



CPE
POWERENG
2026

20TH

INTERNATIONAL CONFERENCE ON COMPATIBILITY, POWER ELECTRONICS, AND POWER ENGINEERING

June 29 – July 1, 2026

Ningbo, China

CONFERENCE PROGRAM

IEEE
**Industrial
Electronics**
Society



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CPE-POWERENG 2026

Conference Overview

CPE-POWERENG is a flagship conference of the IEEE Industrial Electronics Society (IES) devoted to the dissemination of new ideas, research and work in progress within the fields of power electronics, renewable energy integration, power generation, transmission and distribution, power systems, electromechanical energy conversion, automation and EMC/EMI issues.

The world's industry, research, and academia are cordially invited to participate in an array of presentations and social activities for the advancement of science, technology, engineering education, and fellowship.

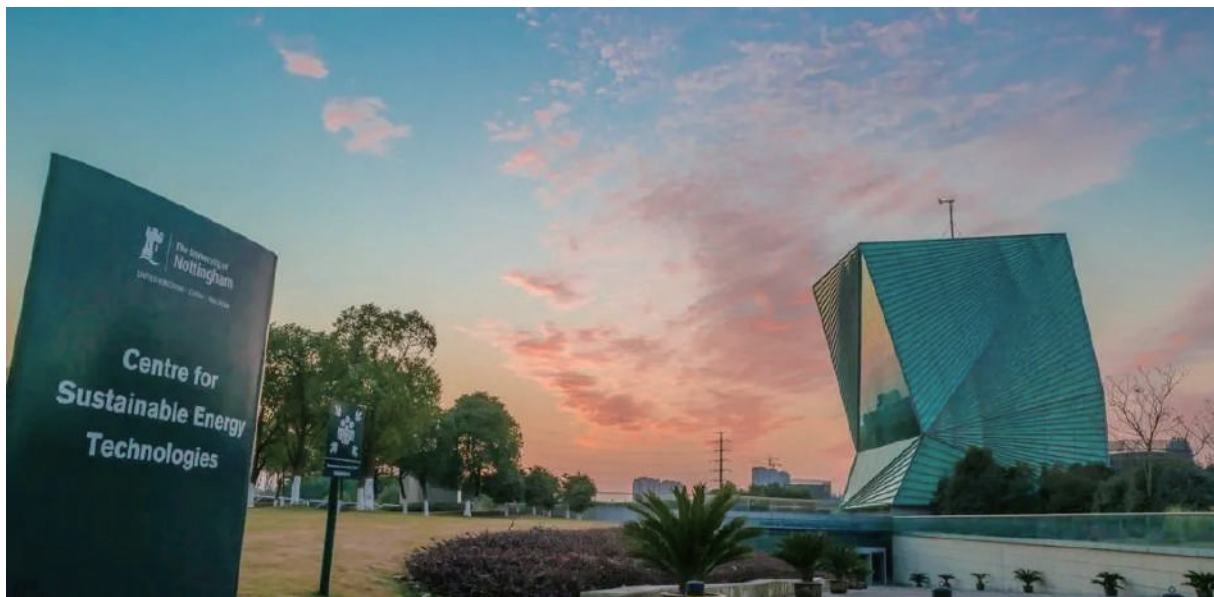
The main features of the conference include Invited Talks, Hands-on Workshops, Tutorials, Technical Sessions and Special Sessions.

Venue Introduction

The University of Nottingham at Ningbo China (UNNC) is located in Zhejiang Province on the south shore of Hangzhou Bay, opposite Shanghai. Ningbo is a 7000-year-old, rapidly growing city, populated with more than six million people and covering over 9000 square kilometers. Ranked 7th by Forbes list of 'the top cities for business in China', it is a thriving blend of enterprise, culture, education, tradition and entertainment.

UNNC was the first Sino-foreign university to open its doors in China in 2004. It is situated in Ningbo Higher Education Park, a leafy suburb on the outskirts of the city. The meticulously landscaped campus features many attractive spaces, including a Chinese garden and an English garden to symbolise the unique partnership behind the University's success. Distinctive canals weave through the University's extensive grounds.

The nearest metro station to the campus is Southern Business District on line 3, which is about 15 minutes' walk. Probably Line 8 will be open soon. So we may updated it on 2026.



Venue Layout Map

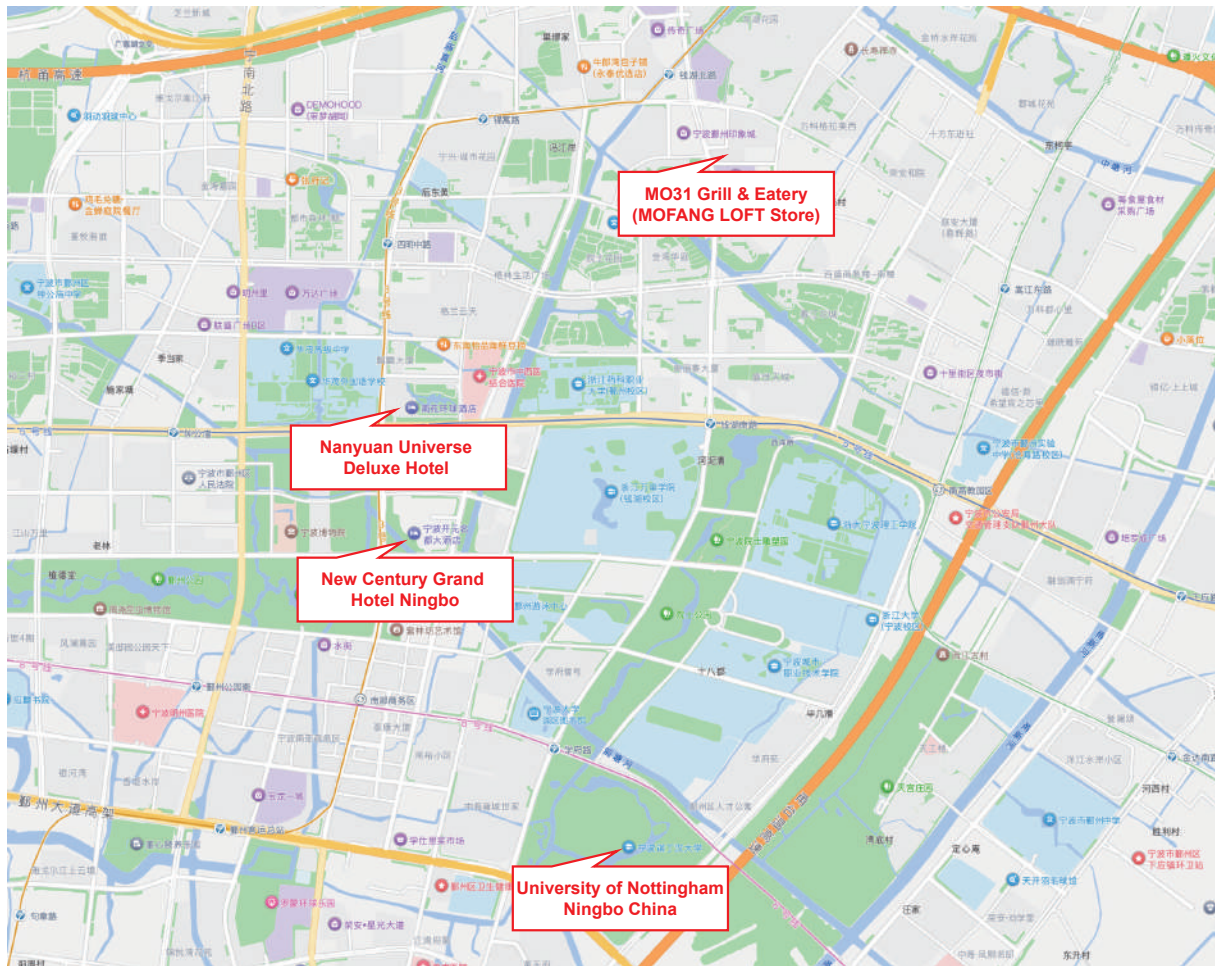


Parking Route

Route to Restaurant

Pedestrian Route

Travel Guide



Session and Event Locations

Keynotes: Auditorium DB-A05

Tutorials: Auditorium DB-A05

Special Sessions: Oral Room 1 (DB-A06) & Oral Room 2 (DB-A04)

Lunch Breaks: LA Hotel

Student and Young Professional Event: MO31 Grill & Eatery (MOFANG LOFT Store)

Banquet: Nanyuan Universe Deluxe Hotel

Distance & Location: UNNC Gate 1

Nearest Metro Stations

Xuefu Road Station (Line 8): Exit B, 2 mins walk straight to Gate 1

Southern Business District Station (Line 3): Exit E, 12–15 mins walk to Gate 1

Ningbo Lishe International Airport

Taxi (Recommended)

30–40 mins ride, 30–50 RMB, direct to Gate 1.

Metro (Budget Option)

Take Line 2 to Shiqi Station → transfer to Line 5 to Yinzhou District Government Station → transfer to Line 3, exit E at Southern Business District Station, then 12–15 mins walk to Gate 1.

CPE-POWERENG Agenda

	DAY0 June 28	DAY1 June 29			DAY2 June 30			DAY3 July 1			
09:00		Opening		Prof. Giampaolo Buticchi		IES introduction	IES Leadership	Auditorium DB-A05	09:00	09:00	Oral Room 1 (DB-A06) & Oral Room 2 (DB-A04)
10:00		09:30 Keynote 1 10:30		Prof. Marco Liserre	Auditorium DB-A05	09:30 Keynote 3 10:30	Prof. Josep M. Guerrero	Auditorium DB-A05	Regular Oral 1 10:40	Regular Oral 2 10:40	
11:00		Break				Break					
12:00		11:00 Keynote 2 12:00		Prof. Carlo Cecati	Auditorium DB-A05	11:00 Keynote 4 12:00	Prof. Xinbo. Ruan	Auditorium DB-A05	11:10 Regular Oral 3 12:30	11:10 Regular Oral 4 12:50	Oral Room 1 (DB-A06) & Oral Room 2 (DB-A04)
13:00											
14:00	14:00	14:00		Dr. Meiqi Wang & Dr. Mukhammed Murataliyev	Auditorium DB-A05	14:00	Prof. Alberto Castellazzi	Auditorium DB-A05			
15:00	Registration	Tutorial 1 15:30				Tutorial 2 15:30				14:50 Regular Oral 5 16:30	14:50 Regular Oral 6 16:30
16:00		Break				Break					
17:00	17:00	16:00 Special Session 1 17:40	16:00 Special Session 2 17:40		Oral Room 1 (DB-A06) & Oral Room 2 (DB-A04)	16:00 Special Session 3 17:40		Oral Room DB-A06			
18:00											
19:00		18:30 Student and Young Professional Event 20:30				19:00 Banquet 21:00		Nanyuan Universe Deluxe Hotel			
20:00											
21:00											



DAY1 June 29, 2026

09:00-09:30 Auditorium DB-A05	Opening Prof. Giampaolo Buticchi
09:30-10:30 Auditorium DB-A05	Keynote 1: Solid-State Transformers for Next-Generation Data Center Power Distribution Prof. Marco Liserre, IEEE Fellow, Kiel University, Germany
10:30-11:00	Break
11:00-12:00 Auditorium DB-A05	Keynote 2: Neural Network - based Model Predictive Control of multilevel converters Prof. Carlo Cecati, IEEE Life Fellow, Department of Information Engineering, Computer Science and Mathematics, University of L'Aquila, L'Aquila, Italy
12:00-14:00	Lunch Break (LA Hotel)
14:00-15:30 Auditorium DB-A05	Tutorial 1: Advances in Bearingless Machine Design, Control, and Applications Dr. Mukhammed Murataliyev, Member, IEEE, Principal Research Fellow, University of Nottingham Ningbo China Dr. Meiqi Wang, Member, IEEE, Senior Research Fellow, Power Electronics Machines Centre, University of Nottingham, U.K.
15:30-16:00	Break
16:00-17:40 Session Chair: Jing Li Oral Room 1(DB-A06)	Special Session 1: Advanced Control for Grid-Connected Converters: From Power Grids to Vehicle-to-Grid and E-Mobility Application Integral-Augmented Sliding Mode Voltage Control for DAB Converters with Q-learning Gain Optimization ————— [CPE- POWERENG26-000022] Ruoning Liu, Yunfei Yin, Yun Wang, Gershome Abaho, Tao Zhou, Zejiao Dong Data-Driven Control for LCC-S DWPT Systems: A Reinforcement Learning Enhanced Model-Free Adaptive Control Approach ————— [CPE- POWERENG26-000024] Yun Wang, Yunfei Yin, Ruoning Liu, Yufei Zhai, Gershome Abaho, Zejiao Dong

<p>16:00-17:40 Session Chair: Jing Li Oral Room 1(DB-A06)</p>	<p>Electric Bicycle Hybrid Energy Storage Wireless Charging System Based on LCC-S Compensation <hr/> [CPE- POWERENG26-000043] Qing Liu, Hailong Zhang, Yanbing Tian</p> <p>Enhanced Model Predictive Control for ISOP Systems Utilizing a Multi Transformer Isolated Weinberg Converter with Integrated Decoupling <hr/> [CPE- POWERENG26-000045] Zhihang Cao, Zheng Dong, Li Yang</p> <p>Multi-Layer Barrier Function-based Adaptive Super-Twisting Control for NPC Converters <hr/> [CPE-POWERENG26-000052] Shuhe Wei, Guangxin Liu, Zhuang Kang, Tailai Li, Xiaoning Shen</p>
<p>16:00-17:40 Session Chair: CF Kwong Oral Room 2(DB-A04)</p>	<p>Special Session 2: Advanced Control Techniques for Power Electronics Converters</p> <p>Short Term Dynamic Power Allocation for Four-Port Solid State Transformers <hr/> [CPE-POWERENG26-000003] Ali Sharida, Sertac Bayhan, Haitham Abu-Rub, Uğur FESLİ</p> <p>Single-Stage Control of Cascaded Interleaved Boost-LLC Converter for PV Battery Charging Using Super-Twisting Sliding Mode Control <hr/> [CPE-POWERENG26-000011] Naki Guler, RIDVAN CANBAZ, Uğur FESLİ, Hasan Komurcugil, Sertac Bayhan</p> <p>Reactive Power Reduction in Three-Phase Dual-Active-Bridge Converters via Particle Swarm Optimization <hr/> [CPE-POWERENG26-000013] Mr. Jiacheng Wen, Prof. Giampaolo Buticchi, Dr. Yury Mikhaylov, Dr. Jiajun Yang, Dr. Shuo Wang, Prof. Nadia Tan</p> <p>Model Predictive Control for Three-Phase NPC Converters with Reduced DC-link Capacitor <hr/> [CPE-POWERENG26-000048] Meiqi Wang, Lorenzo Carbone, Marco Rivera, Jacopo Riccio, Al Watson, Michele Degano</p> <p>Impact of Random Pulse Width Modulation on Closed-Loop Current Control in Three-Phase Inverters <hr/> [CPE-POWERENG26-000059] Mr. Alessandro Silvestro, Prof. Giacomo Scelba, Dr. Shuo Wang, Prof. Giampaolo Buticchi, Dr. Abraham M. Alcaide</p>
<p>18:30-20:30</p>	<p>Student and Young Professional Event</p>



DAY2 June 30, 2026

09:00-09:30 Auditorium DB-A05	IES introduction IES Leadership
09:30-10:30 Auditorium DB-A05	Keynote 3: Grid-Forming Control: From Earth's Renewable Grids to Lunar Power Systems – A 20-Year Technology Roadmap Prof. Josep M. Guerrero, IEEE Fellow, Huanjiang Laboratory, Zhejiang University
10:30-11:00	Break
11:00-12:00 Auditorium DB-A05	Keynote 4: Full-Range Zero-Voltage-Switching Non-Resonant PWM Converters Prof. Xinbo Ruan, IEEE Fellow, Center for More-Electrical-Aircraft Power System, College of Automation Engineering, Nanjing University of Aeronautics and Astronautics, Nanjing, China
12:00-14:00	Lunch Break (LA Hotel)
14:00-15:30 Auditorium DB-A05	Tutorial 2: From Boost-VSI to VSI-Boost and Y-Inversion: New Paradigms for Truly High Performance WBG Power Conversion Prof. Alberto Castellazzi, Faculty of Engineering, Kyoto University of Advanced Science
15:30-16:00	Break
16:00-17:40 Session Chair: Jiaqin Sun Oral Room 1(DB-A06)	Special Session 3: Others Energy Optimization System of Electric Vehicles - A Case Study for Applications of Deep Reinforcement Learning in the Real World _____ [CPE-POWERENG26-000037] Binjian Xin Enhancing DER-Rich Distribution Networks Through V2G-Enabled EV Flexibility and Smart Charging _____ [CPE-POWERENG26-000014] Abdullah Ajabbar, Usman Zafar, Muneera Al-Qahtani, Sertac Bayhan

<p>16:00-17:40 Session Chair: Jiaqin Sun Oral Room 1(DB-A06)</p>	<p>Performance Analysis of Robust Grid-Tied Sustainable PV-Powered EV Charging Terminals <hr/> <i>[CPE-POWERENG26-000020]</i> Deabrata Mazumdar, Josep M. Guerrero, Angula Rajamalliah</p> <p>VSG-MPC-Based LVRT Control Method for Power Systems <hr/> <i>[CPE-POWERENG26-000044]</i> Rui An, Zhenghong Tu, Ying Xu, Zhongkai Yi</p> <p>Fractional-order Terminal Sliding Mode Control of Induction Motor Control System with Unmatched Uncertainties <hr/> <i>[CPE-POWERENG26-000027]</i> Yuhang Zhang, Minghao Zhou, Xinglong Zheng, Zizhen Qiu, Feng Qiu, Zhe Wu</p>
<p>19:00-21:00 Nanyuan Universe Deluxe Hotel</p>	<p>Banquet</p>



DAY3 July 1, 2026

<p>09:00-10:40 Session Chair: Yushan Liu Oral Room 1(DB-A06)</p>	<p>Regular Oral 1:</p> <p>Distributed DC-Link Architecture for Residential Energy Hubs <hr/> <i>[CPE-POWERENG26-000015]</i> Sobhan Mohamadian, Amir Ghasemian, Yonglei Zhang, Xibo Yuan, Concettina Buccella, Carlo Cecati</p> <p>Three-Port Current-Fed DAB for EV Charging from Trolleybus Network with BESS Integration <hr/> <i>[CPE-POWERENG26-000009]</i> Gianluca Gentile, Riccardo Mandrioli, Rudolf Paternost, Filippo Pellitteri, Vincenzo Cirimele, Mattia Ricco</p> <p>A Three-Phase Interleaved Boost Inverter with Carrier Phase-Shift Modulation <hr/> <i>[CPE-POWERENG26-000010]</i> Yushan Liu, Bangshuo Wu, Longtao Zhou, Xiao Li, Marco Rivera, Patrick Wheeler</p> <p>Modified Extended-Phase-Shift for Mitigating Conduction Losses Unbalances in Current-Fed Dual-Active-Bridge Under DC Current Offset <hr/> <i>[CPE-POWERENG26-000012]</i> Diego Anchieri, Lohith Kumar Pittala, Riccardo Mandrioli, Georgios Orfanoudakis, Alon Kuperman, Mattia Ricco</p> <p>A Comparative Study of Common Failures and Fault Ride-Through Techniques for Input-Series Output-Parallel (ISOP) Converters <hr/> <i>[CPE-POWERENG26-000004]</i> Guanchu Wang, Giampaolo Buticchi, Chunyang Gu, Jiajun Yang, Chengbin Ma</p>
<p>09:00-10:40 Session Chair: Xiaochen Zhang Oral Room 2(DB-A04)</p>	<p>Regular Oral 2:</p> <p>Sensitivity Analysis for an Active Neutral Point Clamp Power Converter with GaN Devices <hr/> <i>[CPE-POWERENG26-000018]</i> Marianna Mancini, Filippo Savi, Stefano Nuzzo, Alessandro Chini, Davide Barater</p>

<p>09:00-10:40 Session Chair: Xiaochen Zhang Oral Room 2(DB-A04)</p>	<p>Experimental Validation of a 1-kW Bidirectional Three-Phase Active-Front-End Converter for Electric Vehicle Charging Applications <hr/> [CPE-POWERENG26-000023] Alfonso Núñez</p> <p>High-Speed Motor Test Bench Validation of Single-and Dual-Duty Modulated WBG Y-Inverter <hr/> [CPE-POWERENG26-000030] Ms. Vanesa Vera, Prof. Alberto Castellazzi, Dr. Shuo Wang</p> <p>External Miller Clamp Architectures for GaN HEMT Half-Bridges <hr/> [CPE-POWERENG26-000031] Zhi Lam Ting, Jerome Yuen, Freddy Kheng Suan Tan, Xingqi Liu, Jiajun Yang</p> <p>LLC Resonant Converter Scaling Law Design Method Considerations for High Gain Designs <hr/> [CPE-POWERENG26-000032] Jerome Yuen, Zhi Lam Ting, Freddy Kheng Suan Tan, Jiajun Yang</p>
<p>11:10-12:30 Session Chair: Jianwei Zhang Oral Room 1(DB-A06)</p>	<p>Regular Oral 3:</p> <p>Harmonic State-Space Impedance Models of MMCs under Direct and Indirect Control <hr/> [CPE-POWERENG26-000033] Juhyeong Jeon, Jae-Jung Jung</p> <p>Inner-Loop Broadband Passivity Boundary of Voltage Feedback Decoupling in Virtual-Admittance-Based Grid-Forming Converters <hr/> [CPE-POWERENG26-000035] Stephen Arinze Obi, Jae-Jung Jung</p> <p>Small-Signal Model of Single-Stage Current Source Inverter with Discharge Path in Motor Drives Applications <hr/> [CPE-POWERENG26-000036] Emilio Carfagna, Giovanni Migliazza, Fabio Immovilli, Emilio Lorenzani</p> <p>All-GaN Double Gain Y-Inverter <hr/> [CPE-POWERENG26-000041] Maria Kazakova, Alberto Castellazzi</p>
<p>11:10-12:50 Session Chair: Liang Huang Oral Room 2(DB-A04)</p>	<p>Regular Oral 4:</p> <p>Self-Measurement of Grid-Connected Converters through Secondary-Side Perturbation Injection <hr/> [CPE-POWERENG26-000050] Shaoyuan Shen, Ruokai Xu, Zhixiang Zou, Xingqi Liu</p>

<p>11:10-12:50 Session Chair: Liang Huang Oral Room 2(DB-A04)</p>	<p>Cost-efficient Inductor Sizing in Solid-state DC Breakers Based on Semiconductor Fault-current Conduction Capability <hr/> <i>[CPE-POWERENG26-000054]</i> Honey Mol Mathew, Moein Ghadrnan, Giovanni De Carne</p> <p>Class-E PA Design for Multi-receiver MHz WPT Systems Based on Impedance Region Analysis <hr/> <i>[CPE-POWERENG26-000055]</i> Zhan Liu, Yu Xiao, Shuang Li, Ming Liu, Chengbin Ma</p> <p>State of Health Estimation for Lithium-Ion Batteries Using Charge-Segment Timing Indicators <hr/> <i>[CPE-POWERENG26-000019]</i> Fazal Ur Rehman, Aaruththiran Manoharan, Henrik Andersen, Carlo Cecati, Concettina Buccella</p> <p>Fast Heuristic Weight Tuning for Hierarchical Distributed Consensus-based Post-Disaster Microgrid Energy Management <hr/> <i>[CPE-POWERENG26-000029]</i> Hengrui Tian, Dan Wang, Aditya Joshi, Mo-Yuen Chow</p>
<p>12:50-14:50</p>	<p>Lunch Break (LA Hotel)</p>
<p>14:50-16:30 Session Chair: Yuli Bao Oral Room 1(DB-A06)</p>	<p>Regular Oral 5:</p> <p>A Modular Multi-Agent Simulation Platform for Microgrid Energy Management <hr/> <i>[CPE-POWERENG26-000038]</i> Ruoyi Ding, Mo-Yuen Chow</p> <p>A Smart Transformer Architecture for Datacenter Application <hr/> <i>[CPE-POWERENG26-000060]</i> Mohamed Moharram, Johannes Diers, Martin Votava, Mahyar Hassanifar, Davide D'Amato, Marius Langwasser, Marco Liserre</p> <p>A Performance-Based IEC 61850 Approach for Substation Automation in Renewable Energy Integrated AC Microgrids <hr/> <i>[CPE-POWERENG26-000007]</i> Nobuhiko Kobayashi, Yanqing Liu, Arindam Ghosh, Yanyan Yin</p> <p>Impedance-Based Stability Analysis and Control Design for a Cascaded DAB and GFL Converter System <hr/> <i>[CPE-POWERENG26-000025]</i> Xingqi Liu, Giampaolo Buticchi, Jiajun Yang, Zhixiang Zou, Chengbin Ma, Marco Liserre</p> <p>Mitigating Practical Limitations of LQR for Optimal Control of Grid-Tied Voltage Source Inverter via LQG(MEE) Integration <hr/> <i>[CPE-POWERENG26-000051]</i> Sara Ibrahim, Giampaolo Buticchi, Jiajun Yang</p>

<p>14:50-16:30 Session Chair: Ahmed Nasr Oral Room 2(DB-A04)</p>	<p>Regular Oral 6:</p> <p>Gradient-Based Power Strategies for Battery Energy Storage Systems: State of Health Sensitivity Analysis in Day-Ahead and Intraday Markets <hr/> [CPE-POWERENG26-000057] Antonio J. Romero-Barrera, Alvaro Paricio-Garcia, Miguel A. Lopez-Carmona, Takayuki Ito</p> <p>Magnetic Shielding Measurements of the Dewar System Below 1 kHz <hr/> [CPE-POWERENG26-000005] Manqi Xu, Peng Hu, Zhongyuan Zhou, Wei Hua</p> <p>On Damper Cage End-Effects in Classical Wound-Field Synchronous Generators <hr/> [CPE-POWERENG26-000026] Israr Ullah, Michael Galea, Stefano Nuzzo, Paolo Giangrande, Joseph Cilia, Vincenzo Madonna</p> <p>Evaluation of Maximum Torque and Power of a Switched Reluctance Machine over Entire Speed Range in Driving and Generating Modes Considering Inverter Limitations <hr/> [CPE-POWERENG26-000039] Lam Pham, Nikita Gorbunov, Valeria Garmashova, Hao Chen, Anton Dianov, Pavel Dergachev, Galina Demidova, Alecksey Anuchin</p> <p>Passive Axial Stiffness Enhancement in Radially Magnetised and Halbach-Array Surface Permanent Magnet Machines <hr/> [CPE-POWERENG26-000047] Mukhammed Murataliyev, Amedeo Vannini, Gabriele Antonino Cagliari, Oğuz Korman, Meiqi Wang, Michele Degano, Chris Gerada, Giacomo Sala, Wolfgang Gruber</p>
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Keynote Speakers



Solid-State Transformers for Next-Generation Data Center Power Distribution

Prof. Marco Liserre (Keynote 1)

IEEE Fellow
Kiel University
Germany

Abstract:

This keynote addresses next-generation power conversion architectures for data centers, following the energy path from the medium-voltage grid to the computing infrastructure. It discusses medium-voltage interfaces, solid-state transformers, and emerging DC and hybrid AC/DC distribution architectures at facility and rack level.

Particular attention is given to the impact of AI and accelerated computing, which introduce extreme power density, fast dynamics, and stringent requirements on voltage regulation and system stability. These trends are fundamentally reshaping how power delivery networks are designed and operated.

The keynote also examines the broader system-level implications of large-scale, power-dense data centers on the electrical grid, including peak demand, power quality, fault ride-through, and grid congestion. Potential mitigation strategies such as energy storage integration, hybrid microgrids, grid-supportive control, and demand-side management are discussed, together with the emerging role of hydrogen systems for long-duration storage and backup.

Finally, the talk connects architectural and technological choices to sustainability, addressing efficiency, CO₂ footprint, and circular economy aspects such as materials use, reuse, and end-of-life considerations.

Biograph:

Marco Liserre (S'00-M'02-SM'07-F'13) received the MSc and PhD degree in Electrical Engineering from the Bari Polytechnic, respectively in 1998 and 2002. He has been Associate Professor at Bari Polytechnic and from 2012 Professor in reliable power electronics at Aalborg University (Denmark). From 2013 he is Full Professor and he holds the Chair of Power Electronics at Kiel University (Germany). He has published 500 technical papers (1/3 of them in international peer-reviewed journals) and a book. These works have received more than 35000 citations. Marco Liserre is listed in ISI Thomson report "The world's most influential scientific minds" from 2014. He has been awarded with an ERC Consolidator Grant for the project "The Highly Efficient And Reliable smart Transformer (HEART), a new Heart for the Electric Distribution System". He is member of IAS, PELS, PES and IES. He has been serving all these societies in different capacities. He has received the IES 2009 Early Career Award, the IES 2011 Anthony J. Hornfeck Service Award, the 2014 Dr. Bimal Bose Energy Systems Award, the 2011 Industrial Electronics Magazine best paper award and the Third Prize paper award by the Industrial Power Converter Committee at ECCE 2012, 2012, 2017 IEEE PELS Sustainable Energy Systems Technical Achievement Award and the 2018 IEEE-IES Mittelmann Achievement Award.



Neural Network - based Model Predictive Control of multilevel converters

Prof. Carlo Cecati (Keynote 2)

IEEE Life Fellow
 Department of Information Engineering
 Computer Science and Mathematics
 University of L'Aquila
 L'Aquila, Italy

Abstract:

Multilevel converters are now widely used in a variety of applications, including the conversion of energy from renewable sources such as wind and photovoltaic generators, grid-connected converters, smart transformers and drives for industrial and traction applications. Although the finite control set model predictive control approach is an interesting and effective control technique for cascaded H-bridge converters, its computational complexity means that it becomes impractical as the number of converter levels increases. The presentation introduces a neural network-based approach that can overcome the computational burden of conventional predictive control algorithms. This approach will be applied to a cascaded H-bridge static synchronous compensator using an FPGA to demonstrate that optimal control of multilevel converters with many levels can be achieved with minimal computational effort.

Biograph:

Carlo Cecati (M'90–SM'03–F'06, LF'24) was awarded a Dr.-Ing. Degree in Electrotechnical Engineering from the University of L'Aquila in 1983. He has remained at the same university ever since, becoming a Professor of Power Converters, Electric Machines and Drives in 2006. From 2015 to 2017, he was a Qianren Talents Professor (Distinguished Professor of the 1000 Talents Programme) at the Harbin Institute of Technology in Harbin, China.

His primary research interests include power electronics, distributed generation, e-transportation, and smart grids.

Prof. Cecati was Co-Editor-in-Chief of the IEEE Transactions on Industrial Electronics from 2010 to 2012 and Editor-in-Chief from 2013 to 2015.

He was the co-recipient of the 2012 and of the 2013 Best Paper Awards from the IEEE Transactions on Industrial Informatics; the 2012 Best Paper Award from the IEEE Industrial Electronics Magazine; the 2019 Outstanding Paper Award from the IEEE Transactions on Industrial Electronics; and second prize for the 2023 Best Paper Award from the IEEE Journal of Emerging and Selected Topics in Power Electronics.

In 2017, he received the Antony J. Hornfeck Award from the IEEE Industrial Electronics Society; in 2019, he was awarded the title of "Commander of the Republic of Italy" by the President of the Republic of Italy; and in 2021, he received the Dr.-Ing. Eugene Mittelmann Achievement Award from the IEEE Industrial Electronics Society.

He is Chief Technical Officer at DigiPower Srl, an R&D company active in the field of power electronics.



Grid-Forming Control: From Earth's Renewable Grids to Lunar Power Systems – A 20-Year Technology Roadmap

Prof. Josep M. Guerrero (Keynote 3)

IEEE Fellow
Huanjiang Laboratory
Zhejiang University

Abstract:

The global transition to 100% renewable energy grids is facing a critical "inertia crisis." As synchronous generators retire, system inertia constants (H) have plunged from approximately 5–6 seconds to less than 2 seconds. This drives the rate of change of frequency (RoCoF) beyond 0.5 Hz/s, triggering relay misoperations, cascading outages, and black-start failures. Conventional grid-following (GFL) inverters, designed to maximize power output via maximum power point tracking (MPPT) and phase-locked loops, cannot arrest this instability. This limitation has been evidenced by the 2025 Iberian Peninsula blackout and recurring weak-grid failures in regions such as Ethiopia, Indonesia, and Turkey.

This keynote traces the 20-year evolution of grid-forming (GFM) control, one of the most viable solutions to the inertia gap, from foundational device-level algorithms to global industrial standardization. It presents the paradigm shift from GFL "power followers" to GFM "grid builders." Core technologies include virtual synchronous machines (VSM) governed by the swing equation, synthetic inertia provision, and a three-layer hierarchical control architecture (millisecond-level primary droop, second-level distributed coordination, and minute-level economic dispatch). These technologies now underpin IEEE 2030.7/8 microgrid standards and the IEEE 2800 series grid interconnection specifications.

The keynote will showcase real-world deployments that validate GFM's cross-scenario resilience, including gigawatt-scale renewable integration for offshore wind stabilization in Turkey's WindFlag project, islanded microgrids for the Indonesian archipelago, and shipboard/port microgrids powering Maersk fleets. The speaker will also preview frontier research on a bio-inspired GFM hierarchical framework and the European Space Agency's lunar base power system. Finally, the talk will provide a forward-looking roadmap for power electronics researchers and industry stakeholders, illustrating how GFM is redefining the "operating system" of global energy infrastructure to enable a decarbonized, high-resilience grid spanning terrestrial communities to interplanetary exploration.

Biograph:

Josep M. Guerrero (S'01-M'04-SM'08-FM'15) received the B.Sc. degree in telecom engineering, M.Sc. degree in electronics engineering, and PhD degree from the Technical University of Catalonia, Barcelona, Spain.

Since 2011, he has been a Full Professor with AAU Energy, Aalborg University, Denmark, where he is responsible for the Microgrid Research Program. From 2019, he became a Villum Investigator by the Villum Fonden, which supports the Center for Research on Microgrids (CROM) at Aalborg University, being Prof. Guerrero the founder and Director of the same center (www.crom.energy.aau.dk). In 2020, he initiated neuroscience studies and research. As a result, in 2022 he received the M.Sc. degree in Psychobiology and Cognitive Neuroscience from the Institute of Neuroscience (INc) at the Autonomous University of Barcelona, and in 2023 he received the M.Sc. degree in Sleep: Physiology and Medicine at the University of Murcia, Spain. From 2023 to 2024 he was with the Technical University of Catalonia as an ICREA Research Professor. In 2023 he joined Huanjiang Laboratory as a director of the Center for Renewable Energy and Microgrids, Zhejiang University, Zhuji, Shaoxing, China. In 2025 he became a Distinguished Senior Researcher at the department of electrical engineering, University of Valladolid, Spain.

His research interests are oriented to different microgrid frameworks like energy microgrids, hydrogen and biomass, water micronets, biological systems, seaport microgrids and electrical ships, airport microgrids and more electrical aircrafts, space microgrids and smart medical systems. In these fields, he has been researched distributed and cyber-physical energy systems, cybersecurity for microgrids and smart grids, neuroscience-inspired artificial intelligence for energy systems, machine learning and applications using signal processing, bioinformatics, bio-inspired computing, and quantum computing and quantum communication for complex energy networks.

Prof. Guerrero is an Associate Editor for several IEEE TRANSACTIONS. He has published more than 1,200 journal papers in the fields of microgrids and renewable energy systems, which are cited more than 120,000 times. During nine consecutive years, from 2014 to 2023, he was awarded by Clarivate Analytics as Highly Cited Researcher. From 2020 to 2024 he was listed as the world's top 2% scientist by Stanford/Elsevier. In 2021, he received the IEEE Bimal Bose Award for Industrial Electronics Applications in Energy Systems, for his pioneering contributions to renewable energy based microgrids. In 2022, he received the IEEE PES Douglas M. Staszkesky Distribution Automation Award, for contributions to making the hierarchical control of microgrid systems a practical reality. In 2023, he was the IEEE Modeling and Control Technical Achievement Award recipient for contributions to modelling and control of power electronics based microgrids. In 2024 he received the CSEE Journal of Power and Energy Systems Excellent Paper Award.



Full-Range Zero-Voltage-Switching Non-Resonant PWM Converters

Prof. Xinbo Ruan (Keynote 4)

IEEE Fellow

Center for More-Electrical-Aircraft Power System

College of Automation Engineering

Nanjing University of Aeronautics and Astronautics

Nanjing, China

Abstract:

Soft-switching techniques can greatly reduce the switching loss, thus improving the efficiency, power density, and reliability of power converters. Motivated by this, a family of full-range non-resonant PWM ZVS converters, including dc–dc, dc–ac, and ac–dc converters, is derived. The four-switch buck-boost (FSBB) converter is employed as an example to illustrate the proposed combined PWM and phase-shift control, by which zero-voltage-switching (ZVS) is realized with constant frequency in the full operation range while minimizing inductor current ripple. Inspired by this control scheme, the optimal operating modes for other full-range ZVS non-resonant PWM converters are also analyzed. Finally, the experimental results of the dc–dc converter, the dc–ac inverter, and the simulation results of ac–dc rectifier as an extension, are provided to verify the effectiveness of the non-resonant ZVS approach and generated converters.

Biograph:

Xinbo Ruan received the B.S. and Ph.D. degrees in electrical engineering from Nanjing University of Aeronautics and Astronautics (NUAA), Nanjing, China, in 1991 and 1996, respectively.

In 1996, he joined the Faculty of Electrical Engineering Teaching and Research Division, NUAA, where he became a Professor in the College of Automation Engineering in 2002. From August to October 2007, he was a Research Fellow in the Department of Electronic and Information Engineering, Hong Kong Polytechnic University, Hong Kong, China. From March 2008 to August 2011, he was also with the School of Electrical and Electronic Engineering, Huazhong University of Science and Technology, Wuhan, China. He is the author or co-author of 15 books and more than 300 technical papers published in journals and conferences. His main research interests include resonant and soft-switching power converters, power converter topologies and control, grid-connected converters and system for renewable energy, modeling and stability of power converters, and envelop tracking power supply.

Prof. Ruan was a recipient of the Sustainable Energy Systems Technical Achievement Award from IEEE Power Electronics Society in 2022, the Delta Scholarship by the Delta Environment and Education Fund in 2003, and the Special Appointed Professor of the Chang Jiang Scholars Program by the Ministry of Education, China, in 2007. From 2005 to 2013, and from 2017 to 2025, he served as a Vice President of the China Power Supply Society. From 2014 to 2016, he served as a Vice Chair of the Technical Committee on Renewable Energy Systems within the IEEE Industrial Electronics Society. Currently, he serves as a Co-EIC for IEEE Transactions on Power Electronics, an Editor for IEEE Journal of Emerging and Selected Topics on Power Electronics, and an Associate for IEEE Open Journal of Industrial Electronics Society. He served as an Associate Editor for IEEE Transactions on Industrial Electronics (2011-2021) and IEEE Transactions on Circuits and Systems – II: Express Briefs (2016-2023). He was the General Chair of IPEMC-ECCE Asia 2020 and the General Secretary of IPEMC-ECCE Asia 2009, a Technical Program Committee Chair of the IEEE 7th Annual Energy Conversion Congress and Exposition (ECCE2015), and a Tutorial Committee Chair of the IEEE 12th Annual Energy Conversion Congress and Exposition (ECCE2020).



Tutorial Speakers

Tutorial 1: Advances in Bearingless Machine Design, Control, and Applications

Abstract:

Bearingless machines have emerged as a promising technology that integrates electromagnetic suspension and torque generation into a single system, eliminating the need for mechanical bearings. This integration enables contactless operation, reduced maintenance requirements, and improved efficiency, making bearingless machines highly attractive for high-speed, high-purity, and harsh-environment applications.

This tutorial focuses on recent advances in the design, control, and practical implementation of bearingless machines. On the design side, innovations in electromagnetic topology, multi-degree-of-freedom suspension strategies, and compact integration are enabling higher performance and reliability. Advanced modelling techniques and optimization methods are also improving the precision and scalability of these systems.

From a control perspective, bearingless machines present unique challenges due to their inherently coupled electromagnetic forces and torque production. The session will highlight developments in robust and adaptive control strategies, which enhance stability and dynamic performance under varying operating conditions. In terms of applications, bearingless machines are gaining traction across diverse sectors, including turbomachinery, biomedical devices (such as blood pumps), flywheel energy storage systems, and semiconductor manufacturing. Their ability to operate without mechanical wear or lubrication makes them particularly suitable for cleanroom and vacuum environments.

This session aims to bring together researchers and practitioners to discuss emerging trends, unresolved challenges, and future directions in bearingless drive technology. By fostering interdisciplinary exchange, the session will contribute to accelerating the adoption of bearingless solutions in next-generation electromechanical systems.



Dr. Mukhammed Murataliyev

Member, IEEE

Principal Research Fellow

University of Nottingham Ningbo China

Biograph:

Dr Mukhammed Murataliyev (Member, IEEE) received the Ph.D. degree from the University of Nottingham, U.K., in 2021, with a focus on novel synchronous reluctance machine design and optimization. From 2018 to 2020, he was a Researcher with the Key Laboratory of More Electric Aircraft Technology of Zhejiang Province, China. Since 2021, he has been with the University of

Nottingham, U.K., first as a Research Fellow and later as a Senior Research Fellow with the Power Electronics Machines Centre, Research Institute. He is now a Principal Research Fellow at the University of Nottingham Ningbo China and also serves as a Lead Electromagnetic Design Engineer with Nottingham Drives Specialist Services (NDSS), DER. His expertise includes the design, optimization, and multidisciplinary modelling of high-performance electrical machines for aerospace, automotive, and industrial applications, spanning both academic research and industrial consultancy.



Dr. Meiqi Wang

Member, IEEE

Senior Research Fellow

Power Electronics Machines Centre

University of Nottingham, U.K.

Biograph:

Dr. Meiqi Wang (Member, IEEE) received the Ph.D. degree from the University of Nottingham, U.K., in 2023, with a focus on advanced control of high-speed synchronous machines and power electronic system design. From 2014 to 2019, she was a Research associate at Tsinghua

University, Beijing, China, focus on high-speed machine control and Hardware in the Loop System development for MEA application. From 2019 to 2022, she was a Research associate with the Power Electronics Machines and Control (PEMC) Group, University of Nottingham, U.K., where she focused on high-speed machine control and system-level integration. From 2023 to 2024, she was a Research Fellow with the Key Laboratory of More Electric Aircraft Technology of Zhejiang Province, China. Since 2024, she has been with the University of Nottingham, U.K., first as a Research Fellow and currently as a Senior Research Fellow with the Power Electronics Machines Centre, Research Institute. Her research interests include the control high-speed electrical machines, multiphase and bearingless drives, and design of power electronic systems, and their applications in aerospace, automotive, and biomedical systems.

Tutorial 2: From Boost-VSI to VSI-Boost and Y-Inversion: New Paradigms for Truly High Performance WBG Power Conversion



Prof. Alberto Castellazzi

Faculty of Engineering

Kyoto University of Advanced Science

Abstract:

The disruptively fast-and high-frequency switching capability of wide-band-gap (WBG) semiconductors, which enables joint improvement of power converters efficiency and power density, cannot be fully taken advantage of in conventional topologies, due to severe electro-magnetic and electro-thermal performance degradation.

Novel bespoke solutions have been recently presented, which enable major progress in that direction, while also allowing to partly compensate for the higher cost of WBG devices with savings in other parts of the system. Notable examples are the VSI-Boost and the Y-Inverter architectures, conceived as direct alternatives to the traditional Boost-VSI approach. This tutorial will review in detail their fundamental operation, highlight their benefits over Boost-VSI and discuss differences between them and peculiarities of each solution.

Modulation and control aspects will be addressed and covered exhaustively, including continuous and discontinuous modulation techniques, both for single and three-phase, single-or multi-source implementation. The topic will also offer the opportunity for an experimentally-based comparison of silicon carbide (SiC) MOSFETs and gallium nitride (GaN) HEMTs from an application perspective.

Experimental results from real application examples in the electric-traction and renewable energies/smart-grids domains will be used to illustrate the potential of those topologies, when implemented with both SiC and GaN transistors, as well as in hybrid Si-WBG form.

The tutorial is addressed to post-graduate students, researchers and early and mid-career engineers and practitioners.

Biograph:

Alberto Castellazzi is a Professor in the Faculty of Engineering of the Kyoto University of Advanced Science. He has been active in R&D on power electronics and its enabling technologies for about 25 years, holding positions both in industry and academia. He has published more than 300 papers in specialist international journals and conference proceedings and has held numerous invited talks, seminars and tutorials on SiC power devices packaging and application.