

Finite-Set Model Predictive Decoupled Active and Reactive Power Control for Wind Energy Systems

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Abstract : This paper introduces a novel approach for direct power control of three-phase voltage source inverter in grid connected distribution wind energy systems. In this approach, the control of active and reactive power is based on finite-set model predictive control strategy. The proposed strategy has the simplicity of the direct power control technique and doesn't require any current control loops. To meet the future generation of Permanent magnet synchronous generator wind turbines, a DC-DC boost converter is proposed at the machine-side to simplify the control and potentially reduce the cost of the wind energy system. The wind generation system requirements, such as maximum energy harvesting and regulation of grid active and reactive power are expressed as cost functions. Best switching states are selected and applied to the power converters during each sampling interval based on the minimization of cost functions. The feasibility of the proposed configuration and control scheme are verified through dSPACE 1104 experiments on a low power prototype.

Keywords : Maximum Power Point Tracking, Finite-set model predictive control, Permanent Magnet Synchronous generator, Wind energy system