EPE'25 – Call for Tutorials

Pushing Boundaries in Power Conversion for Renewable Energy Systems

Name(s) and Affiliation(s) of the Lecturer(s):

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Tutorial Objectives:

The growing integration of renewable energy systems into modern power grids necessitates advanced solutions for power converter design and operation. This tutorial provides a detailed exploration of how artificial intelligence (AI) technologies can address key challenges in distributed generation (DG) systems, with a focus on improving converter reliability, operational efficiency, and compliance with grid requirements.

Key topics include:

- **Characterization and Stress Steering in Power Converters**: Utilizing AI-enhanced device characterization and thermal stress mitigation to ensure improved operational longevity and reliability of power converters.
- **AI-Driven Islanding Detection Mechanisms**: Developing robust detection algorithms to identify and mitigate islanding conditions, ensuring system safety and stability.
- **Dynamic Fault Ride-Through (FRT) Protocols**: Implementing AI-based solutions for maintaining grid stability during electrical faults and disturbances.

Participants will gain insights into innovative methodologies through in-depth technical discussions, supported by case studies and practical applications.

Target Audience:

Academics and Researchers: Investigating state-of-the-art AI applications in power electronics and renewable energy integration.

Industry Practitioners: Engineers and technical specialists engaged in the development and maintenance of DG systems and grid-connected power converters.

Graduate-Level Students: Individuals pursuing advanced studies in electrical engineering, power systems, or renewable energy technologies.

Policy Makers and Regulators: Policymakers and stakeholders involved in defining standards for grid stability and renewable energy compliance.

Attendees with foundational expertise in power systems, control systems, or renewable energy will benefit most, though prior detailed experience in AI methodologies is not a prerequisite.

Topical Outline:

Session 1: Introduction and Overview (09:00 - 09:15)

- Overview of challenges in renewable energy integration and power converter operation.
- Introduction to AI methodologies applicable to power electronics.

Session 2: AI for Stress Management and Converter Reliability (09:15 - 10:15)

- AI-based techniques for advanced device characterization.
- Thermal control strategies for stress steering in power converters.
- Methods for assessing converter reliability and lifespan.

Break (10:15 - 10:45)

Session 3: Islanding Detection and Fault Ride-Through Mechanisms (10:45 - 11:45)

- AI-enhanced islanding detection for distributed energy systems.
- Dynamic fault ride-through protocols for grid stability.
- Transition control algorithms for maintaining operational efficiency during disturbances.

Session 4: Conclusions and Discussion (11:45 - 12:00)

- Summarization of discussed topics.
- Q&A session to address specific challenges and future directions.

Provisional Schedule of the Tutorial:

Schedule:

09:00 - 10:15: Introduction / Theme 1
10:15 - 10:45: Coffee break / Lunch Break
10:45 - 12:00: Theme 2 / Conclusions

About the Lecturers:

Varaha Satya Bharath Kurukuru has been a scientist specializing in packaging and multiphysics within the Power Electronics Research Division at Silicon Austria Labs, Austria, since 2022. He holds a PhD focused on the intelligent monitoring of power electronics in distributed generation systems. His expertise includes the characterization of power semiconductors, condition monitoring of power electronics converters, and the development of secure and dependable power electronics systems.

Mohammed Ali Khan (S'17–M'21–SM'24) is currently working as a Postdoctoral Researcher at Centre for Industrial Electronics, University of Southern Denmark. He received his B.Tech. degree in Electrical and Electronics Engineering from Karunya University, Coimbatore, India, in 2013, and M.Tech. degree in Power System from Amity University, Noida, India, in 2016. He completed his Ph.D. degree in Power Management of Grid Connected Distribution Generation with the Advanced Power Electronics Research Laboratory, Department of Electrical Engineering, Jamia Millia Islamia (A Central University), New Delhi, India, in 2021. He worked as a Post-Doctoral Researcher with the Department of Electrical Power Engineering, Faculty of Electrical Engineering and Communication, Brno University of Technology, Brno, Czech Republic from Dec 2021 to Jan 2023. He was a Visiting Researcher at the Center of Reliable Power Electronics, Aalborg University, Aalborg, Denmark, from October to December 2020. His area of research is artificial intelligence, power electronics, and their application in renewable energy systems, power quality improvements, and reliability.