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ADVANCED TOPICS on WATER RESOURCES, HYDRAULICS & HYDROLOGY

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Preface

This book contains proceedings of the **3rd** IASME / WSEAS International Conference on WATER RESOURCES, HYDRAULICS & HYDROLOGY (WHH '08) which was held in University of Cambridge, Cambridge, UK, and February 23-25, 2008. The first WSEAS Water Resources, Hydraulics & Hydrology Conference was held in Chalkis, Greece, February 2006 and the 2nd was also held in Portoroz, Slovenia, February 2007. This year it held in University of Cambridge, Cambridge, UK. The Society (WSEAS) has also organized many other separate or joint conferences Water Resources, Hydrology, Hydraulics, Applied Fluids Technology, Water and Sustainability, Water and Agricultural Development etc as well as their impact and their interaction with other areas of Environmental Engineering, Civil Engineering, Chemical Engineering, Mechanical Engineering, Agricultural Engineering and Applied Physics. The various WSEAS conferences on Water Science, Hydraulics, Hydrology, Water Resources Management etc... as well as their impact and their interaction with other areas of Modern Engineering and Science. The relevant titles could be retrieved from the web site: www.worldses.org/history.htm

The **3rd** IASME / WSEAS International Conference on WATER RESOURCES, HYDRAULICS & HYDROLOGY (WHH '08) aims to disseminate the latest research and applications in the afore mentioned fields. The friendliness and openness of the WSEAS conferences, adds to their ability to grow by constantly attracting young researchers. The WSEAS Conferences attract a large number of well-established and leading researchers in various areas of Science and Engineering as you can see from **http://www.wseas.org/reports**. Your feedback encourages the society to go ahead as you can see in **http://www.worldses.org/feedback.htm**

The contents of this Book are also published in the CD-ROM Proceedings of the Conference. Both will be sent to the WSEAS collaborating indices after the conference: **www.worldses.org/indexes**

In addition, papers of this book are permanently available to all the scientific community via the WSEAS E-Library.

Expanded and enhanced versions of papers published in these conference proceedings are also going to be considered for possible publication in one of the WSEAS journals that participate in the major International Scientific Indices (Elsevier, Scopus, EI, Compendex, INSPEC, CSA .... see: www.worldses.org/indexes) these papers must be of high-quality (break-through work) and a new round of a very strict review will follow. (No additional fee will be required for the publication of the extended version in a journal).

We cordially thank all the people of WSEAS for their efforts to maintain the high scientific level of conferences, proceedings and journals.

The Editors

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Plenary Lecture I

Exergy as a Tool for Sustainability

Professor Marc A. Rosen
Founding Dean
Faculty of Engineering and Applied Science
University of Ontario Institute of Technology
Oshawa, Ontario, Canada
also: President-Elect, Engineering Institute of Canada

Abstract: We conventionally use energy-based efficiency measures to assess how well energy systems perform. Energy-based measures of merit, however, do not really indicate how nearly performance efficiency approaches the ideal. In fact, energy measures can lead to confusion and, in some instances, to wrong decisions and wasteful allocations of resources. Exergy analysis, which is based on the second law of thermodynamics, avoids the difficulties associated with energy methods, and allows efficiencies to be clearly understood and measures to improve efficiency to be properly assessed. In addition, exergy provides insights into environmental impact and ecology, as well as economics. When all facets of exergy methods are viewed together, exergy is seen to provide an extremely useful tool for understanding, assessing and achieving sustainability, within energy and other systems. In this presentation, the exergy concept and its application as an analysis and improvement tool, and its impact on efforts to achieve sustainability, are described. Various examples are used to illustrate the benefits of exergy.

Brief biography of the speaker: Dr. Marc A. Rosen, P.Eng. is Professor and founding Dean of the Faculty of Engineering and Applied Science at the University of Ontario Institute of Technology in Oshawa, Canada. He is also President-elect of the Engineering Institute of Canada and has served as President of the Canadian Society for Mechanical Engineering. With over 50 research grants and contracts and 400 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, and Dr. Rosen has also worked for such organizations as Imatra Power Company in Finland, Argonne National Laboratory near Chicago, and the Institute for Hydrogen Systems near Toronto. Dr. Rosen has received numerous awards and honours, and is a Fellow of the Engineering Institute of Canada, the Canadian Academy of Engineering, the Canadian Society for Mechanical Engineering, the American Society of Mechanical Engineers and the International Energy Foundation.

Plenary Lecture II

Minimum Energy for an Improved Environment: Electrical Machine Design and Control for The Future

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University of East London
E-mail: R.Perryman@uel.ac.uk

Professor Stephen Dodds
Professor of Control Engineering,
University of East London
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Abstract: This paper presents a vision for the future design of electrical machines and the systems in which they are employed with a view to achieving a contribution to the overall energy consumption minimisation throughout industry. For example, developments in rare earth magnetic materials have enabled new designs of high power density, high efficiency machines. Computationally demanding design techniques such as finite elements and genetic algorithms are becoming practicable with advances in software and digital processors. This is enabling the progress of more sophisticated machine designs with special rotor and stator geometries yielding optimal flux paths, high torque and minimal ripple outputs. To achieve the aforementioned energy consumption minimisation, not only is the electrical machine design important but also the consideration of the energy losses in the systems employing the electrical machines. Automatic control will play an increasingly important role in this regard. Optimal control strategies, especially those involving nonlinearities, are of an open loop structure and hitherto have been largely of academic interest in view of their sensitivities to parametric errors and external disturbances. Advances in easily attained computational power, however, are enabling practicable closed loop versions of these optimal controls that overcome these limitations to be created, with the aid of artificial intelligence. This paper includes several applications in which combined electrical machine design for maximum efficiency and system design for minimum energy usage is of paramount importance.

Brief Biography of the Speakers:

Roy Perryman: graduated with a BSc(Hons) in Electrical Engineering in 1969 and gained a PhD in Magnetic Materials in 1974. He spent 17 years in the electrical and electronics industry working with AFA Minerva (EMI) Ltd, Bowthorpe Controls, and Walter Jones & Co Ltd. In 1988 he joined the University of Greenwich and became Associate Head of the School of Engineering. He was subsequently appointed as Head of the School of Electrical & Manufacturing Engineering at the University of East London in 1996 and became Ford Professor in Engineering Education in 2004. He is a Chartered Engineer and Fellow of the Institution of Engineering and Technology (FIET). His research interests are in the design and control of electrical machines and drive systems, magnetic materials, condition monitoring and the application of neural networks.

Stephen Dodds: received a BSc (Hons) in Electrical Engineering in 1967, an MSc in Systems Engineering in 1970 and a PhD in the Control of Flexible Spacecraft in 1985. He spent 13 years as an attitude and orbit control systems engineer on European space programmes and originated new digitally implemented spacecraft attitude control. In 1985 he was appointed Reader in Control Engineering at the University of East London (UEL) and subsequently expanded his control systems research to encompass electrical drives. In 1997 he was made an Academician of the Academy of Non-linear Sciences of Russia and became Professor of Control Engineering at UEL. His general research interests encompass robust control techniques and feedback linearisation, which has resulted in the recent innovations in drive control systems falling under the general heading of 'forced dynamic control'.

Plenary Lecture III

Worldwide Energy Demand and Environmental Safeguard

Professor Francesco Muzi
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Abstract: The great increase in the world's population along with the improvement in life standards of poorer countries will imply a rapidly growing energy demand in the next few decades. Possible scenarios foresee an increase of as much as 100% in global energy demand from the present to 2050, mainly concentrated in Asian countries as China, India, Indonesia, and in southern Africa. In this situation, there will be two main challenges to face: on the one hand, to find and ensure the energy resources necessary to support both the continuing growth of industrialised countries, and the rising demands of developing countries; on the other hand, to mitigate the already occurring climate changes and assure environment safeguard. In order to meet these crucial requirements, innovation and new technologies will play a fundamental role in our future. New, enlightened policies can effectively establish important opportunities for countries willing to face the challenge. From this point of view, Germany and Spain have already undertaken the path of renewable energy since a few years ago; the UK has recently announced the development of a new, important research project aimed at CO2 reduction. Moreover, both the European Union and the U.S.A. have recently enacted a number of directives that clearly point in this direction. As regards this global competition, the present lecture will mainly discuss the combined role of the following topics: the development of renewable energy sources, the efficiency in energy end-uses, and frontier technologies in electric power engineering. In this context, emphasis will be given also to smart-grids and distributed generation for an innovative, effective and comprehensive system of electric energy production and distribution.

Brief Biography of the Speaker: Francesco Muzi is a professor of Power Systems at the University of L'Aquila, Italy, where he has also the scientific responsibility for the Power System Group. His main research interests concern Power systems transients and dynamics, Power quality in distribution systems, Power system reliability, Electromagnetic analysis, and Power systems diagnostics and protection. In these fields, he authored or co-authored over 100 scientific papers published in reviewed journals or presented at international conferences. For his contribution on Lightning Induced Overvoltages, he received a mention in the book of P. Chowdhuri "Electromagnetic Transients in Power Systems", John Wiley & Sons, New York and participated to the outline of the "IEEE Guide for improving the lightning performance of electric lines", IEEE Standards Department, New York. He has also a patent for an industrial invention, namely "Power system controlled by a microprocessor". He is a regional chairman of the Italian National Lighting Society and was a chairman or keynote lecturer in a number of international conferences organized by ISSAT (International Society of Science and Applied Technologies) and WSEAS. He is a technical reviewer for the following international journals: IEEE Transactions on Power Delivery, Electric Power Systems Research by Elsevier Science, IET Generation, Transmission & Distribution.

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