Tutorial – IV
Theme: Micro-grids
Islanded Operation of Micro-grids – Issues and possible solutions

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Abstract

Increasing demand in electrical power has stressed the existing transmission networks in power systems. To meet the power demand economically, microgrids are proven to be a viable alternative than modifying the transmission networks, as in the case of microgrids, generators supply the load directly without passing through the transmission network. Although the microgrids mimic the utility grid, the islanded operation of microgrids especially poses several challenges due to various factors like: use of different generation technologies, power electronic interfaces, small size and strong interaction between active and reactive powers.

Islanded microgrids thus are more prone to voltage and frequency deviations, when events like renewable source intermittency or load dynamic change occur, as they are considered as weaker grids having very less inertia compared to the conventional power system. This emphasises on the design of proper control techniques. The control methodology should be implemented not just at a single level but hierarchically in order to enhance the controllability, flexibility, and security of the system.

In addition, because of the quick response of power electronic inverters, the microgrid should have the capability to detect any disturbance within a short period of time. Accurate and fast estimation of magnitude, frequency, and phase of the grid voltage is essential for inverter-based AC microgrids, while running in an islanded mode. This calls for real-time disturbance detection techniques.

This tutorial introduces the concepts, challenges and barriers of microgrid development and fundamental theories related to the islanded operation of microgrids. The tutorial comes in three parts: Part 1 introduces the primary/secondary control, Part 2 discusses the tertiary control/energy management and Part 3 presents the real-time disturbance detection techniques.

Biography

Dr. Jayashri Ravishankar received her BE, ME and PhD all in Electrical Engineering from Anna University, India. She joined the School of Electrical Engineering and Telecommunications, UNSW in 2010. Her research and teaching areas are in electrical power engineering. Her research interests include power system modelling, analysis and control, renewable energy integration, smart grids and microgrids. She has authored and co-authored more than 60 journal and conference papers in this area. She has supervised to completion 6 PhD students and currently supervising 4 students in this area. In 2012, she developed the first microgrid test bench in UNSW with the funding support from Australian Power Institute. She is a regular reviewer for several IEEE, IET and other journals and conferences.

Jayashri also researches on strategies for improving students' active learning and for providing an inclusive classroom. To date, she has published 14 teaching-related journal and conference papers and 8 presentations within and outside UNSW, demonstrating incorporation of scholarly teaching. In 2016, she received the Teaching Excellence Award in Engineering at UNSW.