Advanced modeling and analysis of the loading capability limits of doubly-fed induction generators

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Abstract

This paper presents an improved mathematical model required for evaluation of the steady-state power
characteristics and loading capability limits of doubly-fed induction generators (DFIGs). Unlike the previous
models, this model takes into consideration the effect of the losses, rotor power flow, and power
factor settings of the grid-side converter (GSC). The impact of various variables and parameters on the
loading capability is determined through detailed analysis of the loading capability limits as well as a
parametric analysis. Simulation results show that DFIGs can provide a continuous controllable reactive
power support to electrical grids. In addition, the results set rules for enhancing the reactive power capability
of DFIGs based on its sensitivity to various parameters and variables of the machine and its controls.
Although, squirrel-cage induction-generators (SCIGs) that connected directly to the grid do not have a
reactive power capability and their reactive power consumption is uncontrollable, its loading characteristics
are also presented for illustrating the value of the partial-scale converter in operational flexibility
enhancement in DFIGs based systems.

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