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Comparison of Control Schemes for Frequency Support in DFIG based WECS

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Abstract

In most parts of the world, the wind power generation, along with other renewable technologies, offers the sustainable, non-polluting and secure option for generating electricity over the long term. The increasing share of wind energy conversion systems (WECS), such as doubly fed induction generators (DFIGs), in electricity power generation would result in a reduction of conventional generator power plants. The variable speed wind turbine (VS-WT) units equipped with DFIGs contribute negligible inertial response to frequency variations. This paper compares different control schemes to provide frequency support in variable speed WECS equipped with DFIG during the system frequency changes. Addition of a supplementary control loop connects the turbine inertia directly to the grid and power can be exchanged with the grid during the frequency variations. Simulation results on a 9 MW wind turbine system equipped with DFIGs illustrate the contributions to frequency support with the proposed control strategies. Comparison of different control strategies have been carried out, when the system is subjected to the grid frequency excursion and load variation. Amongst the three control schemes considered in the present study, it has been found that inertial response of the proportional controller is the best. The particle swarm optimization (PSO) technique is used to tune the controller parameter for minimizing the frequency deviation and maximizing the release of energy. It has been found that inertial response of the system with the PSO optimised proportional controller gives improved results.