Editors:
Prof. Nikos E. Mastorakis, Technical University of Sofia, BULGARIA
Prof. Olga Martin, Politehnica University of Bucharest, ROMANIA
Prof. Xiaojing Zheng, Lanzhou University, CHINA

RECENT ADVANCES IN ENGINEERING MECHANICS, STRUCTURES AND ENGINEERING GEOLOGY

Proceedings of the 2nd WSEAS International Conference on ENGINEERING MECHANICS, STRUCTURES and ENGINEERING GEOLOGY (EMESEG '09)

Rodos (Rhodes) Island, Greece, July 22-24, 2009

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

ISBN: 978-960-474-101-4
ISSN: 1790-2769

Published by WSEAS Press
www.wseas.org

RECENT ADVANCES IN ENGINEERING MECHANICS, STRUCTURES AND ENGINEERING GEOLOGY

Recent Advances in ENGINEERING MECHANICS, STRUCTURES and ENGINEERING GEOLOGY

Proceedings of the 2nd WSEAS International Conference on ENGINEERING MECHANICS, STRUCTURES and ENGINEERING GEOLOGY (EMESEG '09)

Rodos, Greece
July 22-24, 2009

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

Published by WSEAS Press
www.wseas.org

ISSN: 1790-2769
ISBN: 978-960-474-101-4

Recent Advances in ENGINEERING MECHANICS, STRUCTURES and ENGINEERING GEOLOGY

Proceedings of the 2nd WSEAS International Conference on ENGINEERING MECHANICS, STRUCTURES and ENGINEERING GEOLOGY (EMESEG '09)

Rodos, Greece, July 22-24, 2009

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

Published by WSEAS Press
www.wseas.org

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
ISBN: 978-960-474-101-4

World Scientific and Engineering Academy and Society

Recent Advances in ENGINEERING MECHANICS, STRUCTURES and ENGINEERING GEOLOGY

Proceedings of the 2nd WSEAS International Conference on ENGINEERING MECHANICS, STRUCTURES and ENGINEERING GEOLOGY (EMESEG '09)

Rodos, Greece
July 22-24, 2009

Preface

This year the 2nd WSEAS International Conference on ENGINEERING MECHANICS, STRUCTURES and ENGINEERING GEOLOGY (EMESEG '09) was held in Rodos, Greece, in July 22-24, 2009. The Conference remains faithful to its original idea of providing a platform to discuss plasticity, fracture, and damage mechanics, mechanics of nanomaterials, fluid-structure interaction, computational and experimental mechanics, compressible flows, theoretical and experimental statics, dynamics, structural stability analysis, formation and calculation of metal structures, elastic and inelastic behaviour 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

Table of Contents

Keynote Lecture 1

Embedded Systems Design – Scientific Challenges and Work Directions

Professor Joseph Sifakis
Verimag & ARTIST2 NoE
Centre Equation
2 avenue de Vignate
38610 GIERES, FRANCE
E-mail: Joseph.Sifakis@imag.fr

Abstract: The development of a satisfactory Embedded Systems Design Science provides a timely challenge and opportunity for reinvigorating Computer Science. Embedded systems are components integrating software and hardware jointly and specifically designed to provide given functionalities, which are often critical. They are used in many applications areas including transport, consumer electronics and electrical appliances, energy distribution, manufacturing systems, etc. Embedded systems design requires techniques taking into account extra-functional requirements regarding optimal use of resources such as time, memory and energy while ensuring autonomy, reactivity and robustness. Jointly taking into account these requirements raises a grand scientific and technical challenge: extending Computer Science with paradigms and methods from Control Theory and Electrical Engineering. Computer Science is based on discrete computation models not encompassing physical time and resources which are by their nature very different from analytic models used by other engineering disciplines.
We summarize some current trends in embedded systems design and point out some of their characteristics, such as the chasm between analytical and computational models, and the gap between safety critical and best-effort engineering practices. We call for a coherent scientific foundation for embedded systems design, and we discuss a few key demands on such a foundation: the need for encompassing several manifestations of heterogeneity, and the need for design paradigms ensuring constructivity and adaptivity.
We discuss main aspects of this challenge and associated research directions for different areas such as modeling, programming, compilers, operating systems and networks.

Brief Biography of the Speaker: Joseph Sifakis is a CNRS researcher and the founder of Verimag laboratory (http://www-verimag.imag.fr/), in Grenoble, France. He holds the INRIA-Schneider endowed industrial chair since September 1st 2008. He studied Electrical Engineering at the Technical University of Athens and Computer Science at the University of Grenoble. Verimag is a leading research laboratory in the area of critical embedded systems. It developed the underlying theory and technology for the SCADE tool, used by Airbus for the design and validation of its critical real-time systems, and is becoming a de facto standard for aeronautics. Verimag has a lasting and strategic collaboration with ST Microelectronics, France Telecom R&D, and Airbus, through which numerous results on validation and testing have been transferred. Joseph Sifakis is recognized for his pioneering work on both theoretical and practical aspects of Concurrent Systems Specification and Verification. He contributed to emergence of the area of model-checking, currently the most widely-used method for the verification of industrial applications. His current research activities include component-based design, modeling, and analysis of real-time systems with focus on correct-by-construction techniques (http://www-verimag.imag.fr/~sifakis/). Joseph Sifakis has broad experience with industry, notably though joint projects with partners such as Astrium, the European Space Agency, France Telecom, ST Microelectronics and he has also been active for many years in consulting. Joseph Sifakis is the Scientific Coordinator of the European Network of Excellence ARTIST2 on Embedded Systems Design. (http://www.artist-embedded.org/). This network gathers 35 of the best European teams in the area, and aims to produce innovative results for cost-effective design of dependable embedded systems. It will also promote innovative methods safe and secure systems, notably through cooperation with key European industrial partners such as Thales, Airbus, Ericsson, Philips, and ST Microelectronics. Joseph Sifakis is the director of the CARNOT Institute "Intelligent Software and Systems" in Grenoble (http://www.carnot-lsi.com/). Joseph Sifakis is a member of the editorial board of several journals, co-founder of the International Conference on Computer Aided Verification (CAV) and a member of the Steering Committee of the EMSOFT (Embedded Software) conference. He is a member of Academia Europea (http://www.acadeuro.org/) and a member of the French National Academy of Engineering (http://www.academie-technologies.fr/).
Joseph Sifakis has received with Ed Clarke and Allen Emerson for their contribution to Model Checking, the Turing Award for 2007 (http://awards.acm.org/homepage.cfm?srt=all&awd=140). He is also the recipient of the CNRS Silver Medal in 2001.

Keynote Lecture 2

Quantum Cryptography and Chaos Functions: The Ultimate for Network Security

Professor Stamatios Kartalopoulos
Williams Professor in Telecommunications Networking
The University of Oklahoma
USA
Email: Kartalopoulos@ou.edu

Abstract: As the sophistication of intruders' increases, so does the incidents of information integrity breaches and network attacks. In response, very complex cryptographic processes have started being employed, such as chaos theory and quantum theory, in an effort to create the "holy grail" of cryptographic systems and network security.
Quantum theory defines the non-classical qubit, which is the superposition of quantum states having no classical analog. In addition, it is based on the "no cloning" or "no copying" theorem and on Heisenberg's uncertainty. Both, the qubit and the no-cloning theorem, along with the quanto-mechanical properties of photons, have been applied to a new breed of cryptography and secure optical communication networks known as quantum cryptography and quantum networks, respectively.
Chaos is based on the particular behavior of certain non-linear functions, which for a minute change of parameters produce a very large and unstable output, known as the "chaotic regime". However, this chaos is reproducible, which also makes it attractive to secure communications.
In this talk we explain quantum cryptographic protocols as well as chaos and chaotic processes with simple examples. We then describe how chaos functions are used in quantum cryptography in order to increase efficiency and speed of the quantum key establishment.

Brief Biography of the Speaker: Stamatios V. Kartalopoulos, PhD, is currently the Williams Professor in Telecommunications Networking at the University of Oklahoma. His research emphasis is on optical communication networks (FSO, long haul and FTTH), optical technology including optical metamaterials, and optical communications security including quantum cryptography and key distribution. Prior to this, he was with Bell Laboratories where he defined, led and managed research and development teams in the areas of DWDM networks, SONET/SDH and ATM, Cross-connects, Switching, Transmission and Access systems. He has received the President's Award and many awards of Excellence.
He holds nineteen patents in communications networks, and has published more than hundred fifty scientific papers, nine reference textbooks important in advanced fiber optic communications and security, and has also contributed several chapters to other books.
He has been an IEEE and a Lucent Technologies Distinguished Lecturer and has lectured at international Universities, at NASA and conferences. He has been keynote speaker of major international conferences, has moderated executive forums, has been a panelist of interdisciplinary panels, and has organized symposia, workshops and sessions at major international communications conferences.
Dr Kartalopoulos is an IEEE Fellow, chair and founder of the IEEE ComSoc Communications & Information Security Technical Committee, member at large of IEEE New Technologies Directions Committee, and has served editor-in-chief of IEEE Press, chair of ComSoc Emerging Technologies and of SPCE Technical Committees, Area-editor of IEEE Communications Magazine/Optical Communications, member of IEEE PSPB, and VP of IEEE Computational Intelligence Society.

Keynote Lecture 3

Content-Adaptive Efficient Resource Allocation for Packet-Based Video Transmission

Professor Aggelos K. Katsaggelos
Department of EECS
Northwestern University
Evanston, Illinois
USA
E-mail: aggk@ece.northwestern.edu

Abstract: Supporting video communication over lossy channels such as wireless networks and the Internet is a challenging task due to the stringent quality of service (QoS) required by video applications and the many channel impairments. Two important QoS characteristics for video are the degree of signal distortion and the transmission delay. Another important consideration is the cost associated with transmission, for example, the energy consumption in the wireless channel case and the cost for differentiated services in the Internet (with DiffServ) case.
In this presentation we consider the joint adaptation of the source coding parameters, such as the quantization step-size and prediction mode, along with the physical layer resources, such as the transmission rate and power. Our goal is to provide acceptable QoS while taking into account system constraints such as the energy utilization. We discuss a general framework that allows a number of "resource/distortion" optimal formulations for balancing the requirements of different applications. We conclude the presentation with some of the grand opportunities and challenges in designing and developing video communication systems.

Brief Biography of the Speaker: Aggelos K. Katsaggelos received the Diploma degree in electrical and mechanical engineering from the Aristotelian University of Thessaloniki, Greece, in 1979 and the M.S. and Ph.D. degrees both in electrical engineering from the Georgia Institute of Technology, in 1981 and 1985, respectively. In 1985 he joined the Department of Electrical Engineering and Computer Science at Northwestern University, where he is currently professor. He is also the Director of the Motorola Center for Seamless Communications and a member of the Academic Affiliate Staff, Department of Medicine, at Evanston Hospital.
Dr. Katsaggelos is a member of the Publication Board of the IEEE Proceedings, the IEEE Technical Committees on Visual Signal Processing and Communications, and Multimedia Signal Processing, the Editorial Board of Academic Press, Marcel Dekker: Signal Processing Series, Applied Signal Processing, and Computer Journal. He has served as editor-in-chief of the IEEE Signal Processing Magazine (1997-2002), a member of the Publication Boards of the IEEE Signal Processing Society, the IEEE TAB Magazine Committee, an Associate editor for the IEEE Transactions on Signal Processing (1990-1992), an area editor for the journal Graphical Models and Image Processing (1992-1995), a member of the Steering Committees of the IEEE Transactions on Image Processing (1992-1997) and the IEEE Transactions on Medical Imaging (1990-1999), a member of the IEEE Technical Committee on Image and Multi-Dimensional Signal Processing (1992-1998), and a member of the Board of Governors of the IEEE Signal Processing Society (1999-2001). He is the editor of Digital Image Restoration (Springer-Verlag 1991), coauthor of Rate-Distortion Based Video Compression (Kluwer 1997), co-editor of Recovery Techniques for Image and Video Compression and Transmission, (Kluwer 1998), and co-author of Super-Resolution for Images and Video, (Morgan and Claypool, 2007), and co-author of Joint Source-Channel Video Transmission (Morgan and Claypool 2007). He was the holder of the Ameritech Chair of Information Technology (1997-2003), and he is the co-inventor of twelve international patents, a Fellow of the IEEE (1998) and SPIE (2009), and the recipient of the IEEE Third Millennium Medal (2000), the IEEE Signal Processing Society Meritorious Service Award (2001), an IEEE Signal Processing Society Best Paper Award (2001), an IEEE ICME Best Paper Award (2006), and an IEEE ICIP Paper Award (2007). He was a Distinguished Lecturer of the IEEE Signal Processing Society for 2007-2008.

Keynote Lecture 4

Computer Aided-Visual Perception : Challenges and Perspectives

Professor Nikos Paragios
Ecole Centrale de Paris / INRIA Saclay, Ile-de-France
France
E-mail: nikos.paragios@ecp.fr

Abstract: Computer aided human perception aims at developing intelligent algorithms towards understanding visual cues coming from images, video, or other means of gathering visual information. Such a process often consists of three stages, initially the problem of perception is parameterized through a mathematical model where the estimation of its parameters will lead to visual understanding. Then, the model is associated with the available observations through the definition of an objective function and last, this function is optimized using computational methods. The main challenges that one has to address in this context is the curses of dimensionality, non-linearity, non-convexity and modularity. In simple words, even the simplest possible perception problem could involve too many parameters where the association between the data and them is not straightforward and is done through non-convex functions. In this talk, we will present a generic mathematical framework that exploits recent advances in discrete optimization to address computational visual perception. Numerous image processing, computer-aided diagnosis and computer vision applications will be considered to demonstrate the potentials of this method.

Brief Biography of the Speaker: Nikos Paragios (http://vision.mas.ecp.fr) obtained his B.Sc. (highest honors, valedictorian) and M.Sc. (highest honors) in Computer Science from the University of Crete (Greece) [1994,1996] , his Ph.D. in electrical and computer engineering from I.N.R.I.A. [2000] and his D.Sc. (Habilitation a Diriger de Recherches) from the University of Nice/Sophia Antipolis (France) [2005)]. He is professor of applied mathematics at the Ecole Centrale de Paris - one of most exclusive engineering schools "Grande Ecoles" - leading the Medical Imaging and Computer Vision Group. He is also affiliated with INRIA Saclay Ile-de-France, the French Research Institute in Informatics and Control heading the GALEN group. Prior to that he was professor/(2004-2005) at the Ecole Nationale de Ponts et Chaussees, affiliated with Siemens Corporate Research (Princeton, NJ, 1999-2004) as a project manager, senior research scientist and research scientist. In 2002 he was an adjunct professor at Rutgers University and in 2004 at New York University. N. Paragios was a visiting professor at Yale University in 2007.
Professor Paragios has co-edited four books, published more than hundred papers (DBLP server) in the most prestigious journals and conferences of medical imaging and computer vision, gave more that hundred invited lectures, and has twelve US issued patents and more than twenty pending. His work has approx 3,500 citations in googlescholar and approx 2,000 in scopus, and and his H-number according to scholar is 28 and 24 according to scopus. He is a Senior member of IEEE, associate editor for the IEEE Transactions on Pattern Analysis and Machine Intelligence (PAMI), area editor for the Computer Vision and Image Understanding Journal (CVIU) and member of the Editorial Board of the International Journal of Computer Vision (IJCV), the Medical Image Analysis Journal (MedIA) and the Journal of Mathematical Imaging and Vision (JMIV). Professor Paragios is one of the program chairs of the 11th European Conference in Computer Vision (ECCV'10, Heraklion, Crete). In 2008 N. Paragios was the laureate of one of Greece's highest honor for young academics and scientists of nationality or descent (world-wide), the Bodossaki Foundation Prize in the field of applied sciences. In 2006, he was named one of the top 35 innovators in science and technology under the age of 35 from the MIT's Technology Review magazine. He and his collaborators were the recipients of numerous scientific rewards, like for example the Francois Erbsmann prize for the IPMI'07 conference. His research interests are in the areas of computer vision, medical image analysis and human-computer interaction.

Keynote Lecture 5

Control and Estimation Theory: Current Trends, New Challenges, & Directions for the Future

Professor Lena Valavani
Fellow, American Institute of Aeronautics and Astronautics
Laboratory for Information and Decision Systems
Massachusetts Institute of Technology
Cambridge, MA 02139 U.S.A.
E-mail: valavani@mit.edu

Abstract: Despite the tremendous strides witnessed in the Control and Estimation of lumped parameter systems , whether linear or nonlinear, the issue of stability and performance robustness under simultaneous structured and unstructured uncertainty still remains largely unresolved. When fault tolerance, autonomy and reactivity are added to the requirements, this presents an additional challenge. 'Closed form' solutions are in most cases not possible and computational methods (optimization based, search, etc.) do not provide the necessary guarantees.
The challenges become even greater in the case of distributed systems and networks, such as large industrial/manufacturing plants, environmental applications (CO2 sequestration), communications networks, traffic networks (aeronautical, highway), space networks (satellite constellations), biomedical applications(CNS studies) which, by their nature, require control and estimation in a distributed setting. Requirements and specifications can also be widely variable between safety critical and socially/economically significant systems.
It becomes increasingly evident that control, communications and computation need to be synergistically combined through a 'universal formalism' and novel paradigms that combine logical operations (symbolic reasoning and decision making) with analytical constructs (mathematical algorithms)and continuous quantities(throughput, subsystem interconnections), in order to handle heterogeneity, asynchronicity , real time functionality, properties that typically characterize distributed systems/networks.
We focus on some representative examples to elucidate key issues that arise in modeling, algorithm design, computation, in order to ensure robustness , fault tolerance, autonomy and even reactivity of distributed systems/networks, that point to the need for total synergy of Control, Communications , and Computation/Computer Science- to meet today's and future challenges.

Brief Biography of the Speaker: Lena Valavani holds her B.S. in Physics, from Barnard College, Columbia University, and the M.S., M.Phil. and Ph.D degrees in Engineering and Applied Science from Yale University. After postdoctoral positions at Yale and MIT's Laboratory for Information and Decision Systems, she joined the Department of Aeronautics and Astronautics, MIT, where she was Boeing Associate Professor. She also served as Chief Scientist, Systems Engineering, U.S. D U.S. Department of Transportation for four years. She is currently president of Hellenic Space Systems , S .A.
Dr. Valavani served as Associate Editor of IEEE Transactions of Automatic Control, Automatica , AIAA Journal of Guidance, Navigation and Control, and the International Journal on Robust and Nonlinear Control. She was elected to the Board of Directors, AIAA, N.E., and served as General Secretary. She also was for a long time a member of the steering committee of the International Physicians for the Prevention of Nuclear War, GBPSR, (1985 Nobel Peace Prize).
Her research interests are in modeling for, and the analysis and synthesis of control systems, estimation and identification, with emphasis on robustness to structured and unstructured uncertainty, fault tolerance and reconfiguration, currently in distributed systems and networks . Her research in the U.S. was supported by NASA, NSF, AFOSR,ONR ,and by private industry , resulting in innovative designs of prototype systems currently in operation in the U.S; in Europe by ESA and EC. She has supervised 27 Ph.D and 29 M.S theses at MIT , and 22 M.S. theses at NTUA and UoA.
Dr. Valavani was consultant to Lincoln Laboratory, C.S.Draper Laboratory , and Bell Helicopter while in the U.S. She received the Best Research Paper Award (1991) from the International Gas Turbine Institute and holds three U.S. Patents in the area of controlling unsteady aerodynamic processes in compressors. She is an Associate Fellow of AIAA.

Plenary Lecture 1

Application of the Boltzmann Equation in Enzymatic Hydrolysis and in Molecular Mass Distribution

Professor Vassilis Gekas
Dept Environmental Engineering,
Technical University of Crete,
73100 Polytechnioupolis Chania,
GREECE
Email: vassilis.gekas@enveng.tuc.gr

Brief Biography of the Speaker: Vassilis Gekas son of Christos and Dimitra was born in Gallini of Larissa the year 1948. His studies were as follows: elementary school in the Gallini village (1954-1960) , secondary school in Larissa και(1960-1966). Chemical Engineering School in the National Technical University of Athens, (1966-1971). Military Service 1971-1973. In the Greek Industry worked as a Chemical Engineer (1973-1983) Ph D studies in the Technical Institute of Lund (1983-1987). Post doc studies on an ELF AQUITAINE sponsorship in the PAUL SABATIER University in Toulouse of France. Coming back to Sweden he obtained the degree of DOCENT (Asssociate Professor) in 1992.
He taught in Lund and HELSINGBORG of Sweden, Oporto Portugal, Bahia Blanca and Rio Cuarto og Argentina, Celaya and Mexico City of Mexico and also he gave lectures in France, Italy, Spain and Germany. He speaks english, french, german, spanish, italian, portuguese and swedish. Since 1998 Professor of Transport Phenomana & Thermodynamics at the Environmental Department of the Technical University of Crete, Chania. He was the first Chairman of the Department (2000-2004). Author of several books and of chapters of books, in english and in greek. Author of >50 publications in cited journals with a Citation Index of approx. 1000. Know how in Membrane Technology, Food Engineering, Stirling cycles and active heliothermic systems. Current research topics: Desertification, Geometry & transport phenomena of biological structures such as the bronchic tree, sun-driven cars, BOLTZMANN equation. He participates in the Summer school of Delfi teaching on the connection between the modern knowledge with the Ancient Greek wisdom.

Plenary Lecture 2

Improvement of Sandwich Finite Elements by Mixed Formulations

Professor Olga Martin
Applied Sciences Faculty
University "Politehnica" of Bucharest
Splaiul Independentei 313
Bucharest, ROMANIA
E-mail: omartin_ro@yahoo.ro

Abstract: Honeycomb sandwich structures are used extensively on both civil and military aircraft due to their high stiffness and low weight. The designers employ honeycomb sandwich structures on numerous parts of the aircraft including control surfaces, floor panels, access panels and doors, at rear of plane to improve the sonic fatigue resistance and replace the thin plate skin by a honeycomb "plank".
A panel consists of thin stiff face-sheets, either of aluminum alloy or composite (glass/ epoxy, graphite/epoxy etc.), adhesively bonded to a thick honeycomb core that is typically manufactured from aluminum. The honeycomb core provides a lightweight yet stiff structure.
In the present study a model that reduces the honeycomb structure to one classical (with cells) keeping the stiffness is carried out. The theoretical results have been applied to the finding of the stresses and safety margins with a finite element program for an aileron structure that contains a wedge of honeycomb sandwich. This study also gives the procedures for determining core thickness and core shear modulus so that the overall buckling of sandwich panel will not occur.

Brief Biography of the Speaker: Olga Martin graduated the Faculty of Mathematics and Mechanics, University of Bucharest, Romania. She received his PhD in mathematics with the specialization in Dynamic Plasticity with paperwork 'Applications of the Finite Element Method in Dynamic Plasticity'. During of twenty years, she had been senior researcher in Aircraft Institute, Strength Materials Department. Technical experience: structural strength computing reports using ANSYS program (wing-fuselage, fuselage frame, fin, elevator, rudder and aileron), dynamic and static test-programs for aircraft structures, fatigue test-programs for aircraft structures, iterative methods for the study of the reactions, which correspond to movable control surfaces, attached at n – points to an elastic structure and program of this, static and fatigue computation of the propeller (mono-bloc hub, blades and blades retention system).
Nowadays, she is Professor, Applied Sciences Faculty, University Politehnica of Bucharest.
Fields of specialization: Mathematical Analysis, Mathematical Physics, Computational and Experimental Solid Mechanics, Numerical Analysis, Statistical Calculus.
She has published over 80 research papers and 18 books.
She is member of the editorial boards of Politehnica Sci. Bull. Series A, WSEAS Transactions on Applied and Theoretical Mechanics, WSEAS Transactions on Mathematics and she was involved in the program/organizing committees for many international conferences.
Membership of Professional Societies
Society of Computer Aided Engineering – Member
National Union of Romanian Scientists (Founding member)
Balkan Society of Geometers, member
Reviewer: WSEAS Press (books and journals), Scientific Bulletin, Politehnica University of Bucharest
Scientific Evaluation Societies: RELANSIN, Politehnica University of Bucharest, ARACIS, Bucharest, CNCSIS, Bucharest
National Science Fund of Bulgaria.

Plenary Lecture 3

Solving Complexity of Naturally Fractured Reservoirs: A Contemporary Application in Optimizing Production of Deep-Earth Resources

Professor Nam H. Tran
School of Petroleum Engineering
The University of New South Wales
Sydney NSW 2052 Australia
namtran@unsw.edu.au

Abstract: Natural fractures are mechanical breaks or discontinuities in rocks, which form in nature in response to high fluid pressures, lithostatic, thermal and tectonic stresses. Naturally fractured reservoirs cover the world's 50% remaining oil and gas reserves and 100% of the renewable geothermal resources. They also exist in coal beds, groundwater resources and underground (nuclear waste) storages. Thus, comprehensive understanding of how the fractures occur in the reservoirs and how the fluid flows inside the rock and fracture system is critical in various earth sciences. However, it is also concomitantly and scientifically challenging, due to the reservoirs' extreme complexity, due to the lack of efficient techniques to integrate field data and due to inadequate understanding of rock and fluid behaviors under reservoir conditions. This work identifies and overcomes such problems. Based on the applications of the most advanced techniques (e.g. geostatistics, fractal geometry, artificial intelligence, control volume boundary element method, finite element method), naturally fractured reservoirs can be characterized and simulated, optimizing production of the deep-earth resources.

Brief Biography of the Speaker: Dr. Tran H. Nam is a Professor/ Lecturer at the School of Petroleum Engineering, the University of New South Wales.
His work in developing naturally fractured petroleum and geothermal reservoirs is highly regarded both in Australia and on international level, as evidenced by invitations to act as session chair at conferences; to Scientific Advisory Board for Linx Research's Network of Energy; and to Editorial Boards of seven (7) international journals, including the prestigous Petroleum Science and Technology (Taylor & Francis) and Computers & Geosciences (Elsevier). His research activity has resulted in an increased demand for participation in review panels for a wide range of scientific journals, including Advances in Water Resources, Petroleum Journals online, Petroleum Science and Engineering and Journal of Hydrology. Dr. Tran's expertise in the field is also shown through a large number of industrial collaborative projects (with ONGC, Scopenergy Ltd., Santos Ltd., Magellan Petroleum and Sydney Gas P/L). He has collaborations internationally (CSIRO Mathematical and Information Sciences, CSIRO Petroleum Resources, FrOG Tech, Sigma1 Geomechanics, University of Tokyo and University of Tulsa). Although the majority of his contributions were made through industry-focussed projects, Dr. Tran has managed to disseminate his research findings by publishing a large number of scholarly papers in refereed publications, some high standing journals in the fields of petroleum, geothermal and computer engineering (Petroleum Science and Technology, Geothermal Resources Council Transactions, Computers & Geosciences and Mathematical and Computer Modelling). He is either the sole or lead (and corresponding) author in 85% of the publications.

Plenary Lecture 4

Non-Destructive Tests to Determine Lifetime of the Pipes

Professor Mihai Demian
University of Craiova
Faculty of Technological Systems Engineering and Management
from Drobeta Turnu Severin
Department of Engineering
Romania
E-mail: mihaidemian@yahoo.com

Abstract: The life time represent nominal reliability of a product. It is important for power plant to know each moment the remaining life time of the each component equipment. Using a nondestructive method as degradation grains limits it is possible to find quickly the remaining life time of pipes. Struers replicas gives important information's to use the method and give a view about structural evolution in time of the metallic material. The paper present the results of the nondestructive method and shows that the pipes at service temperature there is a increase of the grains, a nodulizing of the carburize precipitation which finally determine cavitations. Experimental data permit comparison between the results of nondestructive and destructive methods.

Brief Biography of the Speaker: Prof. Mihai Demian graduated in 1989 the Faculty of Mechanic, "Traian Vuia" Polytechnic Institute of Timisoara, Romania, as an engineer in machines buildings technology and he is doctor in Materials Science at "Politehnica" University of Timisoara. In present he is Vice-Dean and Assoc. professor at Faculty of Technological Systems Engineering and Management from Drobeta Turnu Severin, Department of Engineering at University of Craiova. His research interest is in nondestructive testing, laser heat treatment, material science. He is author of 9 books and more then 55 scientific papers, published at international conferences and journals. He was manager in 2 projects and member in over 10 national an international research projects.
Demian Mihai worked from 1989 to 1991 at Shipbuilding Yard Enterprise from Drobeta Turnu Severin, in the field of mechanical working for ships. From 1991 he is engineering education, developing researches in the field of materials sciences.

Plenary Lecture 5

Thermodynamic Analysis Based on the Second Law Using Exergy: Illustrative Applications of aSize-Based Assessment Hierarchy

Professor Marc A. Rosen
Faculty of Engineering and Applied Science
University of Ontario Institute of Technology
Oshawa, Canada
President of Engineering Institute of Canada
E-mail: M.Rosen@uoit.ca

Abstract: Exergy analysis has been increasingly applied over the last several decades to systems of various sizes, ranging from nano-sized to planetary. Despite the wide range of application sizes, little research has been carried out on how the size of application affects the manner in which exergy is used. Through examining and performing many exergy analyses, the author has previously observed that there appear to be trends related to the application size and the way in which an exergy analysis is performed. The most appropriate way of applying exergy analysis appears to be dependent on the application size, whether considering a device or micro- or nano-sized subsection of it, or a large macrosystem like a country, or a planetary system. An understanding of these size considerations can help guide users of exergy analysis to the most suitable manner of application for a given system. The six size categories follow, from smallest to largest:
-Sub-device: A sub-device is a part of a device, e.g., a row of blades on the turbine, or an individual blade, or a section of a blade, and can extend to micro- and nano-sized parts of devices.
-Device: Devices are taken to be the individual components that make up systems.
-Simple system: A simple system is taken here to be a system made up of a small number of devices (usually less than six).
-Complex system: A complex system is taken here to be a single system made up of many devices (usually much more than six, and often over 50). These values are not scientifically defined, but are simply illustrative ways of dividing the categories.
-Macrosystem: A macrosystem is considered as a grouping of complex systems, often involving multiple facilities over a region like a community, city, province or country.
-Planetary-scale system: Planetary-scale systems include planets, primary sections of a planet (e.g., the atmosphere), and larger systems like the sun.
In this article, each application category is illustrated with an example. Several conclusions are drawn from the work: 1) the various systems investigated with exergy analysis exhibit size-related trends regarding how the analysis is performed, 2) the most appropriate way of applying exergy analysis appears to be dependent on the size of the application, and 3) the size-based hierarchy helps identify the manner in which exergy analysis can most appropriately be applied for a given system. An understanding of these size considerations can help users of exergy analysis determine the most suitable manner of application for a given system and avoid confusion and wasted effort, thereby improving the usability and utilization of exergy analysis for energy systems.

Brief Biography of the Speaker: Dr. Marc A. Rosen is a Professor of Mechanical Engineering at the University of Ontario Institute of Technology in Oshawa, Canada, where he served as founding Dean of the Faculty of Engineering and Applied Science from 2002 to 2008. Dr. Rosen became President of the Engineering Institute of Canada in 2008. He was President of the Canadian Society for Mechanical Engineering from 2002 to 2004, and is a registered Professional Engineer in Ontario. With over 60 research grants and contracts and 500 technical publications, Dr. Rosen is an active teacher and researcher in thermodynamics, energy technology (including cogeneration, district energy, thermal storage and renewable energy), and the environmental impact of energy and industrial systems. Much of his research has been carried out for industry. Dr. Rosen has worked for such organizations as Imatra Power Company in Finland, Argonne National Laboratory near Chicago, and the Institute for Hydrogen Systems near Toronto. He was also a professor in the Department of Mechanical, Aerospace and Industrial Engineering at Ryerson University in Toronto, Canada for 16 years. While there, Dr. Rosen served as department Chair and Director of the School of Aerospace Engineering.

Plenary Lecture 6

Properties of Covering Materials of Roller Used in Cotton Roller Gin

Professor Vijayan Gurumurthy Iyer
Chief Co-ordinator (EDC)
Dr. M. G. R. University
13/14 A ,Tharachand Nagar Second Street
Virugambakkam, Chennai-92
INDIA
E-mail: vijayaniyergurumurthy@rediffmail.com

Abstract: Cotton ginning process is the mechanical separation of cotton fibres from the seed-cotton (kapas). The roller ginning process for cotton was invented by Fones McCarthy in 1840. This process mechanically separates cotton fibres from seeds by means of one or more rollers to which fibres adhere while the seeds are impeded and struck off or pulled loose. Most of the ginning operations is performed by using double roller (DR) gins which serve an important role in the ginning industries. The roller is the major component of DR gins and one requiring considerable attention. The peculiar gripping action or adherence of the cotton fibres to roller covering surface is an important element in the success of roller ginning process.

In the conventional ginning process, the chrome composite leather-clad (CCLC) rollers emit chromium into environment due to the constant dust-producing grinding action. This contaminates the cotton and its products beyond the safe limit prescribed by International Organisation for Standarization (ISO) 14000 standards. CCLC rollers contain about 18,000 to 36,000 mg/kg (ppm) total chromium in trivalent and hexavalent forms, which are toxic to human health and carcinogenic. Current roller gins manufactured by companies in India and abroad commonly employ CCLC rollers. Since semi-finished chrome leather washers, which contain 3% to 4% chromium, are being used by roller ginning mills in India, Africa, Tanzania, China and Egypt, attention has been drawn to the contamination and pollution aspects of the process. This roller covering wears completely out with usage and repairing the roller consists of re-covering it. Specifically, due to persistent rubbing of the leather-clad roller over the stationary knife during the ginning process, the lint is contaminated with about 140 to 1,990 ppm of chromium, and the spun yarns and cotton by-products contain about 100 to 200 ppm, far in excess of the ISO standards limit of 0. 1 ppm. The use of CCLC rollers in the ginning process also causes air pollution due to chrome-specific dust (CSD) in the mill environment and is responsible for synergistic health complications (chromium based diseases and byssinosis) among gin and mill workers. Chromium in CSD and contaminated cotton products acts on human in three ways such as (1) local action as dermatitis or absorption through skin, (2) direct inhalation and (3) ingestion or absorption into the stomach. Toxic effects are produced by prolonged contact with airborne, solid or liquid chromium contamination and pollution, even in small quantities.

Presently, there are about 4,900 cotton ginning mills and they gin 65% of the seed-cotton produced in major eight cotton growing states in India. As per the rough estimate during field survey and discussions with ginning mill management, presently, there are about 2,13,000 CCLC rollers, which comprise of 1,70,40,000 CCLC washers and they are used for a cotton season of three months. There are about 7,60,000 people working in roller ginning industries in India.

Walrus hide, which was used till 1940 in United States of America, was thought to be unequalled for roller coverings. Research and experiments show the possibility of obtaining a substitute. A literature survey was carried out to help meet the objective of designing and developing eco-friendly alternatives. Various eco-friendly alternative roller covering materials and methods have been studied and deviced, such as vegetable tanned leather, eco-friendly tanned leather, alternative rubber and rubber-processing technologies, and modification of the present CCLC roller ginning system. This research is an attempt to eliminate the contamination of cotton and its products , air pollution in cotton ginning and textile mills, and other ginning problems at the source through the design and development of an eco-friendly , pollution-free chromeless roller. Gin roller packing made of multiple layers of cotton fabric bonded together with a rubber compound has been found to be very promising.

The objectives of this research were to :

• Define the physical properties of a roller material which contribute to its energy consumption , ginning rate potential, eco-friendly quality lint cotton, and to search for a better roller covering material.

• Identify and study the environmental problems asssociated with the CCLC rollers currently employed in cotton roller ginning mills.
• Design and develop an eco-friendly, chromefree roller and evaluate its performance with particular reference to the environmental, technical, and commercial aspects of ginning mills.
A special laboratory-built, 200 mm wide, McCarthy-type reciprocating-knife gin referred to here as a gin roller investigation device (GRID) was designed to test and investigate the various roller materials. The GRID was designed to make speeds, pressures, and adjustments measurable and controllable. Fifteen different gin rollers were constructed to provide a range of material characteristics for testing. Ten different types of gin roller covering materials were used: (1) rubber with cotton fabric packing, (2) vegetable tanned leather disks, (3) chrome tanned leather disks, (4) cotton packing, (5) rubber and cork packing, (6) polypropylene packing, (7) coconut coir buffing disks, (8) cotton buffing disks, (9) walrus covering disks and (10) walrus and cotton packing.
Ginning investigations were carried out to study and search the better gin roller covering material for commercial DR gins with good material properties with respect to good fibre production and quality and to design and develop eco-friendly alternatives. Various alternative roller covering materials, namely,vegetable tanned leather, eco-friendly tanned leather, including rubber and rubber-processing technology and modifying the present CCLC roller ginning system have been studied. In a DR gin, two spirally grooved leather rollers, pressed against stationary knives, are made to rotate at a definite speed. Two moving knives, known as the beaters oscillate by means of a crank or eccentic shaft, close to the leather rollers. When the seed-cotton (or kapas) is fed to the gin in action, fibres adhere to the rough surface of the roller and are carried in between the stationary knife and the roller such that the fibres are partially gripped between them. The oscillating knife beats the seeds and separates the fibres which are gripped from the seed end. This process is repeated a number of times and due to the 'push and pull' action, the fibres are separated from the seeds, carried forward on the roller and dropped out of the gin. The ginned seeds drop down through the slots provided in the seed grid. Ginning rate potential and ginning efficiency depends upon the number of effective working strokes on the moving knives.
Seven types of roller covering materials with different rubber compounds and multiple fabrics composition were tested in GRID and DR gins. The RCF rollers made with these experimental covering materials were tested (1) to establish the existence of ginning rate potential and good lint cotton quality production , (2) to find shortcomings in gin performances such as roller life, rate of wear and tear , temperature, lint contamination and maintenance aspects. This chrome-free RCF rollers were found successful in ginning out seed-cotton in an environment friendly way, while maintaining high ginning rate potential, good cotton technological parameters such as fibre,yarn and fabric properties. The chromium contamination levels for cotton and its products were well above allowable limits for all samples, except the cotton samples ginned with RCF roller gin rollers. On the basis of the design and development of various rollers and subsequent performance evaluations, the chrome-free RCF roller has been demonstrated to be superior with reference to technical, commercial and eco-friendliness aspects of the cotton ginning industry. This improved technology is suitable for commercialization. Although the initial cost of the RCF roller is eleven times that of the CCLC roller, this high price is compensated by benefits. The RCF roller is durable with an estimated life of seven years (compared to a few months for CCLC rollers), and the following additional advantages:
• Negligible wear and tear and very low maintenance requriements .
• Output is about one and half times more than that of CCLC rollers because the RCF roller has a surface finish conducive to high ginning efficiency.
• A reduction in the weight of the rollers of 50% could reduce 25% consumption in electrical energy compared to CCLC roller ginneries.
• Noise level is reduced by 4 to 7 dB(A) due to inherent properties and cushioning effects.
• Eco-friendly cotton and cotton-by products are obtained.
• Labour output per hour is 2. 4 standard performance rating which is twice that of CCLC-equipped mills.
• Medical expenses for treating affected workers are decreased by a factor of 23 .

The manufacturing technology, design engineering features , and assembly experience show that the RCF roller covering can be selected with the following characteristics: hardness of 106 BHN (type Brinell Hardness Number), 7 to 10 layers of fabrics 20 mm length, and fabric thickness of fabrics 1. 2 mm, The rubber compound is resilient and fibre bristles protrude 0. 76 mm beyond the rubber surface is maintained in spite of wear.
• As a result, an eco-friendly roller ginning process has been developed for replacing the conventional CCLC roller ginning process to eliminate the chromium contamination and pollution from cotton ginning mills. This process meets the requirements of ISO 14000 environmental standards while maintaining high-quality spun yarns and woven fabrics to meet ISO 9000 standards. With RCF rollers, ginning mills and textile mills, will be freed from chrome-related contamination and pollution problems, and from chrome-related health hazards. The products have been tested commercially and found to be better in all aspects with reference to cotton technological parameters, dye-catching properties, and physical and chemical properties. Eco-friendly RCF rollers could be successfully used commercially as an improved alternative in ginning mills for a cleaner environment, which benefits society, mill owners, clients, workers , employees and the Government.

Brief Biography of the Speaker: Dr. Vijayan Gurumurthy Iyer has got about 27 years experience in research, teaching, and industry out of which seven years at the level of Professor. He has been serving in Dr.M.G.R. University, Chennai as Professor and as the Chief co-ordinator of AICTE-EDC project. He has obtained his Master's and Ph.D. degrees in Environmental Science and Mechanical Engineering from Indian School of Mines University, Dhanbad . He was a post doctoral researcher of World Scientific and Engineering Academy and Society (WSEAS), Greece. The Yorker International University, Italy has awarded him with an honorary doctorate in Engineering on 29 th June, 2008. He is going to submit his Doctor of Science , D.Sc. thesis to Jadavpur University , kolkata, India .
He has published more than 96 research publications in his professional field which includes 32 research papers in reputed journals and 56 papers in reputed conference proceedings. His publications have cited in 87 citation indices of national and international journals. He has nine awards in his credit. He has been listed in many international

biographical references of repute such as Marquis Who's Who in Asia , Marquis Who's Who in the World , Marquis Who's Who in America , IBC's Dictionary of International Biography, Cambridge Blue Book,2000 Outstanding intellectuals of the 21 st Century, ABI's Great Minds of 21 st Century, ABI's 500 Great Leaders. He is a research supervisor of Anna University and Dr.M.G.R. University for guiding M.S and Ph.D. scholars. He has guided more than 27 projects. He is a reviewer of three international journals, viz., WSEAS, ASABE and Environmental monitor. He has fellowships from five institutions and life memberships of ten institutions. Felowhsips include 1.Fellow of Institution of Engineers (India) Grade- F.I.E.(I), F-110329/2 ,Chartered Engineer (India) , C.Eng. (I), Professional Engineer (India) P.Eng. Arbitrator. 2.Fellow of Institution of Valuers (India) Approved Valuer , Grade- F.I.V., F-9446, 3.Fellow of Textile Association, F.T.A., F-3556 , 4.Fellow of All India Management Association, FIMA, F-200620434, 5. Fellow of Madras Management Association, F.M.M.A., , 6. Fellow of Mining Engineers' Association of India.

Plenary Lecture 7

Current Research Activities in Mechatronic Applications – Case Studies

Professor Heinz Ulbrich
Institute of Applied Mechanics
Technical University Munich
Boltzmannstrasse 15, 85748 Garching
GERMANY
E-mail: ulbrich@amm.mw.tum.de

Abstract: The research field Mechatronics combines the various engineering and science topics of mechanics, electronics, physics, mathematics and computer science into an integrated approach. This interdisciplinary view on technical issues enables the improved design of sophisticated systems meeting the increasing demands on performance, size and weight. Almost any research topic in this exciting field comprises new developments or optimisation in general using state-of-the-art techniques.
The presentation will focus on case studies like electromagnetic actuators, rotor rubbing control using actively controlled auxiliary bearings, hydraulic controlled cam phasing systems, biologically inspired low-cost inertial measurement systems, enhanced cognitive driver assistance systems with inertial measurement systems and gaze control, modelling of haptic contacts for telepresence applications, free walking in the real worlds and humanoid walking machines (from JOHNNIE to LOLA).
All research work is always based on a proper modelling of the entire mechatronic system. The models facilitate the optimisation of structural issues as well as the development of control laws that are investigated in simulations as a basis for the experimental verification. Finally, the application of theoretical results in experiments is an integral part of our work and comprises all the related issues as sensors, signal analysis, power supply and controller implementation.

Brief Biography of the Speaker: Heinz Ulbrich studied Mechanical Engineering at the Technical University Munich. He re-ceived his doctor's degree in mechatronics with his work "Design and Control of a Contact-Free Support for a Rotor System Using Magnetic Bearings" and his Habilitation entitled "Dy-namics and Control of Rotors" both at Technical University of Munich. He was Visiting Re-searcher with Professor Roy Holmes at the University of Southampton, UK and Senior re-search fellow at NASA, Lewis Research Center in Cleveland, Ohio, USA. He received pro-fessorships for Dynamics and Technical Kinematics at Faculty of Mechanical Engineering Technical University of Braunschweig and for Applied Mechanics at Faculty of Mechanical Engineering, University of Essen. Currently, he is Ordinaries and Chair holder, Institute of Applied Mechanics, Faculty of Mechanical Engineering, Technical University of Munich. He is a member of the extended Board Council of the Society of Applied Mathematics and Me-chanics and a Member of the Editorial Board of the International Journal Acta Mechanica Sinica as an associate editor. His main research interests can be entitled with "Dynamics, Control and Optimization of Mechatronic Systems in Theory and Experiment". Different ma-chines have been realized over the years in the his mechatronic labs. For example unique hydraulic, electromagnetic and piezoelectric actuators, different biologically inspired walking machines, a parallel kinematical motion platform and actively stabilized rotor systems with fluid-structure interaction, just to name a few. His publications include four books, more than 60 reviewed Journal Papers and more than 200 conference contributions in proceedings related to the topics Dynamics, non-smooth Dynamics, Robotics, Rotor dynamics, Mechatronics.