Performance Optimization of a PMSG-based Wind Energy Conversion System during Grid Faults Using a Combination of STATCOM and Super-capacitor

In this paper, the performance of a combination of Static Synchronous Compensator (STATCOM) and super-capacitor is investigated in order to improve grid and load connected Permanent Magnet Synchronous Generator (PMSG) variable speed wind turbine. The operation of STATCOM and super-capacitor in both normal and fault conditions are studied. Furthermore, a nonlinear local load is connected to wind turbine to find out a control method for elimination of current harmonics produced by this load. Moreover, a proper controller is proposed to produce modulating signals for wind turbine inverter which maintains THD less than 5% which is an IEEE standard. An LCL filter is designed as an inverter output filter for decreasing harmonics caused by switching. STATCOM and IGBT inverter controllers are respectively designed by d-q synchronous frame and space vector pulse width modulation (SVPWM) in order to maximize the operation of Wind Energy Conversion System (WECS). Simulations are done in MATLAB/SIMULINK. Results show that voltage stability, power factor correction and STATCOM injection/absorption of reactive power are happened correctly during voltage fluctuations caused by Three-phase faults.
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