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Latest Trends on Engineering Mechanics, Structures, Engineering Geology

- 3rd WSEAS International Conference on Engineering Mechanics, Structures, Engineering Geology (EMESEG '10)
- International Conference on Geography and Geology 2010 (WORLDGEO '10)

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Preface

This year the 3rd WSEAS International Conference on ENGINEERING MECHANICS, STRUCTURES, ENGINEERING GEOLOGY (EMESEG '10) and the International Conference on Geography and Geology 2010 (WORLDGEO '10) were held on Corfu Island, Greece, July 22-24, 2010. The conferences remain faithful to their original idea of providing a platform to discuss mechanics of nanomaterials, fluid-structure interaction, geomechanics and mechanics of granular materials, mechatronics, aerodynamics and aeroelasticity, theory of plasticity, water proofing, geotechnical seismic mechanics, environmental geography, geomatics, cartography, history of geography, palaeontology, geochemistry, rock mechanics applied to geology, tectonics and geological mapping, earthquake engineering, earthquake hazard and risk estimation, rock mechanics applied to seismology etc. with participants from all over the world, both from academia and from industry.

Their success is reflected in the papers received, with participants coming from several countries, allowing a real multinational multicultural exchange of experiences and ideas.

The accepted papers of these conferences are published in this Book that will be indexed by ISI. Please, check it: www.worldses.org/indexes as well as in the CD-ROM Proceedings. They will be also available in the E-Library of the WSEAS. The best papers will be also promoted in many Journals for further evaluation.

Conferences such as these can only succeed as a team effort, so the Editors want to thank the International Scientific Committee and the Reviewers for their excellent work in reviewing the papers as well as their invaluable input and advice.

The Editors

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Plenary Lecture 1

Cost Estimating Methods of Industrial Products

Professor Gheorghe Oancea
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Abstract: It is well known that the competitiveness of industrial products is mostly based on cost, quality and innovation. The worldwide competition has demonstrated that it is not important how good the project is, if the product couldn't be designed and manufactured in a short time, with competitive cost and adequate quality. Therefore, the design must be made not only according to the requirements and technical specifications of the product, but also using innovative manufacturing processes with a maximum economic efficiency. The production cost is the factor with major influence on the market and its decrease is the key for companies to survive overall in the world. The lecture presents the cost estimation methods and a software tool used for manufacturing time calculation and cost evaluation for industrial products with high level of customization manufactured by chip removing processes and cold forming processes.

Brief Biography of the Speaker:
Gheorghe Oancea was born in Romania on 11th April 1966. His university education was finished with a diploma degree in Manufacturing Engineering at Transilvania University of Brasov, Romania in 1990. He obtained the PhD degree in Manufacturing Engineering field at the same university in 1997, and he became PhD advisor in 2009. Since 2003, he is full professor at Manufacturing Engineering Department, Transilvania University of Brasov. He is currently involved in undergraduate and postgraduate teaching in the area of CAD/CAPP/CAM Systems.
Professor Gheorghe Oancea has authored and co-authored of 12 books and more than 100 scientific publications. He actively participates in numerous conferences with papers as well as chairman, co-chairman and member of the International Scientific Committee. He also is reviewer for conferences and journals. His current research topics are: CAD/CAPP/CAM Systems, Cost Evaluation and Manufacturing Engineering.

Plenary Lecture 2

Research of Excellence in the National Centre Optimum from "POLITEHNICA" University of Bucharest

Professor Cristina Mohora
The National Research Centre for Performances of Technological Systems-Optimum
"POLITEHNICA" University of Bucharest
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Abstract: The paper presents some results obtained within the National Research Centre for Performances of Technological Systems - Optimum (CNCPST-Optimum) and implemented in industry.
CNCPST-Optimum (http://sun.cfic.pub.ro) is a research and consulting unit with an interdisciplinary profile, in the framework of "POLITEHNICA" University of Bucharest, Faculty of Engineering and Management of Technological Systems, Machine and Production Systems department (www.pub.ro). The centre was founded in 1993 as the result of a project financed by the Global Bank.
The partners in research and educational projects are: INSA Lyon, Ecole Centrale de Paris and Lyon, ENSAM Aix en Provence, ENSAM Lille, Bordeaux 1, (FR), South Bank University of London (UK), Universite Technique De Darmstadt (DE), Bergamo, Torino (IT), Patras, Piraeus (GR), Porto (PT), KU Leuven (BE), University of Liege (BE) etc.
CNCSPT-Optimum carries on: fundamental and applicative research, consulting, education, development, post-graduate studies and distance studies.
The centre has results in: high speed machine design, study and optimization of the interfaces (hexapod-spindle and robot-hexapod); new design solutions (modelling and simulation); mechanical signature analysis (static, dynamic and temperature analysis); optimization by simulation of manufacturing systems; active and passive control, (SMART) solutions for vibrations damping; actuators and control design.

Brief Biography of the Speaker:
Cristina Mohora (http://imst.msp.pub.ro/index/CVMohora/home.htm) is professor at the University POLITEHNICA of Bucharest and International Relations Responsible at CNCPST-Optimum. She has competencies in Analyze of Mechanical Signature of the Technological Systems; Optimisation by Simulation of the Manufacturing Systems, Retrofitting and Open distance learning. From 2003 she is expert evaluator in different programs at EU Commission like FP6, FP7, LLP, and others. She authored or co-authored over 100 scientifical papers published in France, Italy (CIRP), Israel, Maroc, Pakistan, Romania, United Kingdom, Greece, Bulgaria, Croatia, Russia; 10 books; over 50 research contracts. Out of these, 16 research contracts and 4 international projects are finalized under her leading (3 contracts in the National Programme Research of Excellence).

Plenary Lecture 3

Similarity Solutions for Boundary Layer Flow of Non-Newtonian Fluids

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Abstract:

In view of their wide applications in different industrial processes, and also by the interesting mathematical features presented their equations, boundary-layer flows have motivated researchers in many branches of engineering. In recent years, the study of boundary layer flows of non-Newtonian fluids has increased considerably due to their relevance in scientific and technological applications such as oil recovery, material processing, soil and ceramics.

The most frequently used model in non-Newtonian fluid mechanics is the Ostwald-de Waele model (with a power-law rheology), when the relationship between the shear stress and the strain rate is given as follows

$$\tau_{xy} = \mu_0 \left|\frac{\partial u}{\partial y}\right|^{n-1} \frac{\partial u}{\partial y},$$

where positive constant μ_0 is the dynamic coefficient of viscosity and $n > 0$ is called the power-law index. The case $0 < n < 1$ corresponds to pseudo-plastic fluids (or shear-thinning fluids); the case $n > 1$ is known as dilatant or shear-thickening fluids, and for the Newtonian fluid $n = 1$.

The boundary layer equations are nonlinear and have boundary conditions at 0 and at $+\infty$. The problems are very complex to solve analytically and the numerical simulation is even difficult. Therefore, a similarity solution may be a considerable approach. A similarity transformation is used to reduce the system of coupled boundary layer equations into a system of non-linear ordinary differential equations.

Our purpose is to study the solutions to the steady boundary-layer flows of non-Newtonian fluids, represented by a power-law model, over a moving or stationary flat plate in a moving fluid. The effects of the parameters on the skin friction coefficient are analyzed and discussed.

Brief Biography of the Speaker:

Gabriella Bognar received the M.Sc. in Mechanical Engineering from University of Miskolc, Miskolc, Hungary, the Ph.D. in Mathematics and 'Candidate' of Math. Sciences from the Hungarian Academy of Sciences. She is presently a Professor at the Department of Analysis, University of Miskolc, Hungary.

Her teaching and research interests are in the areas of ordinary and partial differential equations, analysis, and complex functions.

Gabriella Bognar has published 5 books, and over 70 papers. She has been reviewer of Mathematical Reviews. She is on the editorial board of Mathematical Notes, Miskolc.

Plenary Lecture 4

Modeling of Vibrations of Lumped and Continual Mechanical Systems by Ordinary Differential Equations

Professor Jan Awrejcewicz
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Department of Automation and Biomechanics
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Abstract: Example taken from mechanical engineering, i.e. dynamics of a triple physical pendulum exhibiting a plane motion (lumped system) and dynamics of a cylindrical shell with the circular cross section (continual system) are studied. In the first case the Lagrange'a equations are used to derive the governing second order ODEs, whereas in the second case strongly nonlinear PDEs are reduced to a truncated set of ODEs via FDM (Finite Difference Method) and the higher order Bubnov-Galerkin approximations.
Mathematical modeling of triple pendulum includes details, taking into account some characteristic features (for example, real characteristics of joints built by the use of roller bearings) as well as some imperfections (asymmetry of the forcing) of the real system. Parameters of the model are obtained by a combination of the estimation from experimental data and direct measurements of the system's geometric and physical parameters. A few versions of the model of resistance in the joints are tested in the identification process. Good agreement between both numerical simulation results and experimental measurements have been obtained and presented. Some novel features of our real system chaotic dynamics have been reported.
In the case of the circular cylindrical shell dynamics the problems related to its regular, bifurcational and chaotic dynamics are illustrated and discussed, as well as it's local (global) stability loss versus control parameters. In addition, the convergence and validity of the applied numerical algorithms are studied.
The lecture includes movies and animations of regular and chaotic dynamics of the analysed systems.

Brief Biography of the Speaker:
Jan AWREJCEWICZ received the M.Sc. and Ph.D. degrees in the field of Mechanics from the Technical University of Lodz in 1977 and 1981, respectively. He received also his bachelor's degree in Philosophy in 1978 from the University of Lodz, and DSc. degree in Mechanics from the Technical University of Lodz in 1990. He is an author or co-author of abort 500 publications in scientific journals and conference proceedings, monographs (37), text books (2), edited volumes (3), conference proceedings (11), journal special issues (11), other books (8) and other short communications and unpublished reports (225). He is now the Head of Department of Automatics and Biomechanics, and the Head of Ph.D. School on 'Mechanics' associated with the Faculty of Mechanical Engineering of the Technical University of Lodz. In 1994 he earned the title of Professor from the President of Poland, Lech Walesa, and in 1996 he obtained the golden cross of merit from the next President of Poland, Aleksander Kwasniewski. He is a contributor to 50 different research journals and to 150 conferences. During his scientific travel he visited 60 different countries. His papers and research cover various disciplines of mathematics, mechanics, biomechanics, automatics, physics and computer oriented science (more details at www.abm.p.lodz.pl).

Plenary Lecture 5

Design of Foundation Structures using the Mechanics of Unsaturated Soils

Professor Sai K. Vanapalli
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Abstract: Bearing capacity and settlement behavior are two key properties required in the design of foundations. In conventional geotechnical engineering practice, the bearing capacity of saturated soils are typically analyzed using two different approaches; effective and total stress approach using Terzaghi (1943) and Skempton (1948) bearing capacity theory, respectively. In most cases, the bearing capacity of unsaturated soils is also interpreted using the effective stress approach regardless of the type of soil (i.e., coarse- and fine-grained soils), which is not rational. In addition, the conventional theory for the estimation of immediate settlement using the modulus of elasticity, E of saturated soils cannot be extended for unsaturated soils or compacted soils as they do not attain saturated condition during their service period.

The mechanics of saturated soils are however employed in practice due to the following two reasons: (i) extending the approach used for saturated soils to soils that are in a state of unsaturated condition provides conservative analysis and (ii) there is no simple framework to design geotechnical structures using the mechanics of unsaturated soils.

In this paper, simple models are proposed for predicting both the bearing capacity and the modulus of elasticity of unsaturated soils for different types of soils. These models use the Soil-Water Characteristic Curve (i.e. SWCC), which is defined as the relationship between the water content and soil suction, as a tool along with saturated soil properties (i.e., bearing capacity and modulus of elasticity under saturated condition). Details of how the proposed models can be implemented into geotechnical engineering practice and differences associated with the proposed methods and conventional methods are also discussed with practical examples. Lastly, a method to estimate matric suction of as-compacted soils using a pocket penetrometer is described.

The simple techniques proposed in this paper should encourage the geotechnical engineers to implement the mechanics of unsaturated soils in practice.

Brief Biography of the Speaker:

Dr. Vanapalli is a Professor and Graduate Program Coordinator of the Civil Engineering Department, University of Ottawa. Dr. Vanapalli received his PhD from the University of Saskatchewan in 1994. Since then, he has been actively involved with research activities related to mechanics of unsaturated soils including expansive soils. The focus of his research was primarily extended towards studying the mechanical behavior of unsaturated soils and proposing simple techniques for the estimation of the soil-water characteristic curve, bearing capacity and settlement behavior of unsaturated soils.

Dr. Vanapalli has authored or co-authored over 120 research publications in peer reviewed journals and conference proceedings, a book chapter and three state-of-the-art reports. He has also delivered three Keynote addresses at the International Soil Mechanics Conferences on topics related to the mechanics of unsaturated soils.

Dr. Vanapalli has been a Co-Chair for the Diamond Jubilee Canadian Geotechnical Conference held in Ottawa, Canada in 2007, Co-Chair of the 12 IACMAG, Goa, India in 2008 and advisor for the 14th Pan-American Conference on Soil Mechanics and Geotechnical Engineering Conference to be held in Toronto, Canada in 2011. He has served as Technical or Scientific Committee Member for several national and international conferences. He has reviewed publications for several technical journals that include Geotechnique, Canadian Geotechnical Journal, Journal of Geotechnical and Geo-environmental Engineering, American Society of Testing Materials, Soil Science Society of America and Transportation Research Board.

Dr. Vanapalli has been nominated by the Civil Engineering Department and the Faculty of Engineering, University of Ottawa for the OCUFA Teaching Excellence Award (2007); University of Ottawa Award for Excellence in Teaching (2006); Civil Engineering Department for the John V. Marsh Teaching Excellence Award (2006). In addition, fifteen

students of Dr. Vanapalli over the last 8 years have received national honors by the Canadian Geotechnical Society and other organizations for submitting best undergraduate (individual and group thesis) and graduate student papers. Dr. Vanapalli is a volunteer for several activities of Canadian Geotechnical Society, Professional Engineers of Ontario and TC6 of the International Society of Soil Mechanics and Geotechnical Engineering which is responsible for promoting cooperation and exchange of knowledge in the area of mechanics of unsaturated Soils.