4th IEEE INTERNATIONAL FUTURE ENERGY ELECTRONICS CONFERENCE IFEEC 2019
SINGAPORE | 25-28 NOVEMBER

Time	Programme	Speakers
08:30 – 17:00	Registration	
09:30 - 10:30	PARALLEL SESSIONS Tutorial 1: High Frequency and Very High Frequency Power Converters: Design and Optimization Tutorial 2: Multi-Cell & Multi-Level Power Converters - A Way to Go Beyond the Limits	T1: Prof Xu Dianguo, Wang Yijie & Guan Yueshi / Harbin Institute of Technology, China T2: Prof Petar J. Grbović / University of Innsbruck, Austria
10:30 - 11:00	Coffee Break	
11:00 - 13:00	Tutorial 1: High Frequency and Very High Frequency Power Converters: Design and Optimization Tutorial 2: Multi-Cell & Multi-Level Power Converters - A Way to Go Beyond the Limits	T1: Prof Xu Dianguo, Wang Yijie & Guan Yueshi / Harbin Institute of Technology, China T2: Prof Petar J. Grbović / University of Innsbruck, Austria
13:00 - 14:00	Lunch	
14:00 - 15:30	PARALLEL SESSIONS Tutorial 3: Photo-Electro-Thermal-Theory for LED Systems and its Applications Tutorial 4: Recent Advances in Permanent Magnet Synchronous Machines for Applications in Automotive and Renewable Energy Systems	T3: Prof Ron Hui & Prof Siew-Chong Tan / The University of Hong Kong, Hong Kong T4: Dr Rukmi Dutta & Prof Faz Rahman / University of New South Wales, Australia + new co-presenter Prof Faz Rahman
15:30 - 16:00	Coffee Break	
16:00 - 17:30	Tutorial 3: Photo-Electro-Thermal-Theory for LED Systems and its Applications Tutorial 4: Recent Advances in Permanent Magnet Synchronous Machines for Applications in Automotive and Renewable Energy Systems	T3: Prof Ron Hui & Prof Siew-Chong Tan / The University of Hong Kong, Hong Kong T4: Dr Rukmi Dutta & Prof Faz Rahman / University of New South Wales, Australia
18:00 - 19:30	Welcome Reception	

Information updated as at 21 November 2019

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Tutorial 1: High Frequency and Very High Frequency Power Converters: Design and Optimization

Speakers:

Professor Dianguo Xu
Vice President
Harbin Institute of Technology, China
and
IEEE Fellow

Professor Yijie Wang
Department of Electrical Engineering
Harbin Institute of Technology, China

Professor Yueshi Guan
Department of Electrical Engineering
Harbin Institute of Technology, China

Abstract:

Recently, with the continuous development of power electronics technologies, small-size and high-power density designs become a development trend. Improving operating frequency can effectively reduce the value and volume of passive components in order to achieve miniaturization. Thus, high and very high frequency power converters receive widespread attention. Moreover, in some cases, even parasitic parameters of a system working at high and very high frequency can also be used as the passive element. At the same time, the third generation of wide bandgap semiconductors such as SiC and GaN with material properties superior to their Si counterparts, create new opportunity and challenge for innovation of power converters. With the maturity of these devices, it provides a broad space for development of high and very high frequency power supplies. However in high frequency and very high frequency situations, the system significantly suffers from high switching loss, high driving loss and high magnetic loss. Hence, design and optimization should be deeply investigated, including the topology, magnetic design and driving method. In this tutorial, a detailed introduction of advanced topologies, magnetic components design and driving methods are discussed, which provides compressive information for optimizing the high frequency and very high frequency power converters.

Biography:

Dianguo Xu received the M.S and Ph.D degrees in electrical engineering from Harbin Institute of Technology (HIT), Harbin, China, in 1984 and 1989, respectively. In 1989, he joined the Department of Electrical Engineering, HIT, as an Assistant Professor, where he has been a Professor since 1994. He was the Dean of School of Electrical Engineering and Automation HIT, from 2000 to 2010. He is currently the Vice President of HIT.

His current research interests include renewable energy power conversion technology, multi-terminal HVDC system based on MMC, power quality mitigation, speed sensorless vector-controlled motor drives, and high performance PMSM servo system.

Prof. Xu is the winner of 2018 IEEE Industry Applications Society Outstanding Achievement Award. He was promoted as a fellow of IEEE for the contribution to control of electrical drives and power electronic converters. He was general chair of ICEMS 2019 and IEEE ITEC Asia-Pacific 2017, TPC chair of IPEMC 2012-ECCE Asia and VPPC 2008. He has published over 600 journal papers, 4 book chapters, and held 63 patents.

He received the prize paper awards from IEEE Transactions on Power Electronics in 2018 and 2019, and best papers awards from the conferences of ICEMS 2019, ITEC Asia-Pacific 2018, ITEC Asia-Pacific 2017, ICEMS 2014, PCIM Asia 2014, IPEMC 2012-ECCE Asia and LSMS & ICSEE 2010. He is an Associate Editor for the IEEE Transactions on Industrial Electronics, IEEE Transactions on Power Electronics and IEEE Journal of Emerging and Selected Topics in Power Electronics. He is the Chairman of the IEEE Harbin Section, the vice president of China Electrotechnical Society (CES).

Yijie Wang was born in Heilongjiang Province, China, in 1982. He received the B.S., M.S. and PH.D. degrees in electrical engineering from Harbin Institute of Technology, China, in 2005, 2007 and 2012, respectively. From 2012 to 2017, he was a lecturer and associate professor with the Department of Electrical and Electronics Engineering, Harbin Institute of Technology. Since 2017, he has been a professor with the Department of Electrical and Electronics Engineering, Harbin Institute of Technology. His interests include DC-DC converters, soft-switching power converters, power factor correction circuits, digital control electronic ballasts, LED lighting systems.

He received prize paper awards from IEEE Transactions on Power Electronics in 2018 and 2019, and best paper awards of ITEC Asia-Pacific 2017, ITEC Asia-Pacific 2018, ICEMS 2018 and 2019. Dr. Wang is an Associate Editor of the IEEE Transactions on Industrial Electronics, IEEE Journal of Emerging and Selected Topics in Power Electronics, IEEE Access, IET Power Electronics and Journal of Power Electronics.

Yueshi Guan was born in Heilongjiang Province, China, in 1990. He received the B.S., M.S. and PH.D. degrees in electrical engineering from Harbin Institute of Technology, China, in 2013, 2015 and 2019, respectively. Since 2019, he has been an associate professor with the Department of Electrical and Electronics Engineering, Harbin Institute of Technology. His research interests are in the areas of high frequency and very high frequency converters, single-stage AC/DC converter, and LED lighting systems. Prof. Guan has authored more than 40 conference and journal papers. He received Nomination Award of Young Engineer Award of PCIM Asia Conference in 2019, the Second Prize Paper Award from IEEE Transactions on Power Electronics, as well as Best Paper awards of ICEMS 2019, SPEED 2019, ITEC Asia-Pacific 2017. He also served as the special session Chair of IEEE ICEMS 2019 conference.

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Tutorial 2: Multi-Cell & Multi-Level Power Converters -A Way to Go Beyond the Limits

Speaker:

Professor Petar J. Grbović
Head of Innsbruck Power Electronics Laboratory (i-PEL)
University of Innsbruck, Austria

Abstract

Power Electronics/Power Converters is an engineering & scientific discipline that was introduced into practice on beginning of the 20th century. Today, on beginning of the 21st century, Power Electronics is part of our everyday life. We can find it applied everywhere; home appliances, automotive, multimedia, ICT, process industry, heavy industry, transportation, military, space, medical, etc., etc. Whenever we need to control power & energy flow without significant losses, we use power electronics and power converters. It would be very difficult, almost impossible to imagine today's life without Power Electronics.

In last few years we have been facing a strong demand to increase converters efficiency and power density. This is mainly driven by emerging applications such as e-mobility (traction inverters, dc/dc boosters, on-board chargers, LV/HV dc/dc battery converters, etc., etc.), Data Center power management (UPS and Bus Converters), Variable Speed Drives and Energy (PV Boosters and Inverters, Battery Interface Converters). In some cases, such as UPS back-to-back converters, efficiency and power density go above 98.5% and 7.5kW/dm3 respectively. Recently we have seen growing interest in "New Topologies" such as Multi-Level and Multi-Cell converters. As claimed and proven by the experts in the field, this concept is a way to push the limits of Si power devices and improve the converter performances, mainly efficiency and power density. A drawback of the concept is complexity of gate driving circuits, which dramatically increases with number of the Levels & Cells.

The objective of the seminar is to fully explore all benefits of multi-cell/multi-level converters. Advantages of these topologies, such as significant reduction of the filter and the dc bus capacitor size will be discussed in details. Moreover, strong impact on the device switching performances including switching loses and the over-voltage stress will be addressed too. Design guidelines for different concepts will be given in details. This seminar is aimed at power electronics engineers, professionals and graduate students who want to improve their knowledge and understanding of multi-cell & multi-level power converters and their application, nowadays as well as in the near future

Biography

Dr. Petar J. GRBOVIĆ received the Dipl. Ing. (B. Sc.) and the Magister (M.Sc.) degrees from the School of Electrical Engineering, University of Belgrade, Serbia, in 1999 and 2005, and the Doctor (Ph.D) degree from the Laboratoire 'Électrotechnique et d'Électronique de Puissance de Lille, l'Ecole Centrale de Lille, France in 2010.

From March 1999 to February 2003, he was an R/D Engineer with RDA Co, Belgrade. From November 2000 to June 2001, he was a Consulting Engineer with CESET Italy (a division of Emerson Appliance Motors Europe). From March 2003 to April 2005, he was with the R&D Department, PDL Electronics, Ltd., Napier, New Zealand. Since April 2005 until July 2010 he was working with Schneider Toshiba Inverter Europe, Pacy-Sur-Eure, France, as Power Electronics Group Expert. Since September 2010 until August 2011 he was with General Electric Global Research, Munich, Germany. Since September 2011 he is with HUAWEI Technologies, Europe Energy Competence Centre in Munich/Nuremberg, Germany, where he works as a Senior Expert in the area of power electronics and power conversion. Since 2016 he is a scientific member of Centre of Power Electronics and Drives, C-PED Lab., Roma TRE University, Italy. In Novembar 2018 he was appointed as Full (University) Professor at Innsbruck Power Electronics Laboratory (i-PEL), the Institute of Mechatronics, the University of Innsbruck, Austria.

The focus of his research is on application and control of advanced power semiconductors, power converter topologies, extreme power density & efficiency power converters, energy storage devices and applications, and control of power converters.

Dr. Grbović published over 60 IEEE conference/journal papers, 16 IEEE tutorials and a book "Ultra-capacitors in power Conversion Systems: Analysis, Modelling and Design in Theory and Practice". He has 17 patents granted and 9 patent application pending.

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Tutorial 3: Photo-Electro-Thermal-Theory for LED Systems and its Applications

Speakers:

Professor Ron Hui
Chair of Power Electronics
Philip K H Wong Wilson K L Wong Professorship in Electrical Engineering
The University of Hong Kong
and
IEEE Fellow

Professor Siew-Chong Tan
Director of Emerging Power Electronics Laboratory
Director of 100 kVA Smart Grid Research Facility
The University of Hong Kong

Abstract

Light science of light-emitting diodes (LED) is a complex discipline involving highly nonlinear interactions of four elements (namely light, heat, power and color). The Photo-Electro-Thermal (PET) Theory is the system theory that unifies the interactions of these four elements under one mathematical framework. The PET Theory has the steady and dynamic forms that can now be used as a general design tool for LED system design and optimization. This tutorial will cover the basic theory and its applications. This is the first time this tutorial is proposed and made available to the professional community.

The basic theory starts with the basic electro-thermal modeling of LED devices and then follows with the formation of a PET model for an LED array mounted on a heat sink. The PET model of an LED system involves model parameters of the LED devices, the power control of the LED drivers and the heatsink design. It can be implemented in existing circuit simulation software so that the LED system can be studied interactively with the dynamic operation of the LED driver. This modeling approach can be applied to an LED system comprising different types of LED devices.

Based on the PET theory, some important design guidelines for maximizing the luminous efficacy of LED systems will be provided. For its applications, the speakers will explain and demonstrate how the PET theory can be applied as a design and optimization tool for LED systems. They will show how various important variables (such as internal junction temperature that is not easily measured), can be predicted dynamically with the PET theory.

The PET theory will be used to predict both steady-state and dynamic behaviors of junction temperature, correlated color temperature, luminous flux and luminous efficacy of LED systems. Guidelines will be set up for designing LED systems for temporary and continuous operations. The theory will be used to clarify several common misconceptions about lighting system design and control in lighting community. Practical applications in precise dimming and color control of LED systems, as well as new sustainable LED street lighting will be presented.

This tutorial suits both researchers and professional engineers in lighting technology.

Biography

Professor Ron HUI is currently Chair Professor of Power Electronics at the University of Hong Kong and Imperial College London. He is an Associate Editor of the IEEE Trans. on Power Electronics and IEEE Trans. on Industrial Electronics, and also an Editor of the IEEE Journal of Selected and Emerging Topics of Power Electronics. He is the recipient of the 2016 IEEE William E. Newell Power Electronics Award, 2010 IET Crompton Medal and 2010 IEEE Rudolf Chope R&D Award.

He is a Fellow of the Royal Academy of Engineering (UK) and a Fellow of the Australian Academy of Technological Sciences and Engineering.

His research areas cover power electronics, wireless power transfer, smart grid and sustainable lighting technologies.

Professor Siew-Chong TAN is a tenured Full Professor at the University of Hong Kong, Hong Kong SAR. He is Director of Emerging Power Electronics Laboratory and Director of 100 kVA Smart Grid Research Facility at the University of Hong Kong. TAN specializes in power electronics and control. He has published works in nonlinear and sliding mode control applications, LED drivers and lighting control, electric springs, resonant converters, and switched-capacitor converters.

He is currently Member, Appeal Board Panel under Electricity Ordinance (Chapter 406), The Government of the Hong Kong Special Administrative Region. He is a practicing consultant and has worked on projects involving power outages, lithium battery testing, advisory role on international LED patent litigations.

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Tutorial 4: Recent Advances in Permanent Magnet Synchronous Machines for Applications in Automotive and Renewable Energy Systems

Speakers:

Dr Rukmi Dutta
Senior Lecturer in Energy Systems
University of New South Wales, Australia

Prof Faz Rahman
Professor in Energy Systems, University of New South Wales, Australia

Abstract

The permanent magnet synchronous machine (PMSM) is the preferred choice of many high performance applications. However, finding an optimum design and matching it with an optimal control strategy that can satisfy diverse criteria demanded by many emerging applications is still a challenge.

This tutorial will start with an overview of the novel permanent magnet (PM) machine topologies that are developed for applications in automotive and renewable energy systems. We will then review the finite-element (FE)-based design optimisation process for such machines highlighting the adverse consequences of oversimplification. Several designs will be presented to exemplify the challenges of large-scale multi-objective design optimization. In the second half of the tutorial, the state-of-the-art control strategies of the PMSM will also be touched upon to show their importance in obtaining optimum performances.

Biography

Rukmi DUTTA has received the PhD degree in Electrical Engineering from the University of New South Wales (UNSW Sydney), Australia, 2007 and the Bachelor of Engineering degree also in Electrical Engineering from Assam Engineering College of Guwahati University, India, 1996. She is currently a senior lecturer at UNSW, Sydney, Australia and a senior member of IEEE. In the past, she worked as an Electrical Engineer at CMG Pty Ltd (currently Regal Beloit Australia) , Reliance Industry Ltd, India, and as a research assistant at Institute of Industrial Science (IIS), Tokyo University Japan.. Her research interests are electrical machine design and control, drive systems, renewable energy and distributed generation.

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Faz RAHMAN is currently Professor in Energy Systems, University of New South Wales, Australia. He received the Ph.D. in Electrical Engineering, University of Manchester Institute of Science and Technology, UK, 1978; M.Sc. in Power Electronics and Systems, University of Manchester Institute of Science and Technology, UK, 1975 and B.Sc. in Electrical Engineering, Bangladesh University of Engineering and Technology, 1972.

Prof Rahman's research interests are in Permanent magnet machines, Power converters and control for grid connection of PV and wind power systems, Direct torque and Sensorless control, Solid-state transformer.

He is a Life Fellow, IEEE and also a member of IEEE Fellow Evaluation Committee for 2018, IEEE Electrical Machines and Industrial Drives Committees and IEEE P1812 Working Group for Testing Standard for Permanent magnet Machines.

He has supervised and graduated 43 PhD students and has won 7 Best Paper Awards. He has 22 chapters in books and 4 books published internationally. He has written 106 journal papers and 380 conference papers.

Prof Rahman has received various awards including IEEE Fellow, since January 2014, "in recognition to Direct Torque Control of Interior Permanent Magnet Machines"; IEEE Third Millennium award in 2000 "in recognition and appreciation of valued services and outstanding contributions to the profession" and Commonwealth Postgraduate Scholarship (1974 – 1977) for higher education in the U.K.

Prof Rahman has given consultancy services to many 15 Australian companies. These are in addition to many Expert Opinions provided through the UNSW consulting body. He also acted in the International Advisory and Technical Committees of many international conferences; two of these in the capacity of Technical Program and Organising Chairs.