Recent Advances in Power Systems, Energy, Environment

> Proceedings of the 2014 International Conference on Power Systems, Energy, Environment

> > Interlaken, Switzerland, February 22-24, 2014

Edited by

Aida Bulucea Eduardo Mario Dias

Energy, Environmental and Structural Engineering Series - 22

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All papers of the present volume were peer reviewed by no less than two independent reviewers. Acceptance was granted when both reviewers' recommendations were positive.

Energy, Environmental and Structural Engineering Series - 22

ISSN: 2227-4359 ISBN: 978-1-61804-221-7

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## **Table of Contents**

Plenary Lecture 1: Discrete Lyapunov Controllers for an Actuator in Camless Engines Paolo Mercorelli	13
Plenary Lecture 2: EMG-Analysis for Intelligent Robotic based Rehabilitation	14
Thomas Schrader	
<u>Plenary Lecture 3: Atmospheric Boundary Layer Effects on Aerodynamics of NREL Phase</u> <u>VI Windturbine in Parked Condition</u> Mohammad Moshfeghi	15
Plenary Lecture 4: Laminar and Turbulent Simulations of Several TVD Schemes in Two- Dimensions Edisson S. G. Maciel	16
Plenary Lecture 5: The Flocking Based and GPU Accelerated Internet Traffic Classification Zhiguang Xu	18
<u>Plenary Lecture 6: The State of Civil Political Culture among Youth: Goals and Results of</u> <u>Education</u> Irina Dolinina	19
Modelling and Cost Estimation of Stirling Engine for CHP Applications Ana C. Ferreira, Ricardo F. Oliveira, Manuel L. Nunes, Luís B. Martins, Senhorinha F. Teixeira	21
<b>Energy-Economical Efficiency of Building Heating and Cooling by Heat Pump Systems</b> Ioan Sarbu, Daniel Dan, Calin Sebarchievici	30
Problems of Fast Frequency Variation Control in Interconnected Power Systems	38
V. Chuvychin, A. Sauhats, R. Petrichenko, G. Bochkarjova	
<u>A Robust Stabilizer H<sub>2</sub>-PSS Applied to Power System (Application under GUI/MATLAB)</u> Ghouraf Djamel Eddine, Naceri Abdellatif	44
The Stochastic Approach for Determination of Transmission Line Wire Cross Section Lubov Petrichenko, Antans Sauhats, Svetlana Guseva, Svetlana Berjozkina, Viktoria Neimane	50
Multi-Objective Optimization using NDSPSO with Cost, Emission and Loss Objectives S. Sivanagaraju, Ch. V. Suresh, K. Srikumar, A. V. Naresh Babu	57
Study of the Voltage Stability of Distribution Network Connected Induction Machines	63
Trinh Trong Chuong, Truong Viet Anh	
Genetic-based Neuro-Fuzzy Design of FACTS Controller in Power System	69

Sattar Jaber Al-Isawi

The Efficiency of the Active Power Filters in High Power DC Drive Systems	74
B. Miedzinski, A. Kozlowski, J. Wosik, M. Kalus	
A Comparative Analysis of UPQC-P, UPQC-Q and UPQC-VAmin - A Simulation Study	80
Yash Pal, A. Swarup	
A MULTISCALE-based Model for Composite Materials with Embedded PZT Filaments	86
Tarek M. Hatem, Mohamed Abdel-Meguid	
An Approach for Optimal Placement, Rating and Investment Cost Recovery of a TCSC in	91
Double Auction Power Market	
Prashant Kumar Tiwari, Yog Raj Sood	
Influence of Environmental Parameters on Spatial Distribution of Pollen Grains in	98
<u>Columbia Basin</u>	
Peter Šiška, Štefan Poláčik	
Android Application Front-end for an Energy Brokerage Agent	105
Christos Petsos, Kostas Kalogirou, Evangelos Bekiaris	
Distribution System Analysis with Time Varying Winter Load and Growth	111
V. V. S. N. Murty, Ashwani Kumar	
Assessment of Restructured Indian Power Sector: Availability, Demand and Shortage	118
Yog Raj Sood, Rajnish Shrivastava, Naveen Kumar Sharma	
A Robust AVR-PSS Synthesis using Genetic Algorithms (Application under GUI/MATLAB)	123
Ghouraf Djamel Eddine, Kabi Wahiba, Naceri Abdellatif, Horch Abdessamed	
Energy Efficiency Potential Assessment and Ranking for Schools in Teresina City	130
E. K. Yamakawa, A. R. Aoki, L. C. Siebert, J. F. Silva Filho, J. B. Lopes, W. G. R. Lopes	
Power Management System in Electro-Solar Vehicle	134
Hemza Saidi, Abdelhamid Mudoun	
Optimal DFIG Location and Impact of Load Model in Pool Electricity Market	149
Ashwani Kumar, Manish Kumar, K. S. Sandhu	
MODELING of Dislocation Evolution in Multi-Junction based Photovoltaic Devices	157
Tarek M. Hatem, Mohamed T. Elewa	
On an Accurate Estimation of HV Insulators Contamination: Combined Image Statistical	160
Features and Neural Networks Approach	
Luqman Maraaba, Hussain Al-Duwaish, Zakariya Al-Hamouz	

Intelligent Control of DFIG based Variable Speed Wind Turbine System using Artificial	166
Neural Network	
Sathans, Jitender Rohilla	
Daylighting Rules of Thumb and a Comparison of Different Floor Depth under Overcast	173
and Intermediate Sky Without Sun	
M. F. M. A. Sadin, N. L. N. Ibrahim, K. Sopian, E. Salleh	
Ecological Refrigerants used in Refrigeration, Airconditioning and Heat Pump Systems	178
Ioan Sarbu, Emilian Stefan Valea	
Ordinal Optimization Approach to Power System Objectives in the Presence of SVC and	185
<u>TCSC</u>	
K. Srikumar, Ch. V. Suresh, S. Sivanagaraju, V. Ganesh	
Removal of Anionic Dyes from Aqueous Solutions using Local Activated Kaolins as	191
<u>Adsorbers</u>	
F. Z. El Berrichi, S. Zen	
Plasma-Assisted Ignition and Combustion of Pulverized Coal at Thermal Power Plants of	197
<u>Kazakhstan</u>	
V. E. Messerle, A. B. Ustimenko, O. A. Lavrichshev	
A Novel STATCOM Wide Area Feedback Controller for Improving Stability in	204
Multimachine System	
Aman Ganesh, Ratna Dahiya, G. K. Singh	
Sliding Mode Control of Chopper Connecting Wind Turbine with Grid based on	211
Synchronous Generator	
Ahmed Tahour, Abdel Ghani Aissaoui, Mohamed Abid, Najib Essounbouli, Frederic Nollet	
The Fundamental Problems of Transmission of Data and Voice by Using PLC via High	216
Voltage Lines	
Javad Abdi, Azam FamilKhalili	
Economic Analysis of Wind Turbine Using New Cost Model	220
Sahil Bajaj, Kanwarjit Singh Sandhu	
Comparative Germination Studies in Mature Seeds of Haloxylon Salicornicum	224
L. Almulla	
Applying GIS to Assessment of Ecosystems in the Landscape Level Case Study from the	227
Czech Republic	
Vilém Pechanec, Ivo Machar, Aleš Vávra, Helena Kiliánová	
Controlled Output of Wind Turbine during Wind Variations	232
Navjot Singh Sandhu, Shelly Vadhera, Kanwarjit Singh Sandhu	

Comparison for Performance and Exhaust Emissions of Steam Injected and Thermal236Barrier Layer (TBL) Coated Piston Spark Ignition Engine236Adnan Parlak, Idris Cesur, Vezir Ayhan, Barış Boru, Görkem Kökkülünk236

### Authors Index

240

#### **Discrete Lyapunov Controllers for an Actuator in Camless Engines**



Professor Paolo Mercorelli Leuphana University of Lueneburg Germany E-mail: mercorelli@uni.leuphana.de

**Abstract:** This paper deals with a hybrid actuator composed by a piezo and a hydraulic part controlled using two cascade Lyapunov controllers for camless engine motor applications. The idea is to use the advantages of both, the high precision of the piezo and the force of the hydraulic part. In fact, piezoelectric actuators (PEAs) are commonly used for precision positionings, despite PEAs present nonlinearities, such as hysteresis, satura- tions, and creep. In the control problem such nonlinearities must be taken into account. In this paper the Preisach dynamic model with the above mentioned nonlinearities is considered together with cascade controllers which are Lyapunov based. The sampled control laws are derived using the well known Backward Euler method. An analysis of the Backward and Forward Euler method is also presented. In particular, the hysteresis effect is considered and a model with a switching function is used also for the controller design. Simulations with real data are shown.

**Brief Biography of the Speaker:** Paolo Mercorelli received the (Laurea) M.S. degree in Electronic Engineering from the University of Florence, Florence, Italy, in 1992, and the Ph.D. degree in Systems Engineering from the University of Bologna, Bologna, Italy, in 1998. In 1997, he was a Visiting Researcher for one year in the Department of Mechanical and Environmental Engineering, University of California, Santa Barbara, USA. From 1998 to 2001, he was a Postdoctoral Researcher with Asea Brown Boveri, Heidelberg, Germany. From 2002 to 2005, he was a Senior Researcher with the Institute of Automation and Informatics, Wernigerode, Germany, where he was the Leader of the Control Group. From 2005 to 2011, he was an Associate Professor of Process Informatics with Ostfalia University of Applied Sciences, Wolfsburg, Germany. In 2010 he received the call from the German University in Cairo (Egypt) for a Full Professorship (Chair) in Mechatronics which he declined. In 2011 he was a Visiting Professor at Villanova University, Philadelphia, USA. Since 2012 he has been a Full Professor (Chair) of Control and Drive Systems at the Institute of Product and Process Innovation, Leuphana University of Lueneburg, Lueneburg, Germany.

Research interests: His current research interests include mechatronics, automatic control, signal processing, wavelets; sensorless control; Kalman filter, camless control, knock control, lambda control, robotics.

The full paper of this lecture can be found on page 19 of the Proceedings of the 2014 International Conference on Circuits, Systems and Control, as well as in the CD-ROM proceedings.

#### EMG-Analysis for Intelligent Robotic based Rehabilitation

Professor Thomas Schrader University of Applied Sciences Brandenburg Germany E-mail: thomas.schrader@computer.org

Abstract: The establishment of wireless sensor network (WSN) technology in physiotherapy and rehabilitation is a clue for improvement of the thera- peutic process, quality assessment and development of supporting tech- nologies such as robotics. Especially for complex therapeutic interventions such as sensorimotor training, a continuous monitoring during the ther- apy as well as for all sessions would be quite useful. For the usage of robotic support in rehabilitation various input informa- tion about the status of patient and his/her activity status of various muscles have to be detected and evaluated. The critical point for robotic intervention is the response time. Under physiotherapeutic and rehabilita- tion conditions, the robotic device should be able to react differently and in various patterns. A complex analysis procedure of input signals such as EMG is essential to ensure an effective response of the robot. However sensor nodes in a wireless (body) area network have limited resources for calculating and storage processes. A stepwise procedure with distributed analysis tasks is proposed. Electromyogram (EMG) measurements of eight muscles were collected and evaluated in an experimental setting of a sensorimotor training using different types of balance boards. Fast and easy methods for detection of activity and rest states based on time domain analysis using low pass IIR filter und dynamic threshold adaption. These procedures can be done on the sensor nodes themselves or special calculation nodes in the network. More advanced methods in frequency domain or analysis of dynamical system behavior request much more system power in calculation as well as storage. These tasks could be done on the level of mobile devices such as mobile phones or tablet computer. A broad range of resources can be provided by cloud/internet. Such level based organization of analysis and system control can be compared with biological systems such as human nervous system.

### Atmospheric Boundary Layer Effects on Aerodynamics of NREL Phase VI Windturbine in Parked Condition



Professor Mohammad Moshfeghi Sogang University, South Korea E-mail: mmoshfeghi@sogang.ac.kr

**Abstract:** In a natural condition, the wind is affected by the groundcover and the type of terrains which impose vertical velocity profile to the wind. This wind profile, which is also called atmospheric boundary layer (ABL), dramatically influences the aerodynamic behaviors and loadings of horizontalaxis wind turbines. However, for the sake of simplicity, many numerical simulations only deal with the uniform wind speed. To consider the effects of the ABL, numerical simulations of the two-bladed NREL Phase VI wind turbines aerodynamicat the parked condition are conducted under both uniform and ABL. The Deaves-Harris (DH)model is applied to the ABL. The wind turbine blades are kept at the six o'clock position and are considered at two different pitch angles. The aerodynamic forces and moments of the uniform the DH model are compared. The results show that the pitch angle at which the HAWT is parked conditions, the Down-blade and the blade in the uniform wind are under approximately similar aerodynamic loadings, while the Up-blade encounters more aerodynamic loads, which is even noticeable value for this small wind turbine. This in turn means that for an appropriate and exact design, effects of ABL should be considered with more care.

**Brief Biography of the Speaker:** Dr. Mohammad Moshfeghi works in Multi-phenomena CFD Engineerng Research Center (ERC) Sogang University, Seoul, South Korea. He is also Lecturer in Qazvin Azad University. He has a registered patent: "Split-Blade For Horizontal Axis Wind Turbines" (Inventors: Mohammad Moshfeghi, Nahmkeon Hur).

#### Laminar and Turbulent Simulations of Several TVD Schemes in Two-Dimensions



Professor Edisson S. G. Maciel Federal University of Great Dourados, Brazil E-mail: edisavio@edissonsavio.eng.br

Abstract: This work, first part of this study, describes five numerical tools to perform perfect gas simulations of the laminar and turbulent viscous flow in two-dimensions. The Van Leer, Harten, Frink, Parikh and Pirzadeh, Liou and Steffen Jr. and Radespiel and Kroll schemes, in their first- and second-order versions, are implemented to accomplish the numerical simulations. The Navier-Stokes equations, on a finite volume context and employing structured spatial discretization, are applied to solve the supersonic flow along a ramp in two-dimensions. Three turbulence models are applied to close the system, namely: Cebeci and Smith, Baldwin and Lomax and Sparlat and Allmaras. On the one hand, the second-order version of the Van Leer, Frink, Parikh and Pirzadeh, Liou and Sreffen Jr., and Radespiel and Kroll schemes is obtained from a "MUSCL" extrapolation procedure, whereas on the other hand, the second order version of the Harten scheme is obtained from the modified flux function approach. The convergence process is accelerated to the steady state condition through a spatially variable time step procedure, which has proved effective gains in terms of computational acceleration (see Maciel). The results have shown that, with the exception of the Harten scheme, all other schemes have yielded the best result in terms of the prediction of the shock angle at the ramp. Moreover, the wall pressure distribution is also better predicted by the Van Leer scheme. This work treats the laminar first- and second-order and the Cebeci and Smith second- order results obtained by the five schemes.

**Brief Biography of the Speaker:** Professor Edisson Sávio de Góes Maciel was born in Recife, Pernambuco, Brazil in 1969, February, 25. He studied in Pernambuco until obtains his Master degree in Thermal Engineering, in 1996, August. With the desire of study aerospace and aeronautical problems using numerical methods as tools, he obtains his Doctor degree in Aeronautical Engineering, in 2002, December, in ITA and his Post-Doctor degree in Aerospace Engineering, in 2009, July, also in ITA. He is currently Professor at UFGD (Federal University of Great Dourados) – Mato Grosso do Sul – Brasil. He is author in 47 papers in international journals, 2 books, 67 papers in international conference proceedings. His research interestes includes a) Applications of the Euler equations to solve inviscid perfect gas 2D and 3D flows (Structured and unstructured discretizations) b) Applications of the Navier-Stokes equations to solve viscous perfect gas 2D and 3D flows (Structured and unstructured discretizations) c) Applications of the Euler and Navier-Stokes to solve magneto gas dynamics flows 2D and 3D; (Structured and unstructured discretizations) d) Applications of algebraic, one-equation, and two-equations turbulence models to predict turbulent effects in viscous 2D flows (Structured and unstructured discretizations), e) Study of artificial dissipation models to centered schemes in 2D and 3D spaces (Structured and unstructures discretizations) f)Applications of the Euler and Navier-Stokes equations to solve reentry flows in the Earth atmosphere and entry flows in Mars atmosphere in 2D and 3D (Structured and unstructured discretizations).

The full paper of this lecture can be found on page 79 of the Proceedings of the 2014 International Conference on Mechanics, Fluid Mechanics, Heat and Mass Transfer, as well as in the CD-ROM proceedings.

#### The Flocking Based and GPU Accelerated Internet Traffic Classification



Professor Zhiguang Xu Valdosta State University USA E-mail: zxu@valdosta.edu

Abstract: Mainstream attentions have been brought to the issue of Internet traffic classification due to its political, economic, and legal impacts on appropriate use, pricing, and management of the Internet. Nowadays, both the research and operational communities prefer to classify network traffic through approaches that are based on the statistics of traffic flow features due to their high accuracy and improved robustness. However, these approaches are faced with two main challenges: identify key flow features that capture fundamental characteristics of different types of traffic in an unsupervised way; and complete the task of traffic classification with acceptable time and space costs. In this paper, we address these challenges using a biologically inspired computational model that imitates the flocking behavior of social animals (e.g. birds) and implement it in the form of parallel programs on the Graphics Processing Unit (GPU) based platform of CUDA from NVIDIA<sup>™</sup>. The experimental results demonstrate that our flocking model accelerated by GPU can not only effectively select and prioritize key flow features to classify both well-known and unseen network traffic into different categories, but also get the job done significantly faster than its traditional CPU-based counterparts due to the high magnitude of parallelism that it exhibits.

**Brief Biography of the Speaker:** Prof. Zhiguang Xu received his Ph.D. in Computer Science from University of Central Florida, FL, USA in 2001. He is currently Professor of Computer Science in the Department of Math and Computer Science at Valdosta State University, GA, USA. His research and teaching interests include Computer Networking, Artificial Intelligence, Parallel and Distributed Computing, and Computer Science Education. Professor Xu is author or co-author of more than 25 published papers in refereed journals or conference proceedings. He has been awarded many grants from both academic and industrial entities. He is actively serving as committee member, reviewer, or lecturer of many national and international conferences and organizations.

The full paper of this lecture can be found on page 88 of the Proceedings of the 2014 International Conference on Mathematical Methods, Mathematical Models and Simulation in Science and Engineering, as well as in the CD-ROM proceedings.

### The State of Civil Political Culture among Youth: Goals and Results of Education



Professor Irina Dolinina Perm National Research University, Russia E-mail: irina\_edu@mail.ru

**Abstract:** Political culture is viewed as a phenomenon of social reality. Attitudes toward it (its meaning or significance) are historically conditioned. This research studies enduring presuppositions about (dispositions toward) society and the state, and how these are reflected in conscious stereotypes and cognitive structures among young people within the sociocultural mechanisms that form and modify the basic characteristics of political culture.

**Brief Biography of the Speaker:** Prof. Irina Dolinina was born in 1960, in Perm, Russia. She is Team Leader in the Research Project «Formation of the political culture of the students», and Professor of Philosophy and Law of the Faculty of Humanities, Perm National Research Technical University since 2012. She has received a lot of honors and awards (2012 - Diploma of the All-Russian Roswitha fund national education and the Education Committee of the State Duma of the Federal Assembly of the Russian Federation. 2013 - Diploma of the All-Russian Roswitha fund national education Committee of the State Duma of the Russian Federation. Diploma-Russian contest "Best Science Book in the humanitarian sphere - 2013). Prof. Dolinina has various progessional organizations and activities.

(Expert on the legislative activities of the Council of Federation of Russia. Board member of the Interregional Association "For civic education." Director of the Research Centre of the political culture).

The full paper of this lecture can be found on page 57 of the Proceedings of the 2014 International Conference on Educational Technologies and Education, as well as in the CD-ROM proceedings.