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Research Article

Analysis and Simulation of Small Signal Model of Virtual Synchronous Generator in Microgrid System

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Abstract

Microgrids based on distributed generation sources are connected to the main power grid through power electronic converters that have low mechanical inertia and damping, so the dynamic characteristics of the power system must be improved simultaneously with the integration of renewable energy sources for stability. Virtual synchronous generators are one of the effective methods for integrating renewable energy systems into the power grid. In order to have a behavior similar to that of a real synchronous generator when changed or disturbed by a virtual synchronous generator, the control operation is performed in the power electronic converter of the distributed generation unit. In this paper, the characteristics of two droop methods and a virtual synchronous generator for controlling active and reactive powers are compared using the small signal model and the state space model. The evaluation between these two different control strategies is performed using simulation results in the MATLAB environment. Also, the characteristics of the synchronous generator due to changes in the moment of inertia and damping coefficient are shown. Integrating the virtual synchronous generator in the microgrid, in addition to reducing frequency and voltage deviations, also improves stability.

Keywords: Inverter, Oscillation equation, Small signal, Synchronous generator, Virtual inertia.

Highlights

- Study of attenuation reduction of power electronic converters in the network.
- Comparison of droop control method with virtual synchronous generator technique.
- Determination of small signal model of virtual synchronous generator connected to infinite bus.
- Comparison of response speed for load changes of two control methods.

Citation: [in Persian].