

Title: A MATLAB/Simulink Approach of Photovoltaic Power Systems: Designing, Modeling, Simulation, and Control

Abstract:

This tutorial provides a practical introduction to photovoltaic (PV) power systems regarding the theoretical analysis, design, modelling, control, and simulation. The objective is to expose the audience to all facets of PV power systems with emphasis on the hands-on tools required for executing academic research and for meeting industry expectations. The development of this tutorial is based on the diverse experience and expertise of the presentation team in both the academia and power industry.

The tutorial will first begin with the fundamentals of PV systems regarding theoretical analysis and design. The modelling includes two parts; one for simulation, and another for dynamic analysis. Based on the system dynamics, a control design approach for grid-forming inverters is introduced to guarantee the system stability and robustness in the presence of multiple PV systems. Finally, transient studies for transmission-level connected PV systems are presented. All analysis and simulation are conducted using function blocks in MATLAB\Simulink environment. After the tutorial, the audience shall be able to design a practical grid-tied PV power system, simulate its operation, and evaluate its performance via MATLAB\Simulink. The tutorial will be organized to facilitate smooth transitions from the fundamental and practical knowledge to more advanced subjects.

Biography:



Weidong Xiao received the Master's and Ph.D. degrees in electrical engineering from the University of British Columbia, Vancouver, Canada, in 2003 and 2007, respectively.

Dr. Xiao is an Associate Professor with the school of Electrical and Information Engineering, University of Sydney, Australia. From 2010 to 2016, he has been working with Masdar Institute of Science and Technology, United Arab Emirates. In 2010, he was a Visiting Scholar with the Massachusetts Institute of Technology (MIT), Cambridge, USA, where he worked on the power interfaces for PV power systems. Before the academic career, he worked as a R&D engineering manager with MSR Innovations Inc., Canada, focusing on integration, research, optimization, and design of photovoltaic power systems. His research interest includes photovoltaic power systems, power electronics, dynamic modeling, control engineering, DC systems, and industrial applications. Dr. Xiao is presently an Associate Editor of the IEEE Transactions on Industrial Electronics.



Jimmy Chih-Hsien Peng received his B.Eng. (Hons) and Ph.D. degrees from the University of Auckland, New Zealand, in 2008 and 2012, respectively. He is an Assistant Professor with the Department of Electrical and Computer Engineering at the National University of Singapore, Singapore. His research includes power system resilience, stability of inverter-based grids as well as cyber and disinformation attacks on critical infrastructures. He was awarded the ‘40 under 40: Disruptors and Innovators’ by the University of Auckland, New Zealand, in 2020.

Since 2020, he has been nominated to serve on the Electrical and Electronics Standards Committee under the Singapore Standards Council—a body that approves the establishment, review, and withdrawal of Singapore Standards and Technical References. He is also a committee member for the SPRING SS-535 Standard: Code of Practice for Installation, Operation, Maintenance, Performance and Construction Requirements of Mains Failure Standby Generating Systems. SPRING is an agency under the Ministry of Trade and Industry, Singapore. He was a former member of the IEC New Zealand National Committee under the Standards New Zealand—a business unit within the Ministry of Business, Innovation and Employment, New Zealand.



Qiang Han received Master’s degree in Electrical Engineering from the University of British Columbia, Vancouver, Canada, in 2007. He is currently working as a Senior Engineer with the Transmission Planning department at BC Hydro, Burnaby, Canada. Prior to his current position, he worked as a Senior Engineer with the Power System Studies group at Powertech Labs, Surrey, Canada, from 2007 to 2014. His expertise includes transmission planning, power system stability, generator field testing and model validation, automatic voltage regulator and power system stabilizer tuning, interconnection of large industrial loads, interconnection of renewable energy, insulation

coordination studies, and variable frequency drives.