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# Mathematical Methods, System Theory and Control

**Proceedings of the 11th WSEAS International Conference on MATHEMATICAL METHODS, COMPUTATIONAL TECHNIQUES & INTELLIGENT SYSTEMS (MAMECTIS '09)**

**Proceedings of the 8th WSEAS International Conference on NON-LINEAR ANALYSIS, NON-LINEAR SYSTEMS AND CHAOS (NOLASC '09)**

**Proceedings of the 5th WSEAS International Conference on DYNAMICAL SYSTEMS and CONTROL (CONTROL '09)**

**University of La Laguna, Tenerife, Canary Islands, Spain, July 1-3, 2009**

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**Preface**

This year the 11th WSEAS International Conference on MATHEMATICAL METHODS, COMPUTATIONAL TECHNIQUES AND INTELLIGENT SYSTEMS (MAMECTIS '09), the 8th WSEAS International Conference on NON-LINEAR ANALYSIS, NON-LINEAR SYSTEMS AND CHAOS (NOLASC '09) and the 5th WSEAS International Conference on DYNAMICAL SYSTEMS and CONTROL (CONTROL '09) were held in the University of La Laguna, Tenerife, Canary Islands, Spain. The Conferences remain faithful to their original idea of providing a platform to discuss finite differences, finite volumes, fem, bem, variational calculus, stochastic systems, non-linear systems in science, chaos and chaotic behaviour, dynamical systems, differential equations, bifurcations, stability of matter, schroedinger operators, stability, observability, controlability, factorizability, reachability, linear control, non-linear 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

## System Biometric: A Door to the Security

**Professor Carlos Manuel Travieso Gonzalez**
Institutional Relations Vice-Dean
University of Las Palmas de Gran Canaria
Spain
Technological Centre for Innovation in Communications (CeTIC)
Higher Technical School of Telecommunications Engineering
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**Abstract:** In this article will be comment the different biometric systems and its real possibility for the its use on real applications. The advances of multimodal biometric systems and the new biometric system allow its use in different scenarios. The union of technology and the biometric business have increased its expansion.

**Brief Biography of the Speaker:** Dr. Carlos M. Travieso was born in Gran Canaria, Spain. He received the M.Sc. degree in 1997 in Higher Technical School of Telecommunication engineering from Polytechnic University of Catalonia (UPC), Spain. Also, he received Ph.D. degree in 2002 in the Department of Signal and Communications from ULPGC-Spain. He is associate-professor from 2001 in ULPGC on subjects about signal and image processing. He has published more than 110 papers, between journals and conferences. Besides, he has participated in 20 research projects with funds from Companies, PF7 and Spanish Government. His research lines include learning systems, pattern recognition and image and signal processing in different areas: biometric systems, biomedicine applications, OCR analysis, etc. Rewiever on different International Journals and Conferences, and he is member of IASTED Technical Committee on Image Processing.

## Plenary Lecture 2

# An Exponential-Fitting Method for the Quantum Corrected Equations

**Assistant Professor Ren-Chuen Chen**
Department of Mathematics
National Kaohsiung Normal University
Yanchao Campus: No.62, Shenjhong Rd., Yanchao Township
Kaohsiung County, 824, Taiwan (R.O.C.)
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**Abstract:** This paper deals with the numerical solution by an exponential-fitting method of the quantum corrected equations. The method is based on the exponential variation phenomenon of the carrier density in semiconductor devices. It allows the mesh requirements to be relaxed considerably. Numerical examples are solved to demonstrate the usefulness of this approach. The numerical results show that the method is efficient and accurate for the simulation of semiconductor devices.

**Brief Biography of the Speaker:**
Education:
Ph.D in Applied Mathematics, Department of Applied Mathematics, National Chiao Tung University, Taiwan (R.O.C.)
M.S. in Applied Mathematics, Department of Applied Mathematics, National Chiao Tung University, Taiwan (R.O.C.)
B.S. in Mathematics, Department of Mathematics, National Kaohsiung Normal University, Taiwan (R.O.C.)
Research Interests:
Numerical methods for PDEs
Scientific computation

## Plenary Lecture 3

# Internet and Network-based Healthcare: Performance Analysis and Improvements

**Dr. Seyed A Shahrestani**
School of Computing & Mathematics
University of Western Sydney
AUSTRALIA
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**Abstract:** eHealth covers the Information and Communication Technology (ICT) related interaction between healthcare professionals and the system clients. It can also include telemedicine services, systems for monitoring and assisting patients and health information networks. Health ICT industry can become the third largest industry in the health sector with a global turnover of €50-60 billion. In particular, telemedicine and homecare is the sector with the greatest prospective for clinical and financial impact. To see why, it can for instance be noted that chronic diseases are responsible for 60% of all deaths. In Europe, over 70% of healthcare costs are spent on chronic diseases. As the risk of chronic disease increases with age, problems will be exacerbated due to world aging population. A clearly advantageous method of dealing with chronic diseases relies on network-based care. It can be based on collecting metrics from biomedical devices used by patients in their homes or other settings and using the communication networks to transmit them to a clinical facility. There are many other promising techniques that can benefit from network-based healthcare. Although the advantages of these techniques are rather obvious, they have not yet enjoyed widespread acceptance and deployments. Many studies have been carried out to identify the reasons for that. Several of these reasons are at least implicitly related to the underlying communication networks and the Internet characteristics. The heterogeneous nature of the Internet, along with its intentional lack of central control and loose hierarchy pose many challenges for its management. In this work, a framework for analysis and management of such complex systems is presented. In particular, the advantages of utilizing these approaches to improve the overall performance of Internet and network-based healthcare systems for a wide range of operating conditions are discussed.

**Brief Biography of the Speaker:** Dr Seyed Shahrestani has received his PhD in Electrical and Information Engineering from University of Sydney. He is currently a Senior Lecturer with the School of Computing and Math, University of Western Sydney. He has established partnerships and collaborations with several researchers and groups in different universities and industries. His main teaching and research interests are in the areas of telecommunication and computer networking, chaos analysis and management, nonlinear control theory, complex system analysis and control, artificial intelligence, network management, cooperative management and health ICT. He has numerous publications in these areas and has served on the editorial board and technical committee for several international conferences and reputable journals. He has also delivered keynote speeches at many international conferences and industry colloquiums.

## Plenary Lecture 4

# Biomimetic Modeling – A New Engineering Challenge in Nanostructured Material Fabrication

**Professor Mihaela Banu**
Manufacturing Science and Engineering Department,
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**Abstract:** The use of biomimetic approach to modeling the mechanical behaviour of the material during its processing within bulk nanostructuring processes allows developing batch manufacturing production for this class of processes. An efficient control of the process parameters with known implications on the material structure changes provides prediction of the mechanical properties with time-varying loads. In this way, we begin to transform crystalline materials into the mechanical products with desired properties, to understand the atom causes of their failings, to build into them safeguards against such failure, and to arrive at true yardsticks of ultimate performance.
The biomimetic model is obtained through a selective set of observations of the biological models, as protein kinetics. Furthermore, this model is applied to the control of the mechanical behaviour of the crystalline materials that are undergone to large deformation processes similar with the bulk nanostructuring processes. Knowing the relation between the input and output parameters, a parametric schedule of the nanostructuring cycle applied to the crystalline work materials could be developed for an oriented product to desired properties. The variables of the parametric schedule are those variables through which the manufacturing process is controlled, and the model parameters are state variables that react to the external loads and perturbations associated to the manufacturing process.
A case study referring to the modelling of the assembly material-process-product within multidirectional shearing of the bulk work materials is presented as an application of biomimetic modelling based on parameter schedule and numerical control.

**Brief Biography of the Speaker:** Dr. Banu graduated Faculty of Mechanical Engineering of University Dunarea de Jos of Galati in 1993, and she obtained the title of Doctor Engineer mention CUM LAUDE in 2000. In the same year, Dr. Banu was awarded with a post-doc grant of the Key Technology Center developing research within Materials Fabrication Laboratory of The Institute of Physical and Chemical Research – RIKEN, Japan.
Since 1993 she followed the academic carrier at Dunarea de Jos University of Galati as assistant, associate professor and professor. Dr. Banu is a visitor scientist of The Institute of Physical and Chemical Research – RIKEN, Volume-CAD Integrated Research Program, Japan.
Research fields are connected with characterisation, modeling and control of the nonlinear behaviour of materials udergo to large plastic deformations, multiscale modeling 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. Banu published 55 articles in journals and internationals conferences proceedings, she is author and co-author of 3 books and she delivered 7 invited conferences in Japan.
The research was done as director or member of 40 research contracts financed by European Commission and Romanian Ministry of Education and Research. The strong cooperation with Laboratoire de Proprietes Mecanique et Thermodinamique des Materiaux – LPMTM Universite Paris 13, France contributed to the enhancement of the research studies on modeling the material behaviour within metal forming.
Dr. Banu is a member of international scientific societies as follows: European Scientific Association of Materials Forming - ESAFORM, since 1998, Society of Automotive Engineers of Japan, since 2004, The American Association for the Advancement of Science – AAAS, since 2007, American Chemical Society – ACS, since 2008.

## Plenary Lecture 5

# Recent Developments in the Von Mises Transformation and its Applications in the Computational Sciences

**Professor M. H. Hamdan**
Department of Mathematical Sciences
University of New Brunswick
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Saint John, New Brunswick, Canada, E2L 4L5
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**Abstract:** The use of (φ,ψ) coordinate system has attained popularity in a number of engineering fields, including aerodynamics, groundwater, magneto-hydrodynamics, and water waves. In the computational sciences, this coordinate system offers flexibility in handling boundary value problems through the mapping a curvilinear domain into a Cartesian domain in which numerical techniques that rely on the finite differences procedure are easily applicable. In unbounded domains, this approach has received wide acceptance as a viable alternative in the study of the complicated equations of electro-magneto-hydrodynamics.
In spite of the attractiveness of the (φ,ψ) system, it introduces an extra equation to be solved for the variable φ(x,y). This is necessary for locating singularities in the computational domain and its boundaries (such as locating the leading and trailing edges of an airfoil, or the location the crest of a wave). In order to circumvent this, it is possible to judiciously replace φ by x, and replace the (φ,ψ) coordinates by the (x,ψ) coordinates which, at the outset, eliminates the need for introducing an extra equation. Furthermore, locations of singularities are either known a priori or can easily be determined using the (x,ψ) system.
The (x,ψ) coordinates are the well-known von Mises variables that were introduced by R. von Mises in 1927 to analyze the boundary layer equations. The use of this system in the study of waves with arbitrary vorticity distribution was made by T.B. Benjamin in 1961. However, the computational von Mises and its use in aerodynamics was introduced by R.M. Barron in 1986.
Over the last two decades, a number of advances have been made in the computational von Mises. These include the introduction of a time-dependent form of the coordinates; the introduction of techniques to handle the infiniteness of the Jacobian of transformation (which arises in some boundary value problems); the introduction of mapping multiple physical domains into a single computational domain; and the analysis and control of grid distortion that inevitably arises due to the use of non-orthogonal (x,ψ) system.
In this talk, we present analysis of the von Mises transformation and its computational complexities, and report on its recent developments and possible extensions to three physical dimensions. A survey of the use of the computational von Mises in the various engineering fields will be provided.

**Brief Biography of the Speaker:** M. H. Hamdan received an Ordinary National Diploma in Technology-Engineering from Swindon College, U.K.; a Certificate in Negotiation, Mediation and Conflict Resolution from St. Mary's University, Canada; a B.Sc, M.Sc., and a Ph.D in Applied Mathematics from the University of Windsor, Canada. He taught at a number of universities both as a regular faculty member and as a visiting professor, in Canada, China and the Middle East. He has been teaching at the University of New Brunswick, Canada, for 18 years, and is a pevious Chair of the Department of Mathematics, Statistics and Computer Science. His teachables span the areas Mathematics, Decision Sciences and Management Science, Mathematical Economics, and Negotiations. His research areas include computational fluid dynamics, single-phase flow through porous media, and modeling dusty gas flow through porous media. He is an International Consultant in Science and Technology Planning and in School Mathematics Curricular Development. He is the recipient of a number of teaching awards, and is listed among American Men and Women of Science; Who's Who in Science and Engineering; Who's Who in the World; and Two Thousand Outstanding Scientists of the 20th Century.

## Plenary Lecture 6

# Video Enhancement Techniques Over Mobile Ad-Hoc Wireless Networks

**Professor Tarek Saadawi**
Electrical Engineering Department
City University of New York, City College
USA
E-mail: saadawi@ccny.cuny.edu

**Abstract:** This talk addresses techniques for enhancing multimedia delivery over mobile ad-hoc networks (MANET) and improve video transmission quality of service. In the first part we focus on multicasting multi-streaming techniques. Dissemination of multicast real time video over the Internet has emerged as an important area of network research. Streaming applications must deal with persistent rate changes to prevent network congestion and avoid overwhelming the client buffer. Therefore, receivers have to be conscious of the network available bandwidth and choose the stream rate appropriately. Here we present a scheme to achieve multicasting multistreaming in MANET.
The second part discusses video caching techniques for MANET. Video caching has been well accepted as viable method to ease the ever growing bandwidth needs, improve the speed of video delivery, reduce the server load, and decrease the client access latency. Here we focus on carefully selecting the nodes to cache the video based on the links reliability, the nodes resources, and the availability to serve other nodes in the network. We discuss caching placement mechanism in an attempt to achieve high network performance by distributing the video streams among the virtual backbone nodes.

**Brief Biography of the Speaker:** TAREK N. SAADAWI is a Professor of Electrical Engineering, City University of New York, City College and director of the Center of Information Networking and Telecommunications (CINT). He has published extensively in the area of mobile ad-hoc wireless networks and multimedia networking, and co-authored a text book on telecommunications. Dr Saadawi organized and chaired the Cyber Infrastructure Security (CIP09) conference, www.ccny,cuny.edu/cip09
He is a former Chairman of IEEE Computer Society of New York City, received IEEE Region 1 Award, and is a co-founder of IEEE Symposium on Computers and Communications (which is in its 14th series, www.comosoc.org/iscc ). Dr Saadawi has been invited and joined US Dept of Commerce Delegation to the Government of Algeria to address rural communications. He also led a group of US experts to provide a telecommunications master plan for the Government of Egypt under US AID funding.

## Plenary Lecture 7

# A New Research Direction of Chaos Control: Multi-Objective Control and its Application

**Professor Jin-Qing Fang**
China Institute of Atomic Energy
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**Abstract:** The conventional chaos control is only to reach single control objective at each time. Different control objective only can be realized at another time. Obviously, that is not enough for applications of chaos control, especially for chaotic connected complex network . Therefore a new research direction of control chaos — multi-objective control (MOC) is naturally raised and needed in practical applications, such as in communication engineering, biological systems, social networks and so on since these systems have more than one unstable equilibrium and infinite unstable periods or time-space patterns . In this speech, we not only introduce some effective control method, but also propose a global linear coupling and combined with local feedback method to realize multi-objective control method for any chaotic connected complex network. To demonstrate the method effectiveness and its potential applications, I will take two typical examples: beam transport network (BTN) with halo-chaos and Lorenz chaotic connected network.

**Brief Biography of the Speaker:** Prof. Jinqing Fang studied and graduated from Department of Physics in Qing-Hua University (1958-1964), Beijing, P.R.China. Since then he has worked in China Institute of Atomic Energy, where he has been a research professor of physics in the 1980's. Since then he became a visiting professor at more than 20 the universities ( Australia National University, The University of Texas at Austin, The University of Houston, The University of Brussele Libre, International Center of Theoretical Physics in Italy, The University of Western Ontario, The University of Alberta, The University of Toronto, The University of Ottawa , The University of Lethbridge, The University of Arizona ,The University of Sydney ,The City University of Hong Kong, The University of Poly-technology of Hong Kong, The Chinese University of Hong Kong, and so on.).
Prof. Fang's main research pursuit has been in the focusing areas in nonlinear science, chaos control and synchronization as well as networks science with applications.

## Plenary Lecture 8

# Non-linear Analysis of the Automotive Suspensions with neo-Hookean Elements

**Professor Nicolae-Doru Stanescu**
University of Pitesti
Faculty of Mechanics and Technology
Department of Applied Mechanics
Pitesti, str. Targul din Vale, nr. 1, jud. Arges, code 110040
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**Abstract:** In this work we present two systems with non-linear neo-Hookean components. In such systems there always exists an element with a non-linear characteristic equation. This element can be considered to be a rubber or another equivalent structure. We shall prove that the utilization of a neo-Hookean element will not destroy the properties of the structure, but it riches these properties and it could be a good solution in many cases. The first model describes a quarter of an automobile and the second one is dedicated to a half-automobile model. We obtain the equilibrium positions, study their stability in the most general case and for the first model we also discuss the stability of the motion. In the paper there are also numerical applications.

**Brief Biography of the Speaker:** Nicolae-Doru Stanescu (born 1965) graduated the Faculty of Machines Construction's Technology at the "Politehnica" University of Bucharest in 1989, and the Faculty of Mathematics and Computer Science at the University of Pitesti in 1995. Since 2003 he is PhD in Mechanical Engineering at the University of Pitesti, and since 2008 he is PhD in Mathematics at the University of Bucharest. Now, he is Associate Professor at the Department of Applied Mechanics of the University of Pitesti, where he teaches Mechanics, Numerical Methods and Non-linear Vibrations. He wrote more than 100 articles and 6 books. He participated as researcher or was director at 8 grants. He is member of the International Institute of Accoustic and Vibration in USA, and of Societe des Ingineurs de l'Automobile, France, among other associations. He was invited professor at Instituto Superior Tecnico, Lisbon, Portugal. His fields of interests are: non-linear vibrations, dynamical systems, stability, chaos, and numerical analysis.

## Plenary Lecture 9

# Machining Process and System Stability – A Chaotic Approach

**Professor Gabriel Frumusanu**
Manufacturing Science and Engineering Department,
"Dunarea de Jos" University of Galati, ROMANIA
E-mail: gabriel.frumusanu@ugal.ro

**Abstract:** The actual technology demand is to minimize the production time, by using high speed machining (HSM), in conditions of obtaining a good quality of the workpiece surface. The main obstacle in front of this purpose is the cutting process instability. In the up to now accepted theory concerning cutting process stability, the process transfer function is considered to be a real constant, by completely neglecting cutting process dynamics. On the other hand, the behavior of the system mechanical structure is accepted as being linear, which enables to the machining system transfer function to be considered as the amplitude-frequency characteristic of the mechanical structure (possible to be experimentally found). Last evolutions in cutting stability theory are given through a significant large number of researches, concerning especially three investigation directions: new models and methods to study machining processes dynamics; analysis and interpretation of the phenomenology connected to instability of cutting processes; finding concrete solutions to improve cutting processes stability. We can generally remark the tendency to drop off the cutting process classic model and to search for new approaches. Recent developments in Chaos Theory furnished tools to be used for studying the systems having chaotic dynamics: attractors fractal dimension, Lyapunov exponent, Poincare map, bifurcation diagrams etc. Until now, it was revealed the chaotic behavior in the cases of electric circuits, lasers, chemical reactions, fluids dynamics or meteorology, but last hour researches started also to claim the chaotic character of cutting process dynamics; anyway, this process is inherently nonlinear, due to frictional effects, delay dynamics, structural nonlinearities and to loss of contact between the tool and the workpiece. From researches and observations done up to now, the current functioning point of a certain machine-tool can be referred to its stability limit by modeling with chaotic models the time evolution of the machining system & process parameters (e.g. the cutting force). This lecture refers to the machining process and system stability, when the two elements (process and system) are treated as a unique entity. To fulfill this objective, the following steps were done: 1) an appropriate type of chaotic model was found, by experimental research, to describe the entity dynamic behavior; 2) numerical simulations were realized by using the adopted model; 3) the simulation results were compared to the observations done on the real system functioning, in the corresponding situations.

**Brief Biography of the Speaker:** Gabriel Frumusanu graduated a 5 years Mechanical Engineering degree program at "Dunarea de Jos" University of Galati (1987); PhD in Industrial Engineering - at "Dunarea de Jos" University of Galati (1999); Training stages at: "Ecole des Mines de Paris", CEMEF, Sophia-Antipolis – France (1992); "Universita degli Studi di Padova", Padua – Italy (1997); "Ecole Nationale Superieure des Artes et Metiers", Angers – France (2002). Research fields: numerical modeling of manufacturing processes and surfaces generation; cutting processes dynamics; metals cold forming (deep drawing, extrusion, orbital volumetric cold forming). Professional experience: 1988 – 1990 – Engineer responsible of equipments maintenance at Cold Rolling Mill from Galati Iron and Steel Company; 1990 – 2000 – Assistant-professor at "Dunarea de Jos" University of Galati, Manufacturing Science and Engineering Department; 2000 – 2004 – Associate-professor, in the same department; 2004 up to present – Professor, in the same department.
Prof Frumusanu participated in over 20 research projects supported by Romanian Ministry of Education and Science; author / co-author of over 20 scientific or didactic books; over 100 scientific papers written or co-authored, published to International / National Conferences proceedings (France, Hungary, Israel, Moldavia) and Journals. Invited professor at "Universita degli Studi di Padova", Padua – Italy (2006). Member of professional and scientific associations: Romanian Association for Non-Conventional Technologies - ARTN, Romanian Association of Managers and Engineers - AMIER, Romanian Association of Tensometry - ARTENS; Expert of Romanian National University Research Council - CNCSIS and of Romanian Agency for Quality Assurance in Higher Education - ARACIS.

## Plenary Lecture 10

# Detection of Level Change (LC) Outlier in Garch(1,1) Processes

**Associate Professor Azami Zaharim**
Coordinator Fundamental Engineering Studies
Faculty of Engineering and Built Environment
Universiti Kebangsaan Malaysia
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**Abstract:** An outlier is an 'extreme' observation that may have a severe effect on data analysis. Their occurrences might cause problems such as bias or distortion of parameter estimation. When a time series with outliers is modelled and forecasted without taking into account their presence or without removing their effects, the test statistics of estimated parameters in the model will be distorted. A GARCH (1,1) process is not exceptional from being affected by outliers. In this study we construct test statistics for identifying outliers in GARCH (1,1) processes with special focus on the temporary change (LC) type. The statistic was developed by the least squares method, and consequently a simulation was carried out for the purpose of finding the critical region. This study is an extension of Chen and Liu's (1993) work on outlier detection. . The simulation was done for eight sample sizes; 50, 100, 150, 200, 250, 500, 1000 and 2000. The 90th, 95th and 99th percentiles were computed for estimating the distribution of the test statistic. The critical value was selected based on the simulation study and was used in detecting the presence of level change (LC) in the return series of Industrial Product Index (IPI). For the period of analysis, the results indicate that LC outlier occurred in 1998.

**Brief Biography of the Speaker:** Azami Zaharim worked first 13 years as a lecturer in the Universiti Teknologi MARA (University of MARA Technology - UiTM) before joining the Universiti Kebangsaan Malaysia (National University of Malaysia - UKM) in the year 2003. He is Associate Professor at the Faculty of Engineering and Built Environment UKM, and is currently Coordinator for the Unit Fundamental Engineering Studies. He obtained his BSc(Statistics and Computing) with Honours from North London University, UK in 1988 and PhD (Statistics) in 1996 from University of Newcastle Upon Tyne, UK. He specialize in statistics, public opinion, engineering education and renewable energy resources.
He has until now published over 80 research papers in Journals and conferences, conducted more than 15 public opinion consultancies and delivered 3 keynotes/invited speeches at national and international meetings. He is currently the head of Renewable Energy Resources and Social Impact Research Group under the Solar Energy Research Institute (SERI). In the year 2007, he headed the Engineering Mathematics Research Group. At the same time, he is currently active involve in outcome based education (OBE) approach at the national level and the chairman of the Engineering Education Research Group since 2005. He is also involved actively in the research for the future of engineering education in Malaysia 2006 under the Ministry of Higher Education of Malaysia.

## Plenary Lecture 11

# A Topological Approach of the Geometry Modeling and Control in Manufacturing

**Dr. Virgil Teodor**
Manufacturing Science and Engineering Department,
"Dunarea de Jos" University of Galati, ROMANIA
E-mail: virgil.teodor@ugal.ro

**Abstract:** Nowadays, the globalization of the economy, science, technology and society leads to an strengthened influence of the customer requirements having as a consequence the need for a higher level of the product quality.
In manufacturing, the quality assessment tends to be performed in real time and to be integrated in the product manufacturing process. Nowadays, modern machine tools are able to generate complex surfaces and consequently the main issue is not the surfaces processing but the surfaces geometry modeling and control.
The dimensional control issue is one of the most important because of the customized small batch production according to the customer requirements. It is noticed that the deviation compensation strategy tends to replace the error reducing strategy. Based on the computer technology development, new computer aided manufacturing systems occurred which has an embedded computer aided inspection system within which the information is digitally processed.
In this new context, the Euclidian geometry – that basically supports the classical dimensional control – becomes inappropriate for this application. The recent literature reports two main approaches concerning generation, measurement and tolerancing of the part geometry. The first one is represented by continuous monitoring of the workpiece during the processing and the second one is based on dimensioning tolerancing of part functionality. Also, from literature review it is obvious that no generalized approach concerning generation, inspection and tolerancing of the mark guide mark surfaces with respect to the surfaces in their assembly location hasn't exist. This is why, it is correct to state that nowadays standards does not corresponds to the most recent evolution in design and machine tool market.
This lecture presents the analysis of the mechanical structures geometry through topological geometry aiming to replace the singular surface analysis with surfaces assembly modeling and control, using a topologic approach. In this way, superior results would be acquired in what concern precision and the possibility of correction, comparing with the case obtained with the surfaces one by one inspected.

**Brief Biography of the Speaker:** Dr. Virgil Teodor graduated Faculty of Mechanical Engineering of "Dunarea de Jos" University of Galati in 1994. In 2000 he graduated the degree program of Master in "Numerical Modeling of Mechanical and Technological Processes". In 2005 he obtained the title of Doctor Engineer. From 1994 to 2002 he worked as design engineer at "Uzinsider Engineering". Since 2002 he followed the academic carrier at "Dunarea de Jos" University of Galati as associate assistant, assistant and lecturer at The Department of Manufacturing Science and Engineering. In 2005 Dr. Teodor followed a 3 months research stage at Technical Superior School of Valladolid, Spain.
His research fields are connected with:
- cutting process modeling;
- surface generation with cutting tools which work by enveloping;
- algorithms for the study of surfaces generation methods.

Dr. Teodor published 50 articles in journals and internationals conferences proceedings and he is author and co-author of 3 books in his research field.
In 2008 he developed a short research stage at Technical Superior School of Valladolid, Spain, in the field of surface identification using 3D measuring machines. Dr. Teodor is an organizing committee member of "New Technologies in Manufacturing – NEWTECH 2009" International Conference. The research activity of Dr. Teodor includes 6 research contracts financed by Romanian Ministry of Education and Research, as director or team member. Dr. Teodor is also a member of The Romanian Scientific Association for Nonconventional Technologies - ARTN.

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