

Data-Driven Simulations Tools for Der and Battery Rich Power Grids

Authors : Ali Moradiamani, Samaneh Sadat Sajjadi, Mahdi Jalili

Abstract : Power system analysis has been a major research topic in the generation and distribution sections, in both industry and academia, for a long time. Several load flow and fault analysis scenarios have been normally performed to study the performance of different parts of the grid in the context of, for example, voltage and frequency control. Software tools, such as PSCAD, PSSE, and PowerFactory DIGSILENT, have been developed to perform these analyses accurately. Distribution grid had been the passive part of the grid and had been known as the grid of consumers. However, a significant paradigm shift has happened with the emergence of Distributed Energy Resources (DERs) in the distribution level. It means that the concept of power system analysis needs to be extended to the distribution grid, especially considering self sufficient technologies such as microgrids. Compared to the generation and transmission levels, the distribution level includes significantly more generation/consumption nodes thanks to PV rooftop solar generation and battery energy storage systems. In addition, different consumption profile is expected from household residents resulting in a diverse set of scenarios. Emergence of electric vehicles will absolutely make the environment more complicated considering their charging (and possibly discharging) requirements. These complexities, as well as the large size of distribution grids, create challenges for the available power system analysis software. In this paper, we study the requirements of simulation tools in the distribution grid and how data-driven algorithms are required to increase the accuracy of the simulation results.

Keywords : smart grids, distributed energy resources, electric vehicles, battery storage systems, simulation tools

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