational electromagnetics,
Numerical techniques on simulation,
Analysis and optimization of microwave devices.

Plenary Lecture 3

AFuzzy Technologies of Weakly Structurable Systems' Modeling and Simulation

Professor Gia Sirbiladze
Department of Computer Science
Iv. Javakhishvili Tbilisi State University,
Georgia.

E-mail: g.sirbiladze@tsu.ge

Abstract: The Plenary Speech will present the new approach to the study of optimization of weakly structurable fuzzy dynamic systems (Extremal Fuzzy Dynamic System (EFDS)). This approach is based on the six papers published in the Int. Journal of General Systems (by G. Sirbiladze, "Modeling of Extremal Fuzzy Dynamic Systems". Parts I-VI: 34,2, 2005, 107-138; 139-167; 169-198; 35, 4, 2006, 435-459; 35, 5, 2006, 529-554; 36,1 2007, 19-58). Different from other approaches where the source of fuzzy uncertainty in dynamic systems is expert, this approach considers time as long as an expert to be the source of fuzzy uncertainty. This notably widens the area of studied problems. All these is connected to the incomplete, imprecise, anomal and extremal processes in nature and society, where connections between the system's objects are of subjective (expert) nature, which is caused by lack of objective information about the evolution of studied system, for example in 1) engineering problems, 2) economics and business of developing countries, 3) management of evacuation processes in catastrophe areas, estimation of disease spreading in epidemical regions; 4) research of complex systems of applied physics, 5) conflictology, sociology, medical diagnosis, etc; One of our purposes is to create scenarios describing possible evolution of EFDS using methods of optimization developed by the framework of expert-possibilistic theory. This includes construction of algorithms of logical-possibilistic simulations of anomal and extremal process analysis.
The plenary speech will cover the following topics: introduce the notions of extremal fuzzy time moments and intervals; construction of fuzzy processes with possibilistic uncertainty, the source of which is extremal fuzzy time intervals; the dynamics of EFDS's; questions of the ergodicity of EFDS's; Fuzzy-integral representations of controllable extremal fuzzy processes; Sufficient and necessary conditions for the existence of an extremal fuzzy optimal control processes.
A separate consideration will be given to the case where an extremal fuzzy control process acting on the EFDS does not depend on an EFDS state. Applying Bellman's optimality principle and assuming that the gain-loss process exists for the EFDS, a variant of the fuzzy integral representation of an optimal control is given for the EFDS. This variant employs the instrument of extended extremal fuzzy composition measures. An example of constructing of the EFDS optimal control will be presented.

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 Science. 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, Fuzzy Extremal Dynamic Systems - Control, Filtration and Identification, Fuzzy Discrete Optimization Problems and Modeling Decisions. Dr. Gia Sirbiladze has published 54 scientific papers on the above-listed topics. 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.

Plenary Lecture 4

Simulation Highway – Step by Step to Common Environment

Professor Egils Ginters
Sociotechnical Systems Engineering Institute
Vidzeme University of Applied Sciences,
Valmiera, LATVIA

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Abstract: Nowadays the decision making becomes very difficult and risky process. The reason is that control of technological processes and management of sociotechnical processes are information capacious and expensive. Due to the reasons mentioned above topical are the requirements for situations forecasting before the decision making. For solving the questions mentioned the varied modelling tools int. al. simulation can be used. Today is possible to design highly functional modelling systems having human-machine interface (HMI), which doest not asks for the specific skills on information and communication technologies (ICT). Unfortunately some serious problems still exist related with standards compatibility, formats harmonization and concepts consistency. Simulation Highway is the project, which aim is the elaboration of the conceptual model and the demonstrator of the open and distributed simulation system aimed to modelling of events and processes at the different structural levels of applied system using the information base, and understandings convenient for the actors of applied area. Using the system mentioned above will be possible to ensure transparent access to simulation environment for the specialists from applied area having minimal knowledge in information technologies.

Brief Biography of the Speaker: Director of Sociotechnical Systems Engineering Institute at the Vidzeme University of Applied Sciences. Full time professor at the Vidzeme University of Applied Sciences; He is member of Institute of Electrical and Electronics Engineers (IEEE). Prof. Egils Ginters is member of the Board of Association of Computer Technologies of Latvia and IT expert of Latvian Council of Sciences. He is an author of data processing systems designing methodology LISTechnology and more than 100 publications related with logistics information systems and simulation. Prof. Egils Ginters was participant of some EU funded projects: INCO Copernicus AMCAI 0312 (1994-1997), INCO Copernicus DAMAC-HP PL976012 (1998-2000), FP5 IST BALTPORTS-IT (2000-2003), FP6 IST e-LOGMAR-M No.511285 (2004-2006) and coordinator of Leonardo da Vinci LOGIS LV-PP-138.003 (2000-2002), LOGIS MOBILE LV/B/F/PP-172.001 (2004-2006) and SocSimNet LV/B/F/PP-172.000 (2004-2006).

Plenary Lecture 5

Emotional Machines

Professor Adnan Khashman
Head of Intelligent Systems Research Group (ISRG)
Chariman of Electrical & Electronic Engineering Department
Near East University
Nicosia, Cyprus

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Abstract: The idea of machines having emotions sounds like science fiction, however, few decades ago the idea of machines with intelligence seemed also like fiction, but today we are developing intelligent machines with successful applications. We have always overlooked the emotional factors during machine learning and decision making; however, it is quite conceivable to artificially model certain emotions in machine learning.
In this lecture/speech a brief review of the attempts made previously to model emotions in machines will be presented. Additionally, the speaker's latest work on "creating" machines with emotions will be described. In particular, the speaker's work on modeling anxiety and confidence "emotions" in supervised neural networks will be presented.

Brief Biography of the Speaker: Adnan Khashman received his Ph.D. and M.Sc. degrees in electronic engineering from University of Nottingham, England, UK, in 1992 and 1997, respectively, and his B.Eng. degree in electronic and communication engineering from University of Birmingham, England, UK, in 1991. During 1998-2001 he was an Assistant Professor and the Chairman of Computer Engineering Department, Near East University, Nicosia, N. Cyprus. Since 2001 he is an Associate Professor and Chairman of Electrical and Electronic Engineering Department at the same university. From 2007 till 2008 he was also the Vice-Dean of Engineering Faculty. He is the founder (in 2001) and Head of the Intelligent Systems Research Group (ISRG) at the same university.
As of 2009 he is a full Professor at the Engineering Faculty. His current research interests include emotion modeling in neural networks and their engineering applications, intelligent systems, image processing and pattern recognition. Prof. Dr. Khashman has authored and co-authored more than 65 scientific publications in books, journals, and conference proceedings.

Plenary Lecture 6

Neuro-Control of Vibration for a Maglev Vehicle Traveling at High Speeds

Professor J. D. Yau
Department of Architecture, Tamkang University
Taipei, Taiwan

E-mail: jdyau@mail.tku.edu.tw

Abstract: This paper is intended to present a neuro-PI (proportional-integral) controller for tuning the dynamic response of a running maglev vehicle at high speeds. The maglev vehicle is simulated as a rigid car body supported by a rigid magnetic bogie-set with a uniformly distributed spring-dashpot system, in which the electromagnetic force is controlled by an on-board PI controller. Considering the motion-dependent nature of electromagnetic force working in a maglev system, this study presents an iterative approach to compute the dynamic response of the running maglev vehicle system based on the Newmark method. The proposed neuro-PI controller is trained using back propagation neural network in such a way that its PI gains are correlated to the generated dataset of moving speeds and the maximum vertical accelerations of maglev oscillators including the midpoint and two ends of the rigid car body. Numerical simulations demonstrate that a trained neuro-PI controller has the ability to control the acceleration amplitude for a running maglev vehicle within an allowable region of restricted acceleration.

Brief Biography of the Speaker:
Studies:
Ph.D. in Civil Engineering, National Taiwan University
Academic Positions
Associate professor of Tamkang University in Taiwan
Scientific Activities
1. Vibrations of high speed rails
2. Geometrical nonlinear analysis of framed structres
3. Structural stability of tapered beams

Dr. Yau is currently an associate professor at Tamkang University in Taiwan. He received his M.S. degree and Ph.D. in civil engineering from National Taiwan University in 1986 and 1996, respectively. His main area of research is on the dynamics of vehicle-bridge interaction with emphasis on high speed railway system, including train-induced resonance phenomenon of bridge response, assessment of running safety and ride quality of traveling vehicles, and influence of ground settlement on a train running over a series of bridge units. He has published over 50 journal papers and articles, and is also the second author of the book: Vehicle-Bridge Interaction Dynamics. His recent research interests focus on vibration control of a running maglev-train and nonlinear dynamics of vehicles traveling over a suspension bridge.

Plenary Lecture 7

3-D Graphical Visualization for Construction Automation

Professor Thomas M. Gatton
Lead Faculty Engineering Programs
School of Engineering and Technology
National University
Aero Court, San Diego

E-mail: tgatton@nu.edu

Abstract: The availability of low-cost, high performance computers that are capable of real-time 3-D graphic processing has lead to a plethora of applications in the construction industry. This technology is particularly beneficial in the design and simulation of automated construction systems. The expense of physically constructing and implementing a full-scale prototype automated construction systems has been a prohibitive factor in significant progress in this area. Computer hardware and software technologies that can perform real-time 3-D graphical simulation and visualization afford a tool that allows investigation and visual demonstration of conceptual and prototype designs, without the related expense of physical prototype construction. This paper overviews the application of 3-D graphical simulation and visualization to construction applications and presents a study to apply 3-D graphical simulation in the development of a prototype automated push-up gantry robot system for automated construction. The investigation demonstrates the use of 3-D Graphical simulation as both a communication and investigative tool for proof-of-concept studies in the development of automated construction systems to demonstrate the feasibility of the push-up gantry automated construction system concept.

Brief Biography of the Speaker: Dr. Gatton graduated from the University of Illinois with Master's degrees in Architecture and Computer Science and a Ph. D. in Civil Engineering. He conducted research for ten years at the Army Corp of Engineer's Construction Engineering Research Laboratory, at the University of Illinois, in the areas of computer graphics, artificial intelligence and robotics, and received an official citation for groundbreaking research and innovation in these areas. He then transferred to Academia as an Assistant Professor at the University of Texas at Austin, and continued his work in 3-D graphical simulation, automation and artificial intelligence applications in the construction industry, until 1997. After 4 years as President of the Construction Automation Research Company, Dr. Gatton returned to Academia, where he is a Professor in the School of Engineering and Technology at National University in San Diego, California. Since joining National University, Dr. Gatton has served as Department Chair and currently directs several construction and manufacturing engineering degree programs. Dr. Gatton has over 50 journal and conference publications and is an internationally recognized speaker in the areas of artificial intelligence, software development, automation and robotics in construction.

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Plenary Lecture 8

Neuro-Control of Vibration for a Maglev Vehicle Traveling at High Speeds

Professor Xi-Ren Cao
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Hong Kong
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Abstract: The standard approach to control and optimization of stochastic systems is based on dynamic programming. This approach works backward in time and it treats the infinite-horizon problems as the limiting case with the backward time going to infinity. Optimality equations are first derived and then it is proved that the solutions to the optimality equations indeed lead to optimal policies. When the value functions are not differentiable, the concept of viscosity solutions is introduced.
A sensitivity-based approach has been developed recently to stochastic learning and optimization. The approach was first developed for discrete event dynamic systems and is being extended to continuous-time and continuous state systems. The basic idea is: fundamentally, one can only compare the performance of two policies at a time; and therefore, when developing optimization theories and methodologies, one has to first study the different of the performance of any two polices. It has been observed that for many stochastic optimization problems the information about the difference of the performance of any two policies can be decomposed into two factors, each of them is associated with one of the policies only. This feature allows us to find a better policy than the policy we are evaluating without analyzing any other policies. We found that this "information decomposition" is essential for optimization.
This "information decomposition" approach has some advantages over the dynamic programming approach: It is intuitive clear because it is based on a direct comparison of any two policies. Thus, it is easy to verify that the solution to the optimality equation is indeed optimal; viscosity solution is not needed. This approach applies in the same way to different performance criteria, including finite and infinite-horizon problems. Furthermore, the approach brings some new insights that leads to new methods and results in control and optimization, including the event-based optimization and gradient-based learning.

Brief Biography of the Speaker: Xi-Ren Cao received the M.S. and Ph.D. degrees from Harvard University, in 1981 and 1984, respectively, where he was a research fellow from 1984 to 1986. He then worked as a consultant engineer/engineering manager at Digital Equipment Corporation, Massachusetts, U.S.A, until October 1993. Then he joined the Hong Kong University of Science and Technology (HKUST), where he is currently chair professor. He held visiting positions at Harvard University, University of Maryland at College Park, AT&T Labs, Tsinghua University, and other universities.
Dr. Cao owns three patents in data- and tele- communications and published three books in the area of stochastic learning and optimization and discrete event dynamic systems: "Stochastic Learning and Optimization - A Sensitivity-Based Approach," Springer, 2007, "Realization Probabilities - the Dynamics of Queuing Systems," Springer Verlag, 1994, and "Perturbation Analysis of Discrete-Event Dynamic Systems," Kluwer Academic Publishers, 1991 (co-authored with Y. C. Ho). He received the Outstanding Transactions Paper Award from the IEEE Control System Society in 1987, the Outstanding Publication Award from the Institution of Management Science in 1990, and the Outstanding Service Award from IFAC in 2008. He was elected as a Fellow of IEEE in 1995, and as a Fellow of IFAC in 2008. He is Editor-in-Chief of Discrete Event Dynamic Systems: Theory and Applications, Associate Editor at Large of IEEE Transactions of Automatic Control. He served as the Chairman of IEEE Fellow Evaluation Committee of IEEE Control System Society (2005-2007), and member on the Board of Governors of IEEE Control Systems Society. He is the chairman of IFAC Coordinating Committee on Systems and Signals (2206-2011) and on the Technical Board of IFAC, He is/was associate editor of a number of international journals and chairman of a few technical committees of international professional societies. His current research areas include discrete event dynamic systems, stochastic learning and optimisation, performance analysis of communication systems, signal processing, and financial engineering.

Plenary Lecture 9

Non-Linear Adaptive Controller with Linear Dynamic Compensator and Neural Network

Assistant Professor Mihai Aureliu Lungu
Faculty of Electrical Engineering
Avionics Department
University of Craiova
Dolj, Romania

E-mail: lma1312@yahoo.com

Abstract: The paper presents complex adaptive non-linear systems with one input and one output which are based on dynamic inversion. Linear dynamic compensator makes the stabilization command of the linearised system using as input the difference between closed loop system's output and the reference model's output (command filter). The state vector of the linear dynamic compensator, the output and other state variables of the control system are used for adaptive control law's obtaining; this law is modeled by a neural network. The aim of the adaptive command is to compensate the dynamic inversion error. Thus, the command law has two components: the command given by the linear dynamic compensator and the adaptive command given by the neural network. For estimation the dynamic compensator's state, the non-linear adaptive controller may have a linear reduced order observer. As control system one chooses the non-linear model of helicopter's dynamics in longitudinal plain. The reference model is linear. One obtains the structure of the adaptive control system of the pitch angle and Matlab/Simulink models of the adaptive command system's subsystems. Using these, some characteristics families are obtained. These describe the adaptive command system's dynamics with linear or non-linear actuator.

Plenary Lecture 10

Mathematical Model and Simulations of Pedestrian Motion in Dangerous Situations

Professor Robert A. Kosinski
Faculty of Physics
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Abstract: The model of pedestrian motion, based on the set of differential Langevin equations is presented. In the equations psychological component in pedestrians motion is described using an additional social force term. Solution of the set of equations for N pedestrians, moving in the buildings of a chosen type (e.g. office building, cinema, self-service shop), enable to simulate evacuation process. As a parameter describing the level of panic in the evacuation process the desired velocity vD was used. In the numerical program the buildings were presented in 2 or 3-dim graphic, which enables to visualize the process of evacuation of buildings. It is also possible to calculate the trajectory of each pedestrian or time of evacuation. Two types of pedestrian motion – laminar and turbulent - were observed, which depends on the vD value. Large level of panic (high vD) causes the increase of the interactions between pedestrians and interactions with the elements of internal architecture of building. The times of evacuation as a function of vD, for the chosen buildings and internal architecture, were calculated and discussed.

Brief Biography of the Speaker: Prof. Robert Kosinski is a Head of the Physics of Complex Systems Division at Warsaw University of Technology. He also works as a professor at Central Institute for Labor Protection – National Research Institute, in Safety Engineering Department. His main research interests concern theory of magnetism, nonlinear dynamics, theory and applications of artificial neural network and physics of complex systems, in particular mathematical modeling and numerical simulations of complex systems of different kinds. In these fields He is an author or coauthor of above 80 scientific papers published in international journals (e.g. IEEE Transactions on Magnetism, Physical Review, International Journal of Modern Physics) as well as two books - on artificial neural networks and textbook for students on statistical physics and quantum mechanics. He participated also in 90 international conferences presenting the results of his research. He is a member of a number of scientific societies (e.g. Polish Physical Society, Societas Humboldtiana Polonorum).

Plenary Lecture 11

Robust Sliding Mode Control of Multivariable Time-Delay Systems

Professor Elbrous M. Jafarov
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Abstract: The problem of sliding mode controller design for uncertain multi-input systems with several fixed state delays is addressed. A combined sliding mode controller is considered and it is designed for the stabilization of perturbed multi-input time-delay systems with matched parameter uncertainties and external disturbances. Delay-independent stability conditions are derived by using Lyapunov-Krasovskii functional method and formulated in terms of LMI. The sliding mode existence conditions are also studied by choosing a suitable Lyapunov function. The stability and sliding conditions are consistent.
Three numerical examples with simulation results are given to illustrate the usefulness of the proposed design method.

Brief Biography of the Speaker: Elbrous Mahmoud Jafarov was born in province Gokche, village Karkibash in the west of Azerbaijan in 15.12.1946 where he left secondary school in 1964 with a gold medal and he received his first class Honors Degree Electro-Mechanical Engineering Diploma (M.Sc. Degree) in Faculty of Automation of Manufacturing Process from Azerbaijan Industrial University (now Azerbaijan State Oil Academy) Baku, in 1969. The USSR State Certification of Candidate Eng. Sc. (Ph.D.) and D.Sc. (Eng) degrees from Research Institute NIPINefteKhimAutomat (Sumgait)-TsNIIKAutomation (Moscow)-IMM and Institute of Cybernetics of Azerbaijan Science Academy; and Institute of Control Sciences (Moscow)-MIEM-LETI in Control and Systems Engineering were received in 1973 and 1982, respectively.

He started as a research engineer in NIPINefteKhim-Automat and then he became Head of Variable Structure Control of the Oil-Chemical Process Laboratory from 1969 to 1984. During 1985-1996 he was Chairman of the Control Systems and Robotics Engineering Department at the Azerbaijan Technical University, Baku.
Dr. Jafarov received the USSR State Certification of Professor in Control Systems Engineering in 1987. He was visiting Professor at Beijing Aeronautical and Astronautical University (BUAA), in1993, where he was awarded by China State BUAA Advisor Professor Certificate; and Georg-Simon-Ohm-Fachhochule Nurnberg, Germany, in 2001. He has been contractual professor in the Aeronautical and Astronautical Faculty of Istanbul Technical University, Turkey, since 1996. He is a senior student of Islam and Sufism University of Allah, Virginia USA.
Professor Jafarov is the author of about 200 scientific journal articles, international conference papers, teaching materials, research reports, etc. and 27 Inventions with USSR State Certificates in Control and Systems Practice Engineering. He is a member of IASTED (Canada), WSEAS Academy (Greece), International Technological Cybernetics Academy (Saint Petersburg), Editorial Board of the Open Electrical and Electronic Engineering Journal, Reviewers Board of IEEE Journals and Conferences, Emerald Literati Network (London) etc. His complete biography is included in the Marquis Who's Who in the World 2006-2009 Editions USA.
His current research and teaching interests include automatic control, variable structure control, time- delay systems, flight dynamics and control, robot control, robust control, optimal control, process control etc. He is also interested in relativity theory, poetry and Sufism. He is married and has two daughters.

Plenary Lecture 12

Mathematical Model and Simulations of Pedestrian Motion in Dangerous Situations

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Abstract: Starting from the theory of the energy-momentum tensor, we introduce the four vector density of entropy current in which the entropy density is regarded as function of the energy density and of the symmetric strain tensor. By considering the concept of relativistic equilibrium state, it is defined the temperature in a generic inertial frame obtaining the transformation equations introduced by H. Ott for the temperature and the heat (without postulate Gibbs relation). Moreover, the considerations on the relativistic stress tensor allow us to obtain the transformation equations for the strain tensor. Finally time component of the derivative with respect to the coordinate of the four vector density of entropy current expresses the entropy balance and therefore the entropy production.

Brief Biography of the Speaker: Important Career Positions: Director of Computer Center University of Messina (Italy), Full Professor 1987-, University of Messina, Faculty of Mathematical-Physics and Natural Sciences.
Number of PhD Students: 10 in due time and 5 Doctors in Mathematics.
Membership of Associations: Academia Peloritana of Messina (1975).
Publications: over 2 books; 87 papers.
Organizer: The 10-th International Conference "Wascom 99" of Waves and Stability in Continuos Media, June 7-12, 1999 Vulcano (Eolie Islands), Italy; The International Conference of Differential Geometry and Dynamical Systems, University Politehnica of Bucharest, October 5-7, 2007
Fields of Interest: Themodynamics systems, Viscoanelastic media, Dielectric and magnetic relaxation phenomena, Dynamical Systems, Applied Mathematics and Physics.

Plenary Lecture 13

An Insight to PENDULAR Control

Professor Catalin Nicolae Calistru
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Abstract: The plenary talk has in view to disseminate the author's original ideas concerning a particular class of nonlinear control systems, so called PENDULAR Control Systems. These systems have an intuitive side as analyzed in the introductive section.
PENDULAR is a mnemonic coming from Pendulum Efficiency with Nonlinear Dynamics and Unconventional Law in Achievement of Robustness. Also, in Romanian the verb "a pendula" defines the pendulum movement.
PENDULAR control systems are referred by the mnemonic PCS. PCS are variable structure systems (VSS) with a simple structure. The main idea is to optimize conventional structures using a nonlinear element on the feedback loop. In fact, this nonlinear element produces changes in structure. So the 2nd section deals with it.
The intuitive aspect of the two system substructures is treated in the 3rd section. In this section are presented some simulations in order to "feel" the PENDULAR concept. Since some of the simulations clearly show that the PCS is unstable, next section deals with the study of stability of PCS. The stability section ends with PCS stability theorem, with recommendation for the PCS controller type and structure.
Next section foresees the PENDULAR control impact over the control strategies. In this section Essential Pendular Control strategy is defined. Examples, simulations are available. Finally, some laboratory experiments over some real plants underline the PCS efficiency.

Brief Biography of the Speaker: Prof. Catalin Nicolae Calistru obtained his Ph.D in Automatic Control from "Gheorghe Asachi" Technical University of Iasi, Romania. He currently teaches Computer Networks, Computational Logics but his interests covers a large variety of topics as Control Theory, Robust Control, Intelligent Control, Nonlinear Control.
Prof. Calistru was invited professor in Prague and Florence, author of more than 85 scientific papers, 3 books, Member of IASTED Technical Control Committee, Member of WSEAS NN and GAs group, Editor of the International Journal of Mathematics and Computers in Simulation.

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