Editors: H. Fujita, J. Sasaki

Selected Topics in Power Systems and Remote Sensing

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10th WSEAS/IASME International Conference on Electric Power Systems, High Voltages, Electric Machines (POWER '10)

6th WSEAS International Conference on Remote Sensing (REMOTE '10)

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Preface

This year the 10th WSEAS/IASME International Conference on ELECTRIC POWER SYSTEMS, HIGH VOLTAGES, ELECTRIC MACHINES (POWER '10) and the 6th WSEAS International Conference on REMOTE SENSING (REMOTE '10) were held at the Iwate Prefectural University, Japan, October 4-6, 2010. The conferences remain faithful to their original idea of providing a platform to discuss power system planning and management, electric machines, electric vehicles, batteries, high voltage engineering, renewable energy sources and technology, transmission and distribution, sensor design and calibration, data acquisition and processing, defense and security 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 Committees 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

High Power Switching Devices: Past, Present and Future

Professor Noel Y. A. Shammas
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Abstract: Switching devices are key components in any power electronic circuit or system as they control and limit the flow of power from the source to the load. Their power level requirements (current & voltage) and switching frequency are continually increasing in the power electronic industry, and this demands larger and faster switching devices.
This paper will focus on the development of high power switching devices and will present an up to date perspective of switching device technology and materials. The most important material has been and still is silicon (Si) for solid-state semiconductor devices. It dominates the world market at present, particularly in its crystalline form. However, silicon power device operation is generally limited to relatively low frequency and temperature.
Silicon Carbide, Gallium Nitride and Diamond offer the potential to overcome the frequency, temperature and power management limitations of silicon. A large number of new concepts and materials are still in the research stage. At present, Silicon Carbide is considered to have the best trade-off between material properties and commercial maturity. Multilayer Silicon Carbide (SiC) power semiconductor devices being in development are promising devices for the near future, but long term reliability, crystal degradation and forward voltage drift problems need to be solved before commercialisation.

Brief Biography of the Speaker:
Noel Shammas is currently a Professor of Microelectronics and Solid-State Power Semiconductor Devices in the faculty of Computing, Engineering and Advanced Technology, Staffordshire University. He received the M.Sc and Ph.D degrees from Salford University in 1972 and 1975 respectively. Since then he lectured and researched at different universities and industry. Research work is primarily focused on Power Semiconductor Devices which includes mainly Power diodes, Light Emitting Diodes (LED's), Insulated Gate Bipolar Transistors and Thyristors. Other related areas of research work includes Power Module Packaging technologies (Both Conventional Press-pack and Smart pack designs) and Series/Parallel operation of high power semiconductor devices and their interaction with external circuits.
Professor Shammas has extensive experience in both experimental and theoretical research work and is recognised internationally for his significant contribution to research in the field of Power Semiconductor Devices. He has published over 120 journal and conference research papers as well as several invited Keynote and Plenary Lectures, and has held several research grants from funding councils, Advantage West Midland (AWM), as well as from industry. He is a regular reviewer for many journals (including IEE Proceeding Electronic devices and systems, IEEE Transactions on power electronics, and Microelectronic Reliability) and international conferences (including the European Power Electronic conference - EPE, Microelectronic conference - MIEL, Universities Power Engineering Conference-UPEC, International Symposium Power Semiconductors-ISPS, etc...). He is a member of scientific committee for many international conferences (including MIEL, EPE, WCE, WSEAS, and Microtherm) and a steering committee member for EPE, UPEC, and ISPS international conferences. He is also a book reviewer for Prentice Hall International and McGraw Hill.

Plenary Lecture 2

Current Research Trends and Applications in Urban Remote Sensing

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Abstract: The talk focuses on current trends in urban remote sensing, and discusses the importance of spectral and object-oriented classification methods for mapping urban features from multispectral and hyperspectral remotely sensed data. By giving examples from 2 projects undertaken in Sydney, Australia and New York, USA, importance aspects of remote sensing applications for urban environments are presented. Decomposing the image pixel is the main goal in urban remote sensing. However, extracting features from urban environment is challenging due to the heterogeneity of urban features and limited spectral separability of certain urban features such as building roofs, roads, open spaces. The importance of combining spectral and object-oriented classification is highlighted in this presentation. An overview of object-oriented classification is also presented.

Brief Biography of the Speaker:
Dr. Bhaskaran has a PhD (2003) in remote sensing and Geographic Information Systems (GIS) from the School of Geomatic Engineering, University of New South Wales, Sydney. Dr. Bhaskaran's research interests are in spatial analysis, image analysis, modeling, data integration and decision support systems. Dr. Bhaskaran has over 10 years of experience in teaching GIS and remote sensing at the post graduate, graduate and undergraduate levels in Australia. Dr. Bhaskaran has developed new course materials on 'Web Based GIS', tutorials in GIS and remote sensing and delivered several workshops to students and staff from the Industry including the Food and Agricultural Organisation (FAO). Dr. Bhaskaran has also designed projects in geospatial technology for schools in Australia and has been the examiner of online courses. Dr. Bhaskaran has over 12 years of research experience in developing GIS and remote sensing applications for a wide range of applications. Since 1999, Dr. Bhaskaran has collaborated with various government and commercial agencies in geospatial projects. He has managed several international geospatial projects and mentored and supervised many researchers and honors students. Dr. Bhaskaran has been awarded over $500,000.00 of grant funding and has also received the Australian Research Council Award for Linkage and Infrastructure (ARC-LIEF). By analyzing and integrating hyperspectral remote sensing and GIS data, Dr. Bhaskaran developed a unique model to map vulnerability from Hail Storms in Sydney. This project and publication in the 'International Journal of Remote Sensing' is widely cited by peers all over the world. Dr. Bhaskaran has won several awards in research throughout his career. Dr. Bhaskaran has published over 40 research papers in peer reviewed journals and proceedings of conferences. In 2001 his paper 'Sub-Pixel analysis of the Urban Environment' was nominated as one of the best papers at the prestigious IEEE/IGARSS symposium. Dr. Bhaskaran is an invited member of peer-review panel on several international journals. He was an invited joint editor for a special issue on 'Hyperspectral Remote Sensing' that featured in the International Journal of Geoinformatics. In 2005, Dr. Bhaskaran was invited as a 'Visiting Scientist' to the prestigious 'ITC' institute in Netherlands. Dr. Bhaskaran is currently co-authoring a book on hyperspectral applications to be published by Springer-Verlag, Holland. Dr. Bhaskaran has served on various spatial sciences committees both at the regional and national levels notably the Spatial Sciences Institute (SSI) and the Queensland fire and biodiversity consortium. He has served as the member of the 13th Australasian Photogrammetry and Remote Sensing Conference (ARSPC) and was the Deputy Chair of the Program Committee. Dr. Bhaskaran has received certificates and commendations for his outstanding contribution to spatial sciences. Dr. Bhaskaran is currently collaborating with GeoEye for conducting research on mapping urban features from high spatial resolution satellite data over New York City. He is developing algorithms using both spectral and spatial attributes for automated mapping of urban features. Currently, Dr. Bhaskaran teaches and conducts research in Geographic Information System (GIS) and remote sensing at the department of Environmental, Geographic and Geological Sciences, Lehman College, City University of New York. Dr. Bhaskaran is an Australian citizen but resides now in US as a permanent resident.

Plenary Lecture 3

Recent Progress in Satellite Image Processing based on Physical Principles

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Abstract: Remote sensing has been expected to provide appropriate information for land cover classification and multi-temporal monitoring of natural environment (agriculture, forest, geology and etc.) as it can cover wide area periodically. In order to utilize satellite images, however, we have to consider many kinds of measurement uncertainty, which are categorized into systematic error and random error. The systematic error should be corrected based on physical models and appropriate data if they are available, and remained uncertainty should be treated statistically. In the case of optical sensor, we need geometric correction and radiometric correction. The light traveling through the atmosphere is scattered and absorbed not only by molecules but also aerosols and clouds. Slopes facing toward the sun receive more light and appear brighter than slopes facing away from the sun. In the case of rugged terrain like most part of Japan, some topographic effects are entangled with atmospheric effects. Therefore, we first have to precisely lay the images over the map by the geometric correction including ortho-rectification as the satellite images are center-projected. Then atmospheric and topographic effects on radiance detected on board are corrected to obtain ground surface reflectance based on the physical principles using the digital elevation model and meteorological data.

Ten years ago, there were many obstacles to process and analyze the satellite images properly for users in application fields. The images, both geometrically and radiometrically, were not so accurate as they are now provided. The users were not given the ortho-rectified images, nor the information and the digital elevation model to perform the ortho-rectification. There were some practical topographic correction methods, which were only applicable to images over moderately rugged terrain and high sun elevation season. The parameters of the correction were usually estimated statistically. The physical model of atmospheric effects were known as the radiative transfer model, and the computer simulation code such as 6S were available, but they could not estimate the spatial variation of sky light and reflected irradiance from the adjacent slope over rugged terrain. Although these effects were known theoretically, their calculation was thought impossible to perform for the hardware and software at that time.

Since then, there have been much progress in the satellite imagery itself as well as methods and data for image processing. Satellite position and attitude are well monitored and controlled by using GPS and star trackers. In order to ortho-rectify satellite images easily, coefficients of rational polynomials are attached to some high resolution satellite images. Computer improved in quality and efficient algorithms for calculating horizon and view-shed are developed. In order to mitigate the random errors, spatial averaging over segmented regions seems useful. By exploiting these progress, the ground reflectance and land cover class can be estimated much more accurately, but the satellite image with low sun elevation over rugged terrain are still difficult to analyze.

Brief Biography of the Speaker:

Yoshikazu Iikura is a full professor with the Faculty of Science and Technology at Hirosaki University, Japan. His current research interests are basic processing of satellite images : geometric correction, illumination correction, and land cover classification. He received the BS, Ms, and Dr. Eng. degrees in instrumentation physics and mathematical engineering from the University of Tokyo, Japan. As a student, he studied statistics (discriminant analysis) and information theory (rate distortion theory). He worked for National Institute for Environmental Studies (Japan) and was engaged in a project for lidar monitoring of stratospheric aerosol. In order to retrieve aerosol concentration, he developed some signal processing method: removing systematic noise caused by photomultiplier, calibration of the signal using Rayleigh scattering profile of upper stratosphere, etc. In late 1980s, he moved to Iwate University and began the study of satellite image processing. At first, he tried to apply the best linear discriminant function to the image but found that atmospheric and topographic effects should be corrected beforehand. He also noticed the need of digital elevation model and radiative transfer code. He invented the automatic geometric correction method using simulated illumination image as a reference and improved the practical topographic correction method based on the physical models. For these achievements (including lider signal processing), he won the best paper prize of the Remote Sensing Society of Japan three times. He has been an IEEE GRSS member since 1990, and served as a chair of the IEEE GRSS Japan Chapter (2008-2009). He is currently a director of the Remote Sensing Society of Japan.