KEYNOTE SPEAKERS

Prof. Marco Liserre (Keynote 1)

IEEE Fellow, Kiel University, Germany

Title:

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

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, CO_2 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.

Prof. Carlo Cecati (Keynote 2)

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

Title:

Neural Network - based Model Predictive Control of multilevel converters

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.

Prof. Josep M. Guerrero (Keynote 3)

IEEE Fellow, Huanjiang Laboratory, Zhejiang University

Title:

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

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 Standford/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. Staszesky 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.

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

Title:

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

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).