



**The 47th Annual Conference of the IEEE
Industrial Electronics Society**
October 13-16, 2021, Sheraton Centre, Toronto, Canada



IECON'2021 Special Session Proposal

FUTURE-PROOF POWER ELECTRONIC SYSTEMS AND CONTROL FOR RESIDENTIAL MICROGRIDS

Organized by

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Joao Martins (IEEE Senior Member), Electrical Engineering Department, Universidade Nova de Lisboa (UNINOVA-CTS), 2829-516 Monte de Caparica, Portugal (e-mail: jf.martins@fct.unl.pt)

Roya Ahmadiyahangar, (IEEE Senior Member), Department of Electrical Power Engineering and Mechatronics, Tallinn University of Technology, Ehitajate tee 5, 19086 Tallinn, Estonia (e-mail: roya.ahmadi@taltech.ee).

Technical Outline of the Issue and Topics:

Thanks to rapid advances in semiconductor and packaging technologies as well as to the development of new power converter topologies, the power electronics is being increasingly employed in brand new applications, such as Electronic Power Distribution Systems, also known as Active Distribution Networks or Smart Grids. Depending on the power scale, such concepts could be applied either for a single building or for districts, thus facilitating larger shares of distributed energy generation and storage, demand-side efficiency and energy trading operations.

Addressing these new challenges is the main focus of this special session. We invite researchers from Academia and Industry to discuss technical challenges, exchange novel ideas, explore enabling technologies, and present R&D results related to power electronic systems, control, protection, communication and



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operation aspects in designing and implementing of different architectures and functionalities in emerging residential microgrids.

Topics of interest include, but are not limited, to the following:

- DC and hybrid AC/DC residential microgrid architectures
- Solutions resolving interoperability issues and facilitating deployment of microgrids
- Optimal design methodologies, transient and stability analysis for residential microgrids
- Power electronics systems for efficient integration of distributed energy generators and storages into residential microgrids
- Active power filtering, load-sharing, islanding operation
- Condition monitoring, intelligent protection, fault diagnosis and self-healing.
- Predictive maintenance, adaptive communication-based protection
- Microgrids during emergency, islanding, and black start
- Supervision, management, security, and hierarchical control
- Communication-based resilient and robust control
- Power management strategies, distributed control and/or decentralized decision making
- Operation and control of interconnected residential microgrids (i.e., a microgrid community)
- Cyber security issues in residential microgrids.
- Control and management of multi-energy systems for residential microgrids

▪ **IES Technical Committee Sponsoring the Special Session (if any):**

Power Electronics Technical Committee: Inverters/Rectifiers subcommittee, Impedance Source Converters subcommittee, Electric Machines and Drives subcommittee, DC-DC Converters subcommittee.



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Brief CV of SS Organizers (photo, name, email, and short CV)

Organizer 1: **Dmitri Vinnikov**, dmitri.vinnikov@taltech.ee, Tallinn University of Technology, Estonia (Corresponding organizer).



Dmitri Vinnikov (M'07, SM'11) received the Dipl.Eng., M.Sc., and Dr.Sc.techn. degrees in electrical engineering from Tallinn University of Technology, Tallinn, Estonia, in 1999, 2001, and 2005, respectively. He is currently the Head of the Power Electronics Group, Department of Electrical Power Engineering and Mechatronics, TalTech (Estonia) and a Guest Researcher at the Institute of Industrial Electronics and Electrical Engineering, Riga Technical University (Latvia). He is the Head of R&D and co-founder of Ubik Solutions LLC - Estonian start-up company dedicated to innovative & smart power electronics for renewable energy systems. Moreover, he is one of the founders and leading researchers of ZEBE – Estonian Centre of Excellence for zero energy and resource efficient smart buildings and districts. He has authored or coauthored two books, five monographs and one book chapter as well as more than 200 published papers on power converter design and development and is the holder of numerous patents and utility models in this field. His research interests include applied design of power electronic converters and control systems, renewable energy conversion systems (photovoltaic and wind), impedance-source power converters, and implementation of wide bandgap power semiconductors.

Organizer 2: **Enrique Romero-Cadaval**, eromero@unex.es, University of Extremadura, Spain



Enrique Romero-Cadaval (S'02–M'05–SM'10) received the M.Sc. degree in Industrial Electronic Engineering from the Escuela Técnica Superior de Ingeniería Industrial (ICAI), Universidad Pontificia de Comillas, Madrid, Spain, in 1992, and the Ph.D. degree from the Universidad de Extremadura, Badajoz, Spain, in 2004. In 1995, he joined the University of Extremadura where he teaches power electronics and researches within the Power Electrical and Electronic Systems (PE&ES) R&D Group in the School of Industrial Engineering. He is the Coordinator of the Energy Group for the Intelligent Specialization (RIS3) of the Extremadura Region (Spain), member of the management council of the Energy Companies Associations of Extremadura, representing the University of Extremadura. He is CRO and Co-founder of “Smart Energy Products and Services”, a Spin-off Company of the University of Extremadura. He is Senior Member of the IEEE, and the current President of the Power Electronics and Industrial Electronics Jointed Spanish Chapter of the IEEE. He is author of more than 200 contributions listed in the main databases and of many conference contributions and book chapters, being also participated in several projects dealing with power electronics applied to power systems, power quality, active power filters, electric vehicles, smart grids, and renewable energy resources.



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Organizer 3: **João Martins**, jf.martins@fct.unl.pt, NOVA School of Science & Technology, Portugal



João Martins (SM'96) was born in Lisbon, Portugal, in 1967. He graduated in electrical engineering at Instituto Superior Técnico (IST), Technical University of Lisbon, in 1990. He received his M.Sc. and Ph.D. degrees in electrical engineering at the same institute, respectively in 1996 and 2003. Currently he is an Associate Professor with Habilitation at the Electrical and Computer Engineering Department, Faculty of Sciences and Technology, NOVA University of Lisbon, Portugal and a senior researcher at CTS/UNINOVA, Portugal. Currently he is the head of the Electrical and Computer Engineering Department and integrates the board of directors at CTS. He has published more than 80 scientific articles in refereed journals and books and more than 180 articles in refereed conference proceedings. His research interests are mainly in energy efficiency: alternative energies and power quality, intelligent and energy efficient buildings, energy awareness, renewables integration and energy flexibility.

Organizer 4: **Roya Ahmadihangar**, roya.ahmadi@taltech.ee, Tallinn University of Technology, Estonia



Roya Ahmadihangar (S'09-M'19-SM'21) received the M.Sc. and Ph.D. degrees in power system engineering from the Babol University of Technology (Ranked 1st, 2017-2019, Times Magazine), Babol, Iran, in 2009 and 2014, respectively. In her Ph.D. studies, she was awarded the Iranian Ministry of Science Scholarship for Ph.D. studies (Merit Scholarship) and Ranked 1st in the Ph.D. program. She is a Postdoctoral researcher with the Department of Electrical Power Engineering and Mechatronics, Tallinn University of Technology (Estonia) since 2018. She has authored or co-authored one book, and five book chapters, as well as more than 50, published papers on the power system and smart grids. She is Senior Member of the IEEE, and the current Secretary of the IEEE Estonia section. Her research interests include the integration of DER in smart grids, demand response and demand-side flexibility, AI applied to smart grid and planning, and management of power systems.