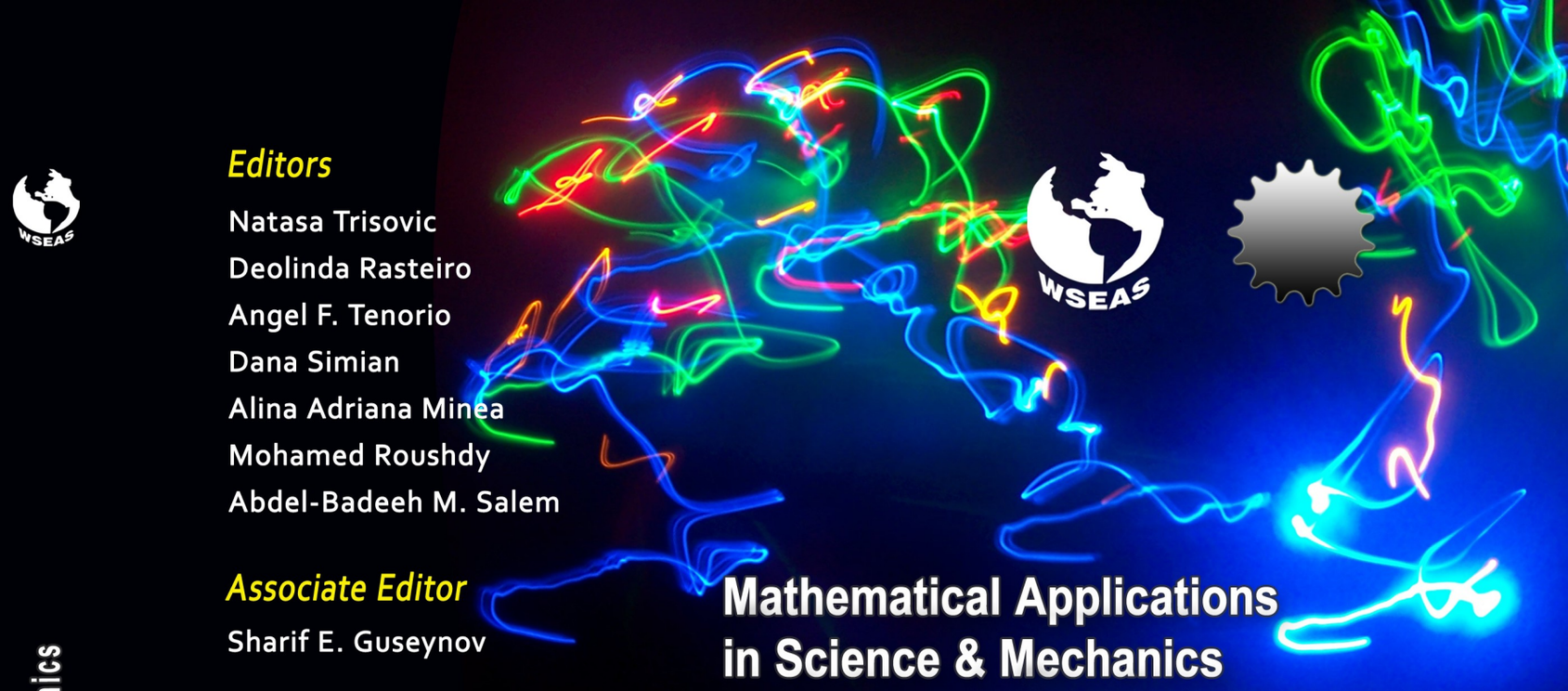

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Published by WSEAS Press
www.wseas.org

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All papers of the present volume were peer reviewed by no less that two independent reviewers. Acceptance was granted when both reviewers' recommendations were positive.
See also: http://www.worldses.org/review/index.html

ISSN: 2227-4588
ISBN: 978-960-474-305-6

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Plenary Lecture 1

The Response of Railway Vehicles' Mechanical Systems to Excitations Appearing During Travel

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Abstract: Land vehicles, especially road and railway vehicles, travel on a specific surface, with sufficient unique characteristics to demand a separate study. The research must define the nature of the excitations induced by the travel way into the mechanical system of the vehicle. Also, depending on the vehicle, a choice of elastic elements like shock and vibration absorbers is necessary such that the effect of excitations in the mechanical systems are diminished to an acceptable level. Support of the land vehicles is sufficiently similar to water in the case of naval transport or air for aerial transportation, such that the nature of excitations is, in most cases, similar. The study of shocks and vibrations in each case is beneficial to all vehicles, not depending on the support on which they travel. The plight of eartquakes is also a problem of dynamics which has faced engineers, mathematicians and physicists with the issue of reducing the response of a mechanical system to within acceptable boundaries (buildings, constructions that also suffer random loading due to wind, snow or other miscellaneous natures etc.). For towed railway vehicles, a research program follows a path and a content that must be rigorously adhered to and to which, following my personal experience in research. I shall further refer.

Brief Biography of the Speaker: Ion Copaci graduated from the "Traian Vuia" Polytechnic Institute in Timişoara, 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 Timişoara, 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 40 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 180 research papers, 7 books and 5 inventor's licences.
He is a member of 8 societies and professional associations and he is a member of the Ukrainian Academy of Science.

Plenary Lecture 2

Multi-Scale Nano-Mechanics

Professor K. M. Liew
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Abstract: Nano-mechanics has been emerging as a new researching domain that excited a considerable interest in the condensed-matter and materials research communities. Due to the difficulty in the theoretical and experimental investigations of nanostructures, numerical modeling and simulation play an important role in capturing their fine behavior and revealing their delicate properties. The particularity of nanostructure brings a challenge to the conventional computational method. For example, a simple nanostructure, such as a MWCNT, involves thousands of atoms that lead to too many degrees of freedom, and atom-based modeling method, such as molecular dynamic, consumes a huge amount of computational time. This fact also stimulated the exploration and development of the new computational techniques in the computational nano-mechanics, such as continuum modeling and multi-scale methods. This talk will address the applications of continuum and molecular dynamics models for modeling of carbon nanotubes. Numerical discretization of these continuum models and the developed multi-scale computational scheme will be discussed.

Brief Biography of the Speaker: Professor Liew jointed the City University of Hong Kong in 2005 as a Chair Professor of Civil Engineering. Currently he is the Head of the Department of Civil and Architectural Engineering. He was formerly a tenured professor at Nanyang Technological University, Singapore. His research activities encompass nano-mechanics, materials modeling, multi-scale analysis, and large-scale simulation and visualization. In recent years, he and his research group have been actively involved in the theoretical research of nano-materials, in particular CNTs, by employing molecular dynamics and continuum approaches, and multi-scale method. He has published over 550 journal articles. He is a Fellow of ASME and IMechE. His current h-index is over 50 and he is cited by the Institute for Scientific Information (ISI) as one of the highly cited researchers in engineering.

Plenary Lecture 3

Variational Principles for Topological Barotropic Fluid Dynamics

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Abstract: Barotropic fluid flows with the same circulation structure as steady flows generically have comoving physical surfaces on which the vortex lines lie. These become Bernoullian surfaces when the flow is steady. When these surfaces are nested (vortex line foliation) with the topology of cylinders, toroids or a combination of both, we show how a Clebsch representation of the flow velocity can be introduced. This is then used to reduce the number of functions to be varied in the variational principles for such flows. I introduce a three function variational formalism for stationary and non-stationary barotropic flows.

Brief Biography of the Speaker: Asher Yahalom is an Associate Professor in the Faculty of Engineering at the Ariel University Center of Samaria and the Academic director of the free electron laser user center which is located within the University Center campus. He was born in Israel on November 15, 1968, received the B.Sc., M.Sc. and Ph.D. degrees in mathematics and physics from the Hebrew University in Jerusalem, Israel in 1990, 1991 and 1996 respectively. From 1994 to 1998 Asher Yahalom worked with Direx Medical System on the development of a novel MRI machine as a head of the magneto-static team. Afterwards he consulted the company in various mathematical and algorithmic issues related to the development of the “gamma knife” - a radiation based head surgery system. In the years 1998-1999 Asher Yahalom joined the Israeli Free Electron Laser Group both as postdoctoral fellow and as a project manager, he is a member of the group ever since. In 1999 he joined the College of Judea & Samaria which became at 2007 Ariel University Center. During 2005-2006 on his first sabbatical he was a senior academic visitor at the institute of astronomy in Cambridge. Currently during his second sabbatical he is a visiting fellow of the Isaac Newton Institute for Mathematical Sciences also in Cambridge UK. Asher Yahalom works in a wide range of scientific & technological subjects ranging form the foundations of quantum mechanics to molecular dynamic, fluid dynamics, magnetohydrodynamics, electromagnetism and communications.

Plenary Lecture 4

Mechanical Design of Electrical Routing on Stretchable Substrate

Professor Hong Hocheng
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Abstract: Stretchable electrical devices, unlike solid and flexible electrical devices, possess high mechanical stretchability in plane that are essentally advantageous for innovative biomedical and textile applications. In last ten years, the design development of mechanics for stretchable electronics has been dedicated to solve for two problems: improving the conductivity while increasing the strain tolerance of the electrical routing. According to the adopted routing geometry and fabrication process, various designs can be divided into five patterns: straight; wavy; wrinkly; bridge-like; and conductive-elastomeric. The geometric function of a specified routing form can be analyzed by finite element simulation and the experimental tensile test. The authors find that the strain limit at wire-breaking is determined by width-to-radius ratio, route angle and wire thickness. Larger angle and thickness with lower width-to-radius ratio provide higher strain limit. The influences are examined and a mathematical function predicting the maximum strain is derived. Furthermore, a fabrication method incorporating the pre-strainis is proposed, that supplies higher stretchability for the electrical routing.

Brief Biography of the Speaker: Professor H. Hocheng earned his Diplom-Ing. from Technische Hochschule at Aachen and Ph.D. from University of California at Berkeley in mechanical engineering. He has been University Chair Professor at National Tsing Hua University. He received numerous national and international research awards and are Fellows of ASME and AMME. His research interest lies in the area of innovative materials processing technoogy.

Plenary Lecture 5

Pareto Optimum in Bayesian Games

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Abstract: The solutions provided by Game Theory are usually specific for different types of games and start from Nash solutions. The Nash equilibrium is specific for non cooperative static games in complete information, Perfect Subgame Equilibrium corresponds to non cooperative sequential games in complete and perfect information, Bayes-Nash equilibrium is specific for static non cooperative games in incomplete information and Perfect Bayes-Nash equilibrium for dynamic non cooperative games in incomplete information. A Nash equilibrium (or different forms of them) basically represents a set of strategies where each player tries to maximize his or her payoff depending on their own strategies and given the possible strategies of the others. Usually, there are not exists a direct relation between Nash equilibrium and Pareto optimal solutions (defining Pareto optimal solution as the state where it is not possible to improve the one player payoff without making the other players' payoff worse). One of the most important examples of this situation is Prisoner Dilemma, where Nash equilibrium is not Pareto optimal. But it is well known that every game has at least one Pareto optimal profile that is not necessary a Nash equilibrium). In the case of non cooperative static game in complete information there are a few games categories (like coordination games) where it is possible to implement Pareto optimum solutions as Nash equilibriums. The case of non cooperative games in complete and perfect information confirms the possibility to obtain Perfect Subgame Equilibrium outside Pareto optimal solutions. One particular situation is in the case of repeated (finite or infinite) games where it is possible to obtain both Pareto optimum and Perfect Subgame Equilibrium for the same set of strategies (under conditions established in folk theorem). Also the Perfect Bayes Nash Equilibriums that corresponds to dynamic non cooperative games in incomplete information usually do not correspond to Pareto optimum without specific constraints. Moreover, in the case of dynamic mechanism design games, it fails to be fully Pareto optimal and incentive compatible and is also not implementable as a perfect Bayes - Nash equilibrium of an extensive form game. The correspondence between Bayes-Nash equilibrium and Pareto optimum for static non cooperative games in incomplete information was less studied in literature. In our study we analyze different types of Bayesian games (like mechanism design games, moral hazard games, adverse selection games or auction games) and we verify the relation between Bayes – Nash equilibrium and Pareto optimum. The main result was that under incomplete information it is not possible to implement the Pareto optimum (or the first best optimum) simultaneously with Bayes – Nash equilibrium (that usually was the second best optimum).

Brief Biography of the Speaker: Mihai Daniel Roman is a full professor of Game Theory and Macroeconomics at The Faculty of Cybernetics, Statistics and Economic Informatics, The Bucharest University of Economic Studies, Romania. He received his master degree in 1994 at the Université de Sciences Sociales, Toulouse, France, specialization Quantitative Economics and the Ph. D. in 1997 at The Bucharest University of Economic Studies in the field of Economic Cybernetics. His scientific interests are primarily focused on Game Theory, Macroeconomics and Quantitative Economic Analysis. As a director, he has conducted more than twenty national research projects, he published more than thirty papers in international prestigious journals, he presented more than one hundred and twenty papers at international and national conferences and he wrote twenty four books. He is a member of the editorial board in six database indexed international journals. He is also the director of the Advanced Research Center for Microeconomic and Macroeconomic Cybernetic Analysis and he organized eight international conferences in the field of economic cybernetic analysis. Since 2012 he has been elected the Vice-president of The Bucharest University of Economic Studies Senate.

Plenary Lecture 6

Extenics Theory Applied to Robotics

Professor Luige Vladareanu
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Abstract: Extenics is a novel theoretical frame of matter element in the world leading science, which establishes the methodology of solving contradictory problems through the intelligent and innovative process in a formal, mathematical and logical way. Starting from the theoretical frame and having pillars the basic-element theory, extension set theory and extension logic, the special extension methodology are presented. The extensibility of matter-element including the divergent, conjugate, correlative, implicative and expansive nature are analyzed in robotics fields. The quantitative tools to solve the robotics contradictory problems based on extension set of extension mathematics are examined. Extension decision methods on robot control field are done by applying a series of comprehensive strategies using extension set and dependent function in order to transformations of goal matter-elements or condition matter-elements in consistency elements and rules of cognitive reasoning. The robotics intelligent control by extension theory and the basic concepts, structure and principles of extension control developed as the knowledge base, the characteristics pattern recognition, fusion of dependent degree on characteristic states, the measure pattern recognition, the adaptive mechanism, the control strategies as the main elements of the control system architecture. Finally, an advanced method is developed for solving contradictory problems in the motion control of autonomous robots by applying extension theory on a multi-dimensional space using non-linear attraction point principle and the network of attraction curves. The obtained results lead to development of a methodology that allows obtaining high level results for robot motion control using extended transformations onto the extension set and an optimization function generated by the extended dependence function in multidimensional space in comparison to the classical method using sequential logic matrices.

Brief Biography of the Speaker: Luige Vladareanu received Ph.D. degree in electronics field from the Institute of Solid Mechanics of Romanian Academy, in 1998. From 2003, Ministry of Education and Research, executive Department for Financing Superior Education and of Scientific University Research - High Level Expert Consulting for MEC/CNCSIS project, from 2003-2005, member of Engineering Science Committee of Romanian National Research Council, from 2005, Scientific Researcher Gr.I (Professor) of Romanian Academy, from 2009 Head of Robotics and Mechatronics Department of Institute of Solid Mechanics, Romanian Academy. His scientific work is focused on real time control in solid mechanics applied in robot trajectory control, hybrid position – force control, multi-microprocessor systems for robot control, acquisition and processing of experimental physical data, experimental methods and signal processing, nano-micro manipulators, semi-active control of mechanical system vibrations, semi-active control of magnetorheological dissipaters systems, complex industrial automations with programmable logical controllers in distributed and decentralized structure. He has published over 35 books and book chapters, 19 edited books, over 200 papers in journals, proceedings and conferences in the areas. Director and coordinator of over 15 grants of international and national research – development programs in the last 5 years, 15 invention patents, developing 17 advanced work methods resulting from applicative research activities and more then 60 research projects. He is the winner of the two Prize and Gold of Excellence in Research 2000, SIR 2000, of the Romanian Government and the Agency for Science, Technology and Innovation. 9 International Invention and Innovation Competition Awards and Gold of World's Exhibition of Inventions, Geneva 2007 - 2009, and other 9 International Invention Awards and Gold of the Brussels, Zagreb, Bucharest International Exhibition. He received "Traian Vuia" (2006) award of the Romanian Academy, Romania's highest scientific research forum, for a group of scientific papers published in the real time control in the solid mechanics. He is a member of the International Institute of Acoustics and Vibration (IIAV), Auburn University, USA (2006), ABI´s Research Board of Advisors, American Biographical Institute (2006), World Scientific and Engineering Academy Society, WSEAS (2005), International Association for Modelling and Simulation Techniques in Enterprises - AMSE, France (2004), National Research Council from Romania(2003-2005), etc. He is a PhD advisor in the field of mechanical engineering at the Romanian Academy. He was an organizer of several

international conferences such as the General Chair of four WSEAS International Conferences (http://www.wseas.org/conferences/2008/romania/amta/index.html), chaired Plenary Lectures to Houston 2009, Harvard, Boston 2010 and Penang, Malaysia 2010, Paris 2011 to the WSEAS International Conferences, is team leader of WSEAS scientific research project: Mechanics & Robotics Systems and is serving on various other conferences and academic societies.

Plenary Lecture 7

Deterministic and Stochastic Advertising Diffusion Models

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Abstract: The paper presents two advertising diffusion models described by systems of nonlinear differential equations, where a firm devotes a fixed proportion of sales to advertising. In the first model the customers go through a two-stage adoption process, from non-adopter to adopter under the influence of word-of-mouth and advertising. There is time delay in the advertising response. In the second model the customers go through a three-stage adoption process: non-adopter-thinker-adopter. The thinker population is exposed to advertisement and will become adopter after some delay. For both models, the deterministic and stochastic versions are described. First, for the deterministic models, the equilibrium points are analyzed. Also, the stability of the Hopf bifurcation is provided. For the linearized perturbed stochastic system, the differential equations for the square mean values are identified and their dynamics are studied. The last part includes numerical simulations and conclusions.

Brief Biography of the Speaker: Mihaela Neamtu was born in Timisoara (Romania) on 1971. She graduated in 1995 the Faculty of Mathematics, West University of Timisoara. In 2001 she obtained the title of Ph.D in mathematics. She followed a didactic career at the Faculty of Economics and Business Administration, West University of Timisoara, Romania and she is currently a professor. She has been a visiting Professor for short periods of time at The Nottingham Trent University, Economics & Politics (Great Britain) and Faculty of Mathematics, Bonn (Germany). Professor Mihaela Neamtu has over 70 articles published in Journals and Proceedings of the International Conferences and 5 monographs; she has been a regular referee of papers for several International Journals and a reviewer of Mathematical Reviews (MathSciNet). She has been participating in 12 multiannual grants (1 of them is international), in 9 as a member and in 2 as a director. Her main academic interests are in dynamical systems and applications in biology and economy.

Plenary Lecture 8

Neural Network and Fuzzy Logic Based Control of Induction Machines

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Abstract: Induction motors have been used as the workhorse in industry for a long time due to their being easy to build, highly robust, and having generally satisfactory efficiency. In addition, induction generators play an important role in renewable energy systems such as energy systems with variable-speed wind turbines.
The induction machine is a nonlinear multivariable dynamic system with parameters that vary with temperature, frequency and magnetic saturation. Considering that neural networks are capable of handling time varying nonlinearities due to their own nonlinear nature, they are suitable for application in induction machine systems. This lecture presents a brief review of applications of artificial neural networks and fuzzy logic for induction machines. Most applications of neuro and/or fuzzy theory in induction machine control systems focus on advanced controllers for speed, position or voltage, where the conventional PI controller is replaced by a neuro and/or fuzzy controller. Few other applications will also be shown in this lecture, such as: neural network-based speed estimator, neural network-based inverter control, applications of neural networks in waveform processing and delayless filtering, identification of machine parameters based on fuzzy/neural concepts and approaches for the efficiency improvement in induction machine systems. Some of the presented simulation and experimental results are obtained at the Research laboratory for Power Electronics of the Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture in Split, Croatia.

Brief Biography of the Speaker: Dinko Vukadinović received the B.E. degree from the University of Split, the M.E. degree from the University of Zagreb and the Ph.D. degree from the University of Split, Croatia, in 1997, 2002 and 2005, respectively, all in electrical engineering. In 1998, he joined the University of Split, Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture (FESB), Department of Electric Power Engineering as a junior researcher. In 2013, he became a Full Professor at the University of Split. In 2009, he was appointed Chair of Power Electronics and Control at the University of Split, FESB.
He is an Associate Editor of the Journal of Computer Science, Informatics and Electrical Engineering, and a member of the Editorial board of the Journal of Convergence Information Technology, Electrical and Electronic Engineering and International Journal of Innovative Research & Development.
His current research interests include induction machine control systems, power electronics, digital signal processors and artificial intelligence.
He has published one book and more than 20 papers in scientific journals and conferences. Also, he was the editor of two books published by Nova Science Publishers Inc.

Plenary Lecture 9

Application of Wavelet Transformation, Mathematical Statistics and Linear Equations for Spectral and Image Processing

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Abstract: Spectral and image processing depend on application and area where we have to use. Methods based on wavelet transformation, mathematical statistics and linear equations are proposed for feature extraction of objects in precision farming using spectral and image characteristics. Neural networks and Fuzzy logic are used for classification of the objects in quality groups.

Brief Biography of the Speaker: Tsvetelina Draganova is graduated with a M.S. degree in Automatics from University of Ruse, Bulgaria in 2001, and then with a M.S. degree in Computer Science and Technologies from University of Ruse, Bulgaria in 2003. She has a doctoral degree in the field of Automation from 2007. From 2007 she has been a faculty member of the Department of Automatics and Mechatronics at the University of Ruse, Bulgaria, serving as an assistant professor from 2007 to May 2012, and an associate professor since May 2012. The research interests of Tsvetelina Draganova include image processing, spectral data analysis, chemometrics, wavelet transformation, linear equations, neural networks, industrial networks and programmable logic controllers. She is author of a few books and more than 40 papers published in international journals and conference proceedings.