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DFIG-Based Wind Turbine with Shunt Active Power Filter Controlled by Double Nonlinear Predictive Controller

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Abstract : This paper presents a wind turbine based on the doubly fed induction generator (DFIG) connected to the utility grid through a shunt active power filter (SAPF). The whole system is controlled by a double nonlinear predictive controller (DNPC). A Taylor series expansion is used to predict the outputs of the system. The control law is calculated by optimization of the cost function. The first nonlinear predictive controller (NPC) is designed to ensure the high performance tracking of the rotor speed and regulate the rotor current of the DFIG, while the second one is designed to control the SAPF in order to compensate the harmonic produces by the three-phase diode bridge supplied by a passive circuit (rd, Ld). As a result, we obtain sinusoidal waveforms of the stator voltage and stator current. The proposed nonlinear predictive controllers (NPCs) are validated via simulation on a 1.5 MW DFIG-based wind turbine connected to an SAPF. The results obtained appear to be satisfactory and promising.

Keywords : wind power, doubly fed induction generator, shunt active power filter, double nonlinear predictive controller
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