

# ECCE 2021 Tutorial 22535 Information

## 1. Tutorial Title

Photovoltaic Systems – From Basics to Advanced Grid Supportive Control

## 2. Tutorial Abstract

Photovoltaic (PV) is one of the renewable favorites with a fast-growing rate, and much more are expected in the future. However, the massive installation of grid-connected PV systems creates many challenges to the grid. Many attempts have thus been made and being explored to better integrate PV systems as grid-friendly systems, which not only minimize the impact on the grid but also offer smart controllability and flexible manageability to enhance the grid performance. To master and then further advance the PV technology, we should understand the basics of PV systems like how the power conversion works, what the technological bottlenecks are, and what is the potential impact for large-scale adoption of power electronic-based PV systems? And, how do we address the increasing issues outlined, e.g., by grid codes and standards, IEEE Std. 1547-2018, through advanced control strategies?

The tutorial is proposed, and it is dedicated to tackling the technological challenges of nondeterministic power generation in grid-connected PV systems. It provides a step-by-step design of grid-friendly PV systems including the PV modules and power converters, and then a comprehensive understanding of the basics of PV systems. The focus is to innovate and improve the operability by means of advanced control to create more sustainable, grid-friendly, and reliable PV systems that comply with grid regulations and contribute to reducing the cost of energy. This enables the grid-supportive operation of PV systems, e.g., inertia emulation, to improve the grid performance. The tutorial is intended for intermediate and advanced audiences in the field of power electronics, engineers, and researchers, who are looking for advanced control solutions to power converters, especially focused on PV conversion systems for distributed generation. Researchers and engineers who seek for the basic knowledge for the PV technology are welcomed.

## 3. Instructor Biography



**Yongheng Yang** (SM'17) received the B.Eng. degree in Electrical Engineering and Automation from Northwestern Polytechnical University, China, in 2009 and the Ph.D. degree in Energy Technology (power electronics and drives) from Aalborg University, Denmark, in 2014.

He was a postgraduate student with Southeast University, China, from 2009 to 2011. In 2013, he spent three months as a Visiting Scholar at Texas A&M University, USA. Since 2014, he has been with the Department of Energy Technology, Aalborg University, where he became a tenured Associate Professor in 2018. In January 2021, he joined Zhejiang University, China, where he is currently a ZJU100 Professor with the Institute of Power Electronics, College of Electrical Engineering. His current research interests include the grid-integration of photovoltaic systems and control of power converters, in particular, the mechanism and control of grid-forming power converters and systems.

Dr. Yang was the Chair of the IEEE Denmark Section (2019-2020). He is an Associate Editor for several IEEE Transactions/Journals. He is a Deputy Editor of the *IET Renewable Power Generation* for Solar Photovoltaic Systems. He was the recipient of the 2018 *IET Renewable Power Generation* Premium Award and was an Outstanding Reviewer for the IEEE Transactions on Power Electronics in 2018. He was the recipient of the 2021 Richard M. Bass Outstanding Young Power Electronics Engineer Award from the IEEE Power Electronics Society. In addition, he has received two IEEE Best Paper Awards. He is currently the Secretary of the IEEE Power Electronics Society Technical Committee on Sustainable Energy Systems.