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Power Angle Control Strategy of Virtual Synchronous Machine: A Novel Approach to Control Virtual Synchronous Machine

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Abstract : Renewable energies such as wind turbines and solar photovoltaic have gained significance as a result of global environmental pollution and energy crises. These sources of energy are converted into electrical energy and delivered to end-users through the utility system. As a result of the widespread use of power electronics-based grid-interfacing technologies to accommodate renewable sources of energy, the prevalence of converters has expanded as well. As a result, the power system's rotating inertia is decreasing, endangering the utility grid's stability. The use of Virtual Synchronous Machine (VSM) technology has been proposed to overcome the grid stability problem due to low rotating inertia. The grid-connected inverter used in VSM can be controlled to emulate inertia, which replicates the external features of a synchronous generator. As a result, the rotating inertia is increased to support the power system's stability. A power angle control strategy is proposed in this paper and its model is simulated in MATLAB/Simulink to study the effects of parameter disturbances on the active power and frequency for a VSM. The system consists of a synchronous generator, which is modeled in such a way that the frequency drops to an unacceptable region during transient conditions due to a lack of inertia when VSM is not used. Then, the suggested model incorporating VSM emulates rotating inertia, injecting a controllable amount of energy into the grid during frequency transients to enhance transient stability.

Keywords : damping constant, inertia–constant, ROCOF, transient stability, distributed sources
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