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ENHANCED PERFORMANCE OF A DOUBLY FED WIND-POWER INDUCTION GENERATOR AT WIND-RANGE BOUNDARIES

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ABSTRACT

The doubly fed induction generator (DFIG) is one of the largest generators used with MW-class wind turbines. This paper focuses on the weak performance areas of grid-connected DFIG-based wind turbines. Basically, the DFIG performance at low wind speeds, close to the cut in speed, and around the full rating operation (in the vicinity of rated wind speed) is investigated. For low wind speed region, the causes of decreased efficiency of the DFIG-based wind turbines are discussed in details. A modified control to extend the concept of maximum wind power tracking to cover the low wind speed region is presented. The associated effects of the expanding technique are examined. For higher wind speeds, the strategy of reactive power flow and the converter ratings are the most significant factors affecting the performance of the DFIG system. Different strategies for reactive power flow are discussed and different converters ratings are considered. An optimum technique for reactive power control is proposed to capture maximum wind power with minimum losses. Moreover, this methodology ensures a unity power factor flow at the generator terminals. Reasonable values for the dc link voltage and converter ratings are investigated. A comprehensive time-domain model for the wind turbine with DFIG and the decoupled dq controller are implemented using Matlab/Simulink software. Comparative simulation results are included to ensure the