Predictive Control of Power Electronics Converters in Wind Energy Systems

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Abstract : In order to make a wind power generation truly costeffective and reliable, an advanced control techniques must beused. In this paper, we develop a new control strategy usingModel Predictive Control (MPC) approach for permanentmagnet synchronous generator based wind turbine system. Theproposed control law is based on two points: MPC-based torquecurrentcontrol loop for the generator-side converter to reach themaximum power point of the wind turbine, and MPC-basedcurrent control loop for the grid-side converter to satisfy the gridcode and to help improve system stability. A small-scale windturbine system prototype was built and tested in the laboratory,and the experimental results are provided to verify the validity ofthe developed control methods, MPPT algorithm andperformance of the system operations.

Keywords : finite-set model predictive control (FSMPC), Permanent Magnet Synchronous Generator (PMSG), Wind Energy Conversion System (WECS), Maximum Power Point Tracking (MPPT) Control, Grid Connected, experimental validation