

Multi-Target Control Technique for DFIG Under Unbalanced Voltage

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The doubly fed induction generator (DFIG) is very sensitive to unbalanced voltage at the point of common coupling (PCC), resulting in unbalanced stator current, double grid frequency oscillation (DGFO) in stator active power, total active power generated from DFIG, electromagnetic torque, rotor current, and DC-link voltage. These adverse effects on the operating variables of DFIG due to unbalanced PCC voltage may lead to its disconnection from the grid. To ensure a stable connection of DFIG with PCC, this paper proposes a multi-target control technique. The proposed technique formulates a multi-objective optimization problem with different objectives, such as minimizing unbalance in the stator current and DGFO in stator active power, electromagnetic torque, and rotor current. The solution of the formulated multi-objective problem is obtained using the weighted least square method. In contrast to previously individual target-based methodologies, which achieve one target at a time, the proposed methodology facilitates the customized reduction of DGFO in torque, stator active power, stator, and rotor current. Along with the rotor side converter, the grid side converter is also controlled to minimize the DGFO in DC link voltage and the total power generated from the DFIG. An extensive simulation study of the proposed algorithm on distribution and transmission level is done on the Real-Time Digital Simulator (RTDS). Hardware-in-loop (HIL) validation further supports its applicability under practical scenarios.