

Precise linear Modeling and Classic Nonlinear Passivity-Based Control for LCL-Filtered Three-Phase Grid-Tied Inverter

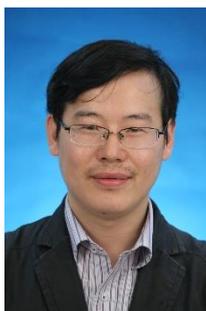
With the dramatic development of the distributed power generation systems, the LCL-Filtered Grid-Tied Inverters (GTI) have been increasingly employed as efficient and flexible grid interfaces in the power system. Many researchers have studied how to design a stable controller for this system.

In this talk, I will introduce my ground recent researches on this issue. This talk includes two main parts: 1. precise linear modeling and design for LCL-filter GTI to deal with the adverse effect caused by imbalanced grid impedance; 2. classic nonlinear Passivity-Based Control (PBC) design for LCL-filter GTI.

In part 1, the main reasons which significantly lead to the unbalanced grid impedance will be first summarized. Then, the issues caused by LCL filter-based grid-tied inverter under unbalanced grid impedance are presented. Further, the precise analysis and design method based on ICAD will be presented, and the different design methods are compared to highlight the significant advantage of the proposed method. Finally, effectiveness and accuracy of the proposed method will be verified through simulations and experiments.

In Part 2, the mathematical model of LCL-filtered GTI together with the deduction of PBC control law is first introduced. Then, the procedure of separated loop control parameter design strategy will be proposed. Furthermore, a brief introduction for the state observer and method to achieve the zero steady-state error are presented. Finally, I will give the related experimental results.

Besides the main two parts of this talk, I will provide a brief overview on our research over these years, as well as our points on new trends on the control of the high-order-filter-based GTI.



Prof. Weimin Wu received Ph.D. degrees in Electrical Engineering from the College of Electrical Engineering, Zhejiang University, Hangzhou, China, in 2005.

He worked as a research engineer in the Delta Power Electronic Center (DPEC), Shanghai, from July, 2005 to June, 2006. Since July, 2006, he has been a Faculty Member at Shanghai Maritime University, where he is currently a Full Professor in Department of Electrical Engineering. He was a Visiting Professor in the Center for Power Electronics Systems (CPES), Virginia Polytechnic Institute and State University, Blacksburg, USA, from Sept. 2008 to March. 2009. From Nov. 2011 to Jan. 2014, he was also a visiting professor in the Department of Energy Technology, Aalborg University, Demark, working at the Center of Reliable Power Electronics (CORPE). He has coauthored over 100 papers and holds eight patents. His areas of interests include power converters for renewable energy systems, power quality, smart grid, and energy storage technology. Dr. Wu serves as an Associate Editor for the IEEE TRANSACTIONS ON INDUSTRY ELECTRONICS.