

# Reliability of Power Electronics in PV systems: Design and Control solutions

## Abstract

Power electronics are essential for power conversion of Photovoltaic (PV) systems, and their reliability strongly affects the availability and consequently the cost of PV energy. To further reduce the cost of PV energy, the reliability of power electronics in PV systems needs to be improved to reduce the (unexpected) failure in field operation. This tutorial aims to address the reliability challenge and solution for power electronics in PV applications. It will start with identifying key components and their stress parameters in the PV inverter. Then, an approach to analyze the reliability of power electronics in PV applications will be introduced, which includes thermal stress modeling, lifetime prediction, and reliability evaluation. The impact of certain parameter variations, which introduces uncertainties in the reliability evaluation, will also be discussed and demonstrated with a practical example. Moreover, emerging control solutions to further enhance the reliability performance of the PV inverters will be demonstrated.

## Instructor Bio



**Ariya Sangwongwanich** received the M.Sc. and Ph.D. degree in energy engineering from Aalborg University, Denmark, in 2015 and 2018, respectively. Currently, he is working as a Postdoc Fellow at the Department of Energy Technology, Aalborg University. He was a Visiting Researcher with RWTH Aachen, Aachen, Germany from September to December 2017. His research interests include control of grid-connected converter, photovoltaic systems, reliability in power electronics and multilevel converters. In 2019, he received the Danish Academy of Natural Sciences' Ph.D. prize and the Spar Nord Foundation Research Award for his Ph.D. thesis.



**Frede Blaabjerg** was with ABB-Scandia, Randers, Denmark, from 1987 to 1988. From 1988 to 1992, he got a Ph.D. degree in Electrical Engineering at Aalborg University in 1995. He became an Assistant Professor in 1992, an Associate Professor in 1996, and a Full Professor of power electronics and drives in 1998. In 2017 he became a Villum Investigator. He is honoris causa at University Politehnica Timisoara (UPT), Romania, and Tallinn Technical University (TTU) in Estonia. His current research interests include power electronics and its applications such as in wind turbines, PV systems, reliability, harmonics, and adjustable speed drives. He has published more than 600 journal papers in the fields of power electronics and its applications. He is the co author of four monographs and editor of ten books in power electronics and its applications.