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# RECENT ADVANCES IN SYSTEMS THEORY & SCIENTIFIC COMPUTATION

PROCEEDINGS OF THE 9TH WSEAS INTERNATIONAL CONFERENCE  
ON SYSTEMS THEORY AND SCIENTIFIC COMPUTATION  
(ISTASC'09)

Moscow, Russia, August 20-22, 2009

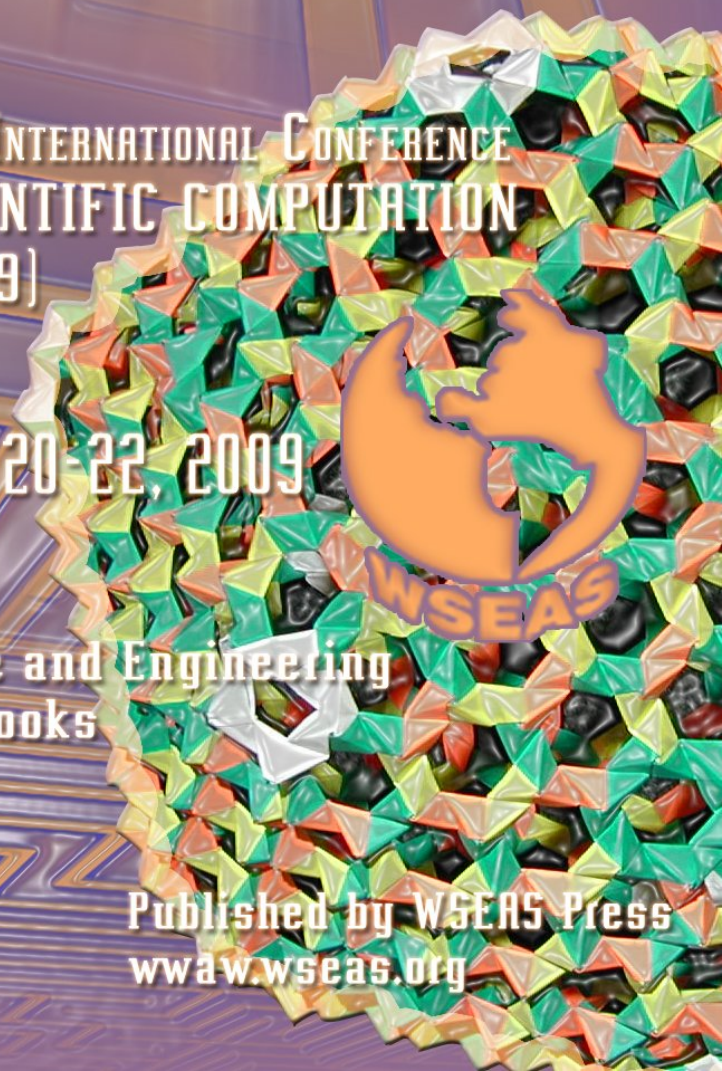
Mathematics and Computers in Science and Engineering  
A Series of Reference Books and Textbooks

ISBN: 978-960-474-109-0

ISSN: 1790-2769

Published by WSEAS Press

[www.wseas.org](http://www.wseas.org)



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All papers of the present volume were peer reviewed by two independent reviewers. Acceptance was granted when both reviewers' recommendations were positive.  
See also: <http://www.worldses.org/review/index.html>

ISSN: 1790-2769  
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**Preface**

This year the 9th WSEAS International Conference on SYSTEMS THEORY AND SCIENTIFIC COMPUTATION (ISTASC '09) was held in Moscow, Russia, in August 20-22, 2009. The Conference remains faithful to its original idea of providing a platform to discuss dynamical systems, control systems, simulation, modelling, dynamical systems and chaos, virtual reality, matrix theory, tensor analysis, linear and multilinear algebra, iterative methods, combinatorics and graph theory 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](http://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

### Nonlinearity and Uncertainty Issues for Concurrent Design and Control of MEM Systems



**Dr. Ahmet Kuzu**

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**Associate Professor Seta Bogosyan**

UAF, Electrical and Computer Eng. Dept.,  
University of Alaska Fairbanks,  
USA

**Abstract:** In this lecture, we will outline nonlinearity and uncertainty sources common to most MEMS systems, and propose control solutions for these uncertainties. Moreover, the concurrent design of MEMS with the consideration of these uncertainties will be discussed. It is a well-known fact that all MEMS structures face some nonlinear effects because of the nature of electrostatic force, coulomb friction and elasticity. Moreover, MEMS processes also include high tolerances which cause high uncertainties in structural parameters, such as in the dimension of beams, and physical parameters, such as viscous friction coefficients, which all affect the system response. Therefore, nonlinear robust control techniques, such as sliding mode control and nonlinear H-inf control, are gaining increased attraction in the control of MEMS devices, by providing rejection against matched nonlinearities and uncertainties. In this study, firstly nonlinearity sources and tolerance effects in MEMS are discussed. Next, several robust nonlinear techniques are discussed to address this problem and system performances under such robust methods are compared with those obtained with classical control methods. Finally, concurrent design methodology considering those issues is introduced.

**Brief Biography of the Speakers:** Ahmet KUZU has received his B.Sc. degree in electronics and telecommunication engineering in 2003, M.Sc. Degree in mechatronic engineering in 2006 from Istanbul Technical University, and has been a Ph.D candidate in electrical and control engineering at the same university. He is a Senior Researcher at Turkish Scientific and Technological Research Council, where he has worked since 2004. His research interests are design and control of multidisciplinary systems such as MEMS, NEMS, avionics and biomedical systems. He has authored 10 journal and conference and 3 patent and utility model application. He is PI to several government funded research grants.

Seta Bogosyan has received her B.Sc., M.Sc. and Ph.D degrees in electrical and control engineering from Istanbul Technical University, Turkey in 1981, 1983, and 1991, respectively. She conducted her PhD studies at the Center for Robotics in University of California at Santa Barbara, where she worked as researcher and lecturer between 1987 and 1991. Between 1992 and 2003, she worked as associate professor at Istanbul Technical University and is currently associate professor at the Department of Electrical and Computer Engineering in the University of Alaska Fairbanks, USA

Her research interests are nonlinear control and estimation techniques for electromechanical systems with applications in direct-drive systems, sensorless control of induction motors, hybrid and autonomous vehicles, bilateral systems and remote robotics. She has authored over 80 journal and conference publications and a book on modeling and control of induction motors. She is PI to several NSF, NATO, and other federally funded research grants. She is associate editor of International Journal of Intelligent Automation and Soft Computing and IEEE Industrial Electronics Society (IES) Magazine. She is also an AdCom member and currently, Vice President of IES in Membership Activities since January, 2006.

## Plenary Lecture 2

### Linear and Nonlinear Filtering in Mathematical Finance



#### Dr. Paresh Date

Center for the Analysis of Risk and Optimisation Modelling Applications  
Department of Mathematical Sciences  
Brunel University, UB8 3PH  
UK

Email: [Paresh.Date@brunel.ac.uk](mailto:Paresh.Date@brunel.ac.uk)

**Abstract:** The problem of filtering unobservable or latent variables from noisy data arises naturally in many financial applications. This talk will provide a broad overview of time series filtering, with an emphasis on the theory of affine Gaussian filtering (or Kalman filtering) of discrete time series data. Empirical work is presented on two specific filtering applications in finance: modelling the short rate using observed bond yields and modelling the daily volatility of stock price based on the observed intra-day data. The talk concludes with an outline of recently proposed approximate filtering methods for nonlinear time series.

**Brief Biography of the Speaker:** Dr Date completed his doctoral studies in systems theory at University at Cambridge, UK. He joined Brunel University, UK as a lecturer in mathematical sciences in 2002, where he is now a senior lecturer. Dr Date has published over 20 refereed papers in the areas of uncertainty modelling, calibration and filtering, with a special emphasis on financial applications. He has held visiting positions in India, Canada and Australia and has given invited talks at several UK and overseas Universities on topics in systems theory. He is an Associate Editor of IMA Journal of Management Mathematics.

## Plenary Lecture 3

### Multitime Dynamic Programming for Curvilinear Integral Actions



**Professor Constantin Udriste**  
Department of Mathematics  
University Politehnica of Bucharest  
Romania  
E-mail: [anet.udri@yahoo.com](mailto:anet.udri@yahoo.com)

**Abstract:** This paper introduces a new type of dynamic programming PDEs for optimal control problems with performance criteria involving curvilinear integrals. The main novel feature of the multitime dynamic programming PDEs, relative to the standard Hamilton-Jacobi-Bellman PDEs, is that they are connected to the multitime maximum principle. In other words, we present an interesting and useful connection between the multitime maximum principle and the multitime dynamic programming, characterizing the optimal control by means of a PDEs system that may be viewed as a feedback law. In the case of performance criteria involving curvilinear integrals with quadratic integrands, the new equations lead to multitime variants of the Riccati equation.

Section 1 shows how a multitime control dynamics determines the multitime Hamilton-Jacobi-Bellman PDEs via the value function. Section 2 describes a two-time dynamics with nine velocities. Section 3 describes the connection between multitime dynamic programming and the multitime maximum principle. Section 4 analyzes the linear regulator problems.

#### **Brief Biography of the Speaker:**

Important Career Positions: Dean, Director, Chair, Full Professor 1990-, University Politehnica of Bucharest, Department of Mathematics.

Number of PhD Students: 25 in due time and 13 Doctors in Mathematics.

Membership of Associations: AMS, 1987; Tensor Society, 1985; Balkan Society of Geometers, President, 1994;

Publications: over 40 books; 200 papers; 200 communications.

Honors: D. Hurmuzescu Prize, Romanian Academy, 1985; Award MEI, 1988; Correspondent Member, Academia Peloritana, Messina, 1997; Titular Member, Academy of Romanian Scientists, 2007; Honorary Member, World Scientific and Engineering Academy and Society, 2008-;

Organizer: The International Conference of Differential Geometry and Dynamical Systems, University Politehnica of Bucharest, October 5-7, 2007; 7th WSEAS International Conference on Systems Theory and Scientific Computation (ISTASC'07), Vouliagmeni Beach, Athens, Greece, August 24-26 (2007); European Computing Conference, Vouliagmeni Beach, Athens, Greece, September 24-26, 2007; 12th WSEAS International Conference on Applied Mathematics, Cairo, Egypt, Dec. 29-31, 2007; 7th WSEAS International Conference on Circuits, Systems, Electronics, Control and Signal Processing, Cairo, Egypt, Dec. 29-31, 2007; Chair-Committee: American Conference on Applied Mathematics (Math'08) and Management, Marketing and Finances (MMF'08), Cambridge, Massachusetts, USA, March 24-26, 2008; International Program Committee: The Applied Computing Conference (ACC-08), Istanbul, Turkey, May 27-30, 2008.

Fields of Interest: Differential Geometry, Optimizations on Riemannian Manifolds, Magnetic Dynamical Systems, Geometric Dynamics.

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