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ADVANCES IN DYNAMICAL SYSTEMS AND CONTROL

**6th WSEAS International Conference on
Dynamical Systems and Control (CONTROL '10)**

Sponsor and Organizer:

**University of Sfax,
Faculty of Sciences of Sfax**



Kantaoui, Sousse, Tunisia, May 3-6, 2010

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Preface

This year the 6th WSEAS International Conference on DYNAMICAL SYSTEMS and CONTROL (CONTROL '10) was held in Kantaoui, Sousse, Tunisia, May 3-6, 2010. The conference remains faithful to its original idea of providing a platform to discuss dynamical systems, differential equations, singular perturbations, fractals, ergodic theory, image compression, scientific visualization, hyperbolic dynamics, visualization of complex dynamical systems, mathematical theory of control, computational intelligence, control for electric machines, fault detection, simulation, robotics, mechatronics, artificial intelligence 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

Fault Detection and Diagnosis of Distributed Parameter Systems based on Sensor Networks and Bayesian Networks



Professor Constantin Volosencu

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Abstract: This paper presents some scientific solutions of the way to use Bayesian networks in the applications of fault detection and diagnosis in distributed parameter systems, using intelligent ad-hoc wireless sensor networks. They may be placed in the areas of distributed parameter systems and they may be seen as distributed measuring sensors for the physical variables of distributed parameter systems. Fault detection and diagnosis in distributed parameter systems became more easily and more performing using these concepts. The paper presents some applications in fault detection and diagnosis based on fuzzy logic and artificial neural networks. Fuzzy logic allows the treatment of physical variables by human reasoning on operator knowledge, with fuzzy concepts of membership functions. Neural networks allow treatment of large and complex systems with many variables by learning and extrapolation. Using sensor networks multivariable estimation techniques may be applied in distributed parameter systems.

Brief Biography of the Speaker:

Constantin Volosencu is a professor at “Politehnica” University of Timisoara, Romania, Faculty of Automatics and Computers, Department of Automatics and Applied Informatics. He graduated “Traian Vuia” Politechnic Institute of Timisoara, Romania in 1981 as an engineer in automatics and computers. He is doctor in automatics at “Politehnica” University of Timisoara, Romania.

Prof. Constatin Volosencu has researches in the field of linear control systems, fuzzy control, neural networks, control of electrical drives, system identification, sensor networks and distributed parameter systems. He is author of author of 10 books, over 130 scientific papers published in journals and conference proceedings and 27 patents. He managed over 30 international and national research projects.

From 1982 to 1991 he worked as a researcher and designer at “Electrotimis” enterprises in the filed of electrical drives. He developed electrical equipments for machine tools, spooling machines, high power ultrasonic installations and other.

Member of the Editorial Review Board of Computer Science, Computer Engineering, BCIS, MIS of Scientific Journals International.

Member of Authors Advisory Board at Journal of Biochemical Technology, Sevas Educational Society. Referee at Journal of Control Engineering and Applied Informatics, Bucharest.

IEEE member of Control Systems Society and Computational Intelligence Society. Member of S.R.A.I.T and S.I.E.A.R. Romania. Onorific member of WSEAS.

Plenary Lecture 2

On the Shock Caused by the Collision of Railway Vehicles



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Abstract: The shock caused by the collision of railway vehicles determines the transmission of forces and accelerations to the vehicles, with unwanted consequences. In order to diminish the effects of the shock, railway vehicles are equipped with shock insulators. A personal theoretical approach is presented, completed by a series of experimental studies on the efficiency of the elastic elements of buffers and long displacement dampeners, in regards to the diminishing of the response amplitude of the mechanical system formed by the vehicles that take part in the collision.

The energy characteristics of the shock caused by collision of railway vehicles are described, a personal computation method of the force transmitted during collision, original force transducer solutions used in order to determine the force transmitted during collision.

The time evolutions of the kinematic and dynamic parameters (displacement, velocity, acceleration) of the vehicles during the shock are presented and the unwanted consequences of the shock caused by collision are discussed in regards to the resistance of the bearing structures, the equipment and the integrity of the transported freight.

Brief Biography of the Speaker:

Ion Copaci graduated from the "Traian Vuia" Polytechnic Institute in Timisoara, Romania, Faculty of Mechanics. He received his Ph.D. in the field of Mechanical Engineering with the thesis „Contributions on the Behaviour of the Bearing Structures of Railway Cars During the Longitudinal Shock Caused by Collision”, presented at the "Politehnica" University Timisoara, Faculty of Mechanics, Department of Rolling Stock.

Technical Experience: research in the area of vibrations and shocks on railway vehicles (rolling quality, repeated shock), bearing structure resistance (lifetime, fatigue), elastic elements that equip the suspension or shock insulators of railway vehicles, torsional rigidity and travel safety, quantitative determinations (MATHAR) of the internal stresses on the bearing structures of bogies and Francis turbine rotors. Contributions and experimental research for the promotion on the railway of over 150 freight and passenger railway car prototypes, in almost 30 countries on 5 continents, as a result of over 30 years of research.

Nowadays he is a Professor at the Faculty of Engineering of "Aurel Vlaicu" University, Arad, Romania.

Field of specialization: Railway Transport Vehicles, with disciplines taught: "Dynamics of Railway Vehicles" and "Experimental Research on Railway Vehicles".

He has published over 120 research papers, 7 books and 4 inventor's licences.

He is a member of 6 societies and professional associations and he is a member of the Ukrainian Academy of Science.

Plenary Lecture 3

Variable Structure Control and Time-Delay Systems: A Survey



Professor Elbrous M. Jafarov
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Abstract: It is well known that the variable structure control is now recognized as one of the powerful robust tools for solving control problems of uncertain linear and nonlinear dynamical systems subject to parameter perturbations, unmodeled dynamics, external disturbances, and time-delay effects.

Several fundamental monographs and books have been written on the various aspects of the variable structure control and time-delay systems, and their world wide applications in various industrial and manufacturing systems since 1960's. Recent advances and some new results on the stability analysis and robust sliding mode control of multivariable uncertain dynamical systems with and without time-delay are systematically presented in this survey. The materials of this survey are original, which are obtained by the author in the past decade in Istanbul Technical University. The survey is not only a collection of the authors' original papers, but also the latest results on variable structure theory and time-delay systems obtained by other authors and colleagues are systematically used in general framework of control theory.

From the brief historical outline of development of variable structure control presented in the survey, it can be seen that significant contributions to the variable structure control has been made by researchers of this control field:

- 1) Parameters optimization of variable structure control constrained by stability and sliding mode existence conditions
- 2) Development of new set of pneumatic variable structure P, PI, PID, universal, multistrukture, adaptive controllers and systems confirmed by 27 Soviet patents
- 3) Industrial confirmations and applications of sliding mode controllers with chattering in process control actuated by membrane control valves for the first time.

A key issue in the analysis and design of feedback control systems is the stability and robustness of the resulting closed-loop system. That is the problem of controlling uncertain linear and nonlinear systems without or with time-delay subject to external disturbances is a basic topic that is situated in the center of interest of control researches and engineers. One approach to solving this problem is by using principles and methods of variable structure control.

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 then he received his first class Honors Degree Electro-Mechanical Engineering Diploma (M.Sc. Degree) in Faculty of Automation of Manufacturing Processes 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 and Systems Engineering in 1987. He was visiting Professor at Beijing Aeronautical and Astronautical University (BUAA), in 1993, 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 the book 'VARIABLE STRUCTURE CONTROL AND TIME-DELAY SYSTEMS' published by WSEAS Press 2009 and 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, quantum physics, poetry and Sufism. He is married and has two daughters.

Plenary Lecture 4

Metal Forming Process Control based on Reduced Order Model



Professor Catalina Maier

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Abstract: Sheet metal stamping is an important manufacturing process because of its high speed and low cost for mass production. The control of flow of material into the die cavity is crucial to good part quality and consistency. Different solutions are developed in this field: i). MPF – multi-point forming is a flexible manufacturing technique for the forming of 3D surfaces of the sheet metals; MFR is dividing the curved surface of the die into many discrete pins, using many punches instead of the traditional die, and each punch can be controlled by computer; ii). DDF – digitized-die forming is a method to form the part section by section and this technique makes it possible to manufacture large-size parts in a small DDF press; iii). VP-DDF – Varying path DDF consist in a continuous variation of the shape of the digitized-die during the forming process, using a geometrical criteria; iv). Multi-step DDF is approximate to VP-DDF; in this technique the forming process is completed through many forming steps and the final deformation of the parts is accumulated by a series of small deformations in each step; because of the small deformation of the sheet, the forming defects such as wrinkling, tearing and dimpling can be avoided completely; v). Closed-loop forming system was build by combining DDF with rapid 3D-shape measurement system. All this techniques assure the control of the forming process by geometrical criteria and those can be applied for particular shape of the parts. The main objective of this paper is to present a new method for metal forming process control based on reduced order modelling. The reduced order model is obtained considering the material response during the metal forming process and assure the real-time control. Identification of the reduced order model parameters is made considering a data base obtained by finite element simulation and experimental tests.

Brief Biography of the Speaker:

Dr. Maier graduated Faculty of Mechanical Engineering of University Dunarea de Jos of Galati in 1979, and she obtained the title of Doctor Engineer in 1997. In the next year, Dr. Maier was awarded with a post-doc grant of The Mechanical and Thermodynamical Materials Properties Laboratory – LPMTM, University Paris 13, France. Since 1983 she followed the academic carrier at Dunarea de Jos University of Galati as researcher associate professor and professor. Dr. Maier was a visitor scientist of The University Paris13, France and, in the period 2000-2003 she was visiting professor in The Mechanical and Thermodynamical Materials Properties Laboratory of the Galilee Institute, University Paris 13, France. Research fields are connected with characterisation, modelling and control of the nonlinear behaviour of materials undergo to large plastic deformations, multiscale modelling of the materials under large plastic deformation within manufacturing the parts by metal forming, integrated system researches of the body cars. In the mentioned subject, Dr. Maier published 53 articles in journals and international conferences proceedings, she is author and co-author of 8 books and she delivered 7 invited conferences in France. The research was done as director or member of 38 research contracts financed by European Commission and Romanian Ministry of Education and Research. The strong cooperation with The Mechanical and Thermodynamical Materials Properties Laboratory – LPMTM, University Paris 13, France contributed to the enhancement of the research studies on modelling the material behaviour within metal forming. Dr. Maier is a member of international scientific societies as follows: European Scientific Association of Materials Forming - ESAFORM, since 1997, Society of Automotive Engineers of Japan, since 2006.

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