

RE Rich Microgrid: Operation and Control

Tutorial-IA

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Speaker: Sukumar Mishra, Professor, Department of Electrical Engineering, IIT Delhi, India

Abstract:

Distributed energy resources (DERs), mostly solar and wind farms, are getting prime interest of the power system operators to overcome shortage of fossil fuels and for sustainable growth of the grid. It is necessary to understand the behaviour of voltage source inverters (VSIs) due to its importance in integrating DERs in the microgrids. Additionally, good understanding of transition from synchronous generators to the VSIs is required to achieve smart operation and control of the power network. There are several methods available for effective operation of the VSIs, which are mostly categorized in three modes. Firstly, grid following (GFL) operation of VSIs to meet the voltage and frequency of the grid at the local point of common coupling. Secondly, VSIs operate in grid supporting (GS) mode. Some of the popular GS functionalities are frequency, reactive, inertial and voltage support. Power regulatory authority of different countries impose grid codes for the operation of generating units comprising of DER in the distribution system. The DER operator adheres to the grid codes to maintain operation of the VSI in GFL and GS mode. Last but not the least, grid forming (GFM) operation of the VSIs, which is effective in autonomous micro-grid. The DERs in the micro-grid are operated in conventional droop to handle active and reactive power flows to maintain demand and generation balance of the system. The widely used conventional droops are P-f and Q-V droop which are used in power sharing among the DERs. The choice of droop coefficient of the DERs is a critical task as it is highly motivated by the economics of the plant as well as the network parameters.

The tutorial will discuss all the detailed mathematical formulations, controller design and their working philosophy.