Selected Topics in Energy, Environment, Sustainable Development & Landscaping

Editors: Petru Andea, Stefan Kilyeni

Selected Topics in Mathematical Methods & Computational Techniques in Electrical Engineering

12th WSEAS International Conference on Mathematical Methods and Computational Techniques in Electrical Engineering (MMACTEE '10)

Hosted and Sponsored by

"Politehnica" University of Timisoara
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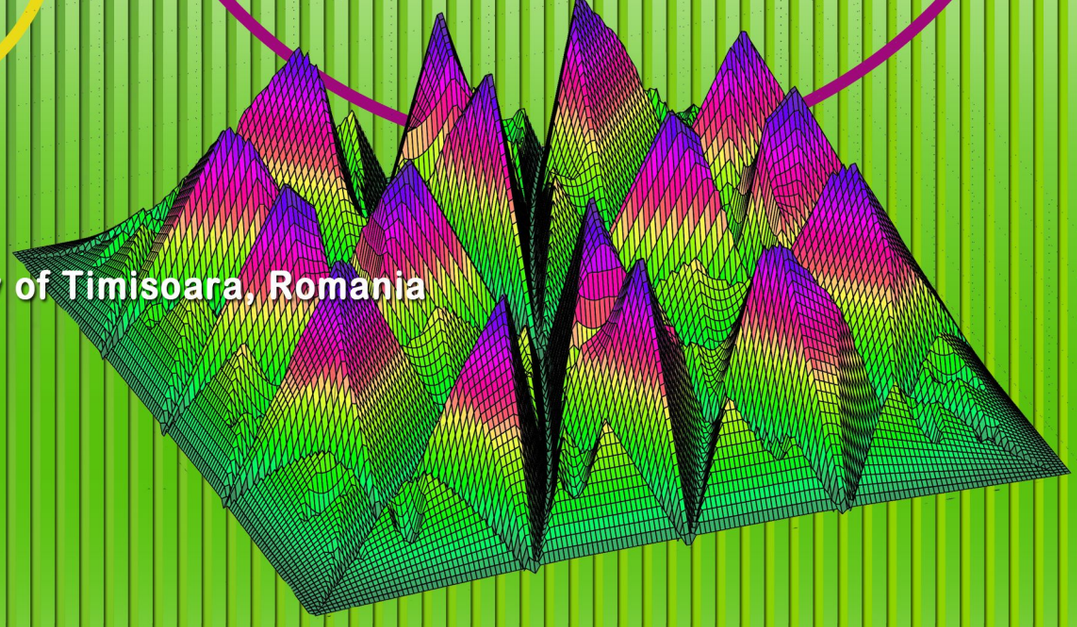

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Stefan Kilyeni

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Preface

This year the 12th WSEAS International Conference on MATHEMATICAL METHODS and COMPUTATIONAL TECHNIQUES in ELECTRICAL ENGINEERING (MMACTEE '10) was held at the Politehnica University of Timisoara, Romania, October 21-23, 2010. The conference remains faithful to its original idea of providing a platform to discuss differential equations, finite differences, variational calculus, cellular automata, wavelets, integral equations, linear and non-linear time series, neural networks, fuzzy logic, evolutionary computing, circuits, systems theory, dynamical systems, chaos, electromagnetic fields etc. with participants from all over the world, both from academia and from industry.

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

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

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

The Editors

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Plenary Lecture 1

Assessment of Power-Frequency Based Algorithms for Fault Location in Power Grids

Professor Marcel Istrate
Vice Dean of the Electrical Engineering Faculty
Technical University "Gheorghe Asachi" of Iasi
Romania
E-mail: mistrate@ee.tuiasi.ro

Abstract: The complexity of the actual power grids implies dynamic operative structures leading to more frequent and dynamic changes of the fault currents' levels and, as a consequence, the sensitivity and selectivity of an entire population of relays must be frequently verified and adjusted. At the same time, these changes into the operating schemes of the power grids, eventually as a result of the distributed generation using unconventional sources, give an increased importance to the detection and the location of the grids' lines faults, not only in the long transmission lines but in the distribution ones, too.
Nowadays, the trend into the power grids' operation is that of the quick faults' location, without human intervention. This is made directly possible by utilizing fault-generated signals, the fault producing a wide spectrum of signals that contains information on the fault distance. These signals are the power frequency components and the transients. Traveling wave based fault location techniques need a high sampling frequency, special transducer and sophisticated electronic devices, becoming more expensive and not as developed as the power-frequency based fault location techniques.
This paper presents the state of the art of the fault location techniques based on power frequency phasors estimation, together with a mathematical model of a fault locator processing only transient voltages, result of the investigations conduced by the author.
A section of the paper will be dedicated to the algorithms used for power frequency phasors estimation and the results obtained on the basis of in-site registered results. A special section of the paper will be dedicated to the implementation of the phasor estimation and of the fault location algorithms into ATP-EMTP software, results of the author's research. The very flexible programs, obtained by these means, will be used to identify the influence of some grid's parameters on fault locating error. The parametrical analysis and, thus, the assessment of the fault location accuracy will refer to the following parameters: sources' power, fault's inception angle, fault's position along the grid's lines, lines' asymmetry, the combined effect of the load current and fault resistance, the uncertainty into the lines parameter's estimation, the presence of the harmonics and the frequency deviation.

Brief Biography of the Speaker:
Marcel ISTRATE was born in Suceava, Romania, on the 5th of September 1960. He graduated in Electrical Engineering at the Technical University "Gheorghe Asachi" of Iasi, Romania, in 1985. Between 1985 and 1988 he worked as an electrical engineer for design and maintenance of low and medium voltage grids and equipment in a water supply company. In 1988 he joined the Technical University "Gheorghe Asachi" of Iasi, Romania. At present, he is a professor in the Power System Department of the Faculty of Electrical Engineering. In 1996 he received the Ph D degree in power systems from the Technical University "Gheorghe Asachi"of Iasi and in 2003 and 2009 he has attended postdoctoral studies in energy efficiency and in educational management, at the same university. In 1999, he visited the Ecole Superieure d'Ingineurs de Poitier, France, and Escuela Tecnica Superior de Ingenieros Industriales, Valladolid, Spain. Since 2004 he is Vice Dean of the Electrical Engineering Faculty. He is conducting lectures on High Voltage Engineering, Electromagnetic Transients and Pollution Control of the Power Plants. His scientific and educational experience is disseminated, as author or coauthor, in 13 books, over 120 papers in the area of power systems, published in international journals and conference proceedings (11 papers in ISI and other indexing international databases) and 17 patents (all available in ISI web of Science). He also has a valuable project management experience, being project manager or member in a research team of over 45 research grants sponsored by national research organizations or by different companies. He is member of CIGRE since 2005, member of the National Romanian Committee of World Energy Council and member of the editorial advisory board of the Environmental Engineering and Management Journal. His main research interests are directed towards computer assisted analysis of the transients, fault location in power grids, protection against lightning strokes and against overvoltages, modeling and simulation of power grids' protection systems.

Plenary Lecture 2
Heuristic and Metaheuristic Optimization Techniques with Application to Power Systems

Professor Mihai Gavrilas
"Gh. Asachi" Technical University of Iasi
ROMANIA
E-mail: mgavrilas@yahoo.com

Abstract: The development of modern wide-area power systems, as well as recent trends towards the creation of sustainable energy systems have given birth to complex studies addressing technical, but also economical and environmental, aspects related to simple or multi-objective optimization problems. Examples of optimization problems widely encountered in power system applications are: normal operating conditions and post-fault distribution network reconfiguration, reactive power planning, optimal design of FACTs' parameters, unit commitment, simple or multi-area economic dispatch, generation expansion planning, optimal load shedding, steady-state security analysis, state estimation, optimal power-flow, distributed multi-generation system optimization, power plant control and others. Most of these optimization problems are combinatorial in nature, have nonsmooth and nondifferentiable objective functions, and have lots of local minima. For this type of problems conventional optimization techniques barely can find acceptable solutions or any solution at all.
During the last decades, several heuristic techniques were proposed to solve such difficult optimization problems. These techniques include: simulated annealing, tabu search, genetic algorithms, immune algorithms, memetic algorithms, symbolic regression, ant colony optimization, particle swarm optimization, variable neighborhood search etc Recently, metaheuristic approaches that apply combinations of different heuristics with or without traditional search and optimization techniques were proposed to be used to solve extremely complex problems. The main advantage of the (meta)heuristics is that the problem can be solved without a precise description of the optimization background; a simple association between a solution representation and the objective function(s) is enough.
The purpose of this presentation is to provide the audience with basic knowledge of most widely used (meta) heuristic optimization techniques, and how they are applied in common optimization problems in power systems. Example applications will be presented to stress the similarities and differences between different (meta)heuristics, their advantages and their drawbacks.

Brief Biography of the Speaker:
Mihai Gavrilas was born in Iasi, Romania on February, 6, 1959. He received the M.Sc. degree from the "Gh. Asachi" Technical University of Iasi, Romania, in 1984. Between 1984 and 1988 he worked as a field engineer and then as a design engineer in the field of power station and substation building and design. Since 1988 he has been devoted to education and research at the "Gh. Asachi" Technical University of Iasi, where, at present, he is a professor with the Power System department, inside the faculty of Electrical Engineering. In 1994 he received the Ph D degree in power systems from the Technical University of Iasi. He is reading courses on Power systems steady state and stability analysis, Intelligent systems application in power systems and Electricity markets. He has a remarkable scientific and educational experience being the author or joint author of 11 books, and over 130 papers in the area of power systems and intelligent systems applications, published in international journals and conference proceedings (16 papers indexed by ISI and other international databases). He also has a valuable project management experience (project manager or member in the research team) in over 40 research grants sponsored by research organizations and / or research programs with partners from industry. He is an IEEE member (Power and Energy Society, Computational Intelligence Society, Systems, Man and Cybernetics Society) since 1994, and a CIGRE member since 2008. His main research interests are directed towards multi-objective optimization for power systems steady-state operating conditions, power systems dynamics and control, state estimation and observability analysis in power systems, and computational intelligence application in power systems. He participated in the 8th WSEAS International Conference on POWER SYSTEMS (PS 2008), Santander, Cantabria, Spain, and the 9-th WSEAS / IASME International Conference on Electric Power Systems, High Voltages, Electric Machines (POWER 2009), Genova, Italy. During POWER 2009 Conference he was invited as a Plenary Speaker to present a speech on "Recent Advances and Applications of Synchronized Phasor Measurements in Power Systems".

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