Editors: Nouras Barbu Lupulescu, Snejana Yordanova, Valeri Mladenov

Recent Researches in Neural Networks, Fuzzy Systems, Evolutionary Computing & Automation

- 12th WSEAS International Conference on Neural Networks (NN '11)
- 12th WSEAS International Conference on Fuzzy Systems (FS '11)
- 12th WSEAS International Conference on Evolutionary Computing (EC '11)
- 12th WSEAS International Conference on Automation & Information (ICAI '11)

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Transilvania University of Brasov, Romania, April 11-13, 2011

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Preface

This year the 12th WSEAS International Conference on NEURAL NETWORKS (NN '11), the 12th WSEAS International Conference on FUZZY SYSTEMS (FS '11), the 12th WSEAS International Conference on EVOLUTIONARY COMPUTING (EC '11) and the 12th WSEAS International Conference on AUTOMATION & INFORMATION (ICAI '11) were held at the Transilvania University of Brasov, Romania, April 11-13, 2011. The conferences provided a platform to discuss mathematical foundation of neural networks, neural network software, mathematical foundation of fuzzy logic, fuzziness and statistics, mathematical foundation of genetic algorithms and evolutionary computing, evolution strategies, differential evolution, artificial life, digital organisms, circuits and systems, network theory and applications, signal processing, automatic control and robotics, machine learning, numerical analysis, microprocessors, computer architecture etc. with participants from all over the world, both from academia and from industry.

Their 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 these conferences 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.

Conferences such as these 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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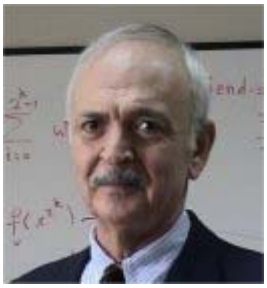
Keynote Lecture

Fluctuation Free Matrix Representation in Expectation Value Dynamical Issues and their Applications



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Abstract: Parabolic partial differential equations are encountered in many diverse fields of science and engineering and even managerial sciences, like classical or quantum wave propagations, nonequilibrium statistical mechanics, probabilistic and stochastic issues. In these aspects, they are unignorable components of the modellings in research areas like chemistry, biology, and even business and economy. These types of equations are generally first order in one coordinate which may be regarded as time and second order in some other coordinates which may be called space coordinates by following the most frequently encountered cases of modelling. Their first order temporal nature enforces them to be accompanied by an initial condition while certain boundary conditions should be imposed on spatial coordinates because of the ellipticity in their operator structures on spatial coordinates. Ellipticity means boundary value problem nature and therefore the expansions on certain orthonormal basis functions in appropriately defined Hilbert spaces can be used as the basic mathematical tools to construct the solutions. To this end the unknown solution can be considered as an infinite linear combination of the basis function varying in spatial coordinates only, with temporally changing linear combination coefficients. A complete set of basis functions in Hilbert space enables us to use the linear combination coefficients of a function as its matrix (or vector in a better terminology) representation. The linear operators mapping from the considered Hilbert space to the same space can also be given via their matrix representations. Matrix representations are important because they convert the abstractness of the Hilbert spaces to the concreteness of the Cartesian spaces. A mapping from a Hilbert space to itself can be described by an appropriately defined linear operator while its matrix representation arises as a tool mapping from a corresponding Cartesian space to itself. Thus elliptic PDE nature mapping from an appropriately defined Hilbert space to itself becomes a transformation by a matrix from a corresponding Cartesian space to itself by removing PDE related problematic issues from the scene and leaving us with the pleasent environment of the theory of matrices and linear algebra.

A parabolic PDE describes an evolution in one coordinate we call time, and therefore, it somehow defines a dynamical change, or in mechanical terminology, motion. When we use the matrix representation for the solution and elliptic part of the PDE under consideration time derivative of the unknown function becomes the time derivative of the vector coming from the unknown function's matrix representation whereas the elliptic part of that PDE becomes a time variant matrix when its matrix representation is used. Therefore the PDE and the accompanying boundary conditions define an infinite set of ODEs accompanied by an initial condition whose given vector function value at the beginning of the time comes from the matrix representation of the initial value function of the PDE. This infinite set of ODEs can be solved under the initial vector condition. However this may be considered as a formidable task because of the infinite dimensionality and we intend to truncate those ODEs appropriately to get an approximation. The numerical efficiency of this truncation based methodology completely depends on how the basis functions are constructed. This issue depends on rather modelling nature of the PDE under consideration.

What we have mentioned above is basically for the case of linear elliptic operator including PDEs. When the nonlinearity comes to the scene the matrix representations may become complicated and the tools of linear space may not work. Although there are of course some possibilities for these cases, they will be kept out of the content of this presentation.

Even in the linear case of ODEs the dimensionality may become an unpleasent problem if it grows undesiredly. Those cases can be treated in a different way by using fluctuation free matrix representation and the dimensionality growth can be suppressed accordingly in many cases. The fluctuation free matrix representation is based on fluctuationlessness theorem conjectured and proven by the presenter. It states that the matrix representation of an algebraic function operator which multiplies its operand with the function under consideration in the operator definition, is equivalent to the image of the universal matrix which is the matrix representation of the independent variable operator multiplying its operand by the independent variable, under the abovementioned function, over the same basis function set. This equivalence holds when the set is complete to span entire Hilbert space wheras any

incompleteness coming from the usage of a subset of the complete basis function set destroys this equivalence. However, even in the case of incompleteness, the deviation from the equivalence come from the fluctuation terms which are related to the differences of the matrix representations of powers of the independent variable from the same power of the matrix representation of the independent variable alone. These fluctuation terms may tend to quite rapidly vanish when the considered set approaches or gets close to the whole basis set. Hence theorem dictates the equivalence for all cases when all fluctuations are ignored. This theorem enables us to simplify the matrix representation of the PDE's elliptic part at the threshold of fluctuation free representations and therefore to construct good quality approximations. Talk will be about these issues up to certain details which can be given as much as time allows.

Brief Biography of the Speaker:
Metin Demiralp was born in Turkey on 4 May 1948. His education from elementary school to university was entirely in Turkey. He got his BS, MS, and PhD from the same institution, Istanbul Technical University. He was originally chemical engineer, however, through theoretical chemistry, applied mathematics, and computational science years he was mostly working on methodology for computational sciences and he is continuing to do so. He has a group (Group for Science and Methods of Computing) in Informatics Institute of Istanbul Technical University (he is the founder of this institute). He collaborated with the Prof. Herschel A. Rabitz's group at Princeton University (NJ, USA) at summer and winter semester breaks during the period 1985–2003 after his 14 months long postdoctoral visit to the same group in 1979–1980. Metin Demiralp has more than 90 papers in well known and prestigious scientific journals, and, more than 170 contributions to the proceedings of various international conferences. He gave many invited talks in various prestigious scientific meetings and academic institutions. He has a good scientific reputation in his country and he is one of the principal members of Turkish Academy of Sciences since 1994. He is also a member of European Mathematical Society and the chief–editor of WSEAS Transactions on Computers currently. He has also two important awards of turkish scientific establishments. The important recent foci in research areas of Metin Demiralp can be roughly listed as follows: Fluctuation Free Matrix Representations, High Dimensional Model Representations, Space Extension Methods, Data Processing via Multivariate Analytical Tools, Multivariate Numerical Integration via New Efficient Approaches, Matrix Decompositions, Multiway Array Decompositions, Enhanced Multivariate Product Representations, Quantum Optimal Control.

Plenary Lecture 1

Fault Detection and Isolation using Neuro-Fuzzy Systems

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Abstract: Intelligent systems have been widely used in many industrial applications such as: Control systems, Identification, Pattern recognition and fault detection and diagnosis; being fault detection one of the most developed area cause of it direct incidence on productivity and security. Artificial Neural Networks and Fuzzy systems have been some of the Artificial Intelligence techniques that have been used for these activities.
Some of the reasons for using Artificial Neural Networks are: Can “Learn” from historical data, so they can be used as associative memories. they have great generalization capabilities, so they can give accurate outputs for input patterns different that the used in the training phase. They can be used with corrupt or incomplete data, because the “knowledge” is spread over the networks interconnection weights. Can give input/output maps from data without apparent relation. They are easy for computer implantation. There exist a great number of learning algorithms that can be used for specific problems.
On the other hand, fuzzy logic emulates the human classification capabilities using multivaluated criteria instead of the classical binary logic used in computational environments. Fuzzy logic creates some fuzzy sets which are described using linguistic labels and a membership level with values between [0,1] according to the real partial belonging to each of the created fuzzy sets. In this plenary speech it will be presented fault detection schemes based on diverse Neuro-Fuzzy configurations. It will be also presented some industrial examples.

Brief Biography of the Speaker:
Francklin Rivas-Echeverria Systems Engineer, MSc. in Control Engineering and Applied Science Doctor. Full professor in Control Systems Department, at Universidad de Los Andes, Venezuela. He has been invited professor in the Laboratoire d'Architecture et d'Analyse des Systemes (LAAS, Toulouse-France) and some Venezuelan and international Universities. He has also been technical advisor for “Venezuelan Oil Company” (PDVSA), “Aluminum Venezuelan Company” (VENALUM), “Steel Venezuelan Company” (SIDOR), Trolleybus System in Venezuela (TROLMERIDA). He has created and is the Director of the Intelligent Systems Laboratory and is the head of the University consulting unit (UAPIT-ULA). Over 180 publications in high level conferences and journals: the main topics of his papers are: Artificial Intelligence, Intelligent Control, Automation Systems and Industrial Applications. He has applied his results to many fields: Processes Control and Supervision, Oil production, Steel production processes, among others. Also, has developed several tools for automatic control teaching. He is coauthor of two books concerning Artificial Intelligence and Nonlinear Systems.

Plenary Lecture 2

Monitoring Distributed Parameter Systems Based on Expert Systems and Sensor Networks

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Faculty of Automatics and Computers
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Abstract: The paper presents an expert system developed for the monitoring process of the distributed parameter systems. The information from these systems is obtained using sensor networks and estimation techniques. The problem is formulated in the frame of the uncertainties of a specific distributed parameter system, as the heat transfer. A knowledge base is developed using human expertise on the distributed parameter system. The expert system is implemented in real time, using virtual instrumentation and it is placed in the real distributed parameter system, as a suplimentary information system.

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" Polytechnic Institute of Timisoara, Romania, in 1981, as an engineer in automatics and computers. He has a doctorate in automatics at "Politehnica" University of Timisoara, Romania.
Prof. Constantin 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.
Author of 10 books, over 130 scientific papers published in journals and conference proceedings and 27 patents. Manager of over 30 international and national research projects.
From 1982 to 1991 he worked as a research and design engineer at "Electrotimis" Enterprises Timisoara, Romania in the field of electrical drives. He developed electrical equipments for machine tools, spooling machines, high power ultrasonic installations and other.
Member of the Editorial Review Board for computer science, computer engineering, BCIS and MIS at Scientific Journals International SJI, member in the Authors Advisory Board at Journal of Biochemical Technology, member of the editorial board of Journal of Computer Science and Information Technology JCSIT.
Member in scientific committees and chair at international conferences.
Member of the following professional associations: S.R.A.I.T. and S.I.E.A.R Romania, IEEE Control System Society and Computational Intelligence Society, ACM.
In the frame of WSEAS prof. Constantin Volosencu is author of 18 papers published at WSEAS conferences and 8 papers published in WSEAS transactions. He was plenary speaker at the following WSEAS conferences: 9th Int. Conf. on Automatics & Information (ICAI'08), Bucharest, Romania, 2008, 8th Int. Conf. On Simulation, Modeling and Optimization (SMO '08), Santander, Spain, 2008, 8th Int. Conf. on Signal Processing, Robotics and Automation (ISPRA '09), Cambridge, U.K., 2009, 10th Int. Conf. on Automation & Information (ICAI'09), Prague, Czech Rep., 2009, 11th Int. Conf. on Automatic Control, Modeling and Simulation (ACMOS '09), Istanbul, Turkey, 2009, 9th Int. Conf. on Simulation, Modeling and Optimization, (SMO'09), Budapest Tech, Hungary, 2009, 1st Int. Conf. on Manufacturing Engineering, Quality and Production Systems, (MEQAPS'09), Brasov, 2009.

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