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Design Optimization of Doubly Fed Induction Generator Performance by Differential Evolution

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Abstract : Doubly-fed induction generators (DFIG) due to their advantages like speed variation and four-quadrant operation, find its application in wind turbines. DFIG besides supplying power to the grid has to support reactive power (kvar) under grid voltage variations, should contribute minimum fault current during faults, have high efficiency, minimum weight, adequate rotor protection during crow-bar-operation from +20% to -20% of rated speed. To achieve the optimum performance, a good electromagnetic design of DFIG is required. In this paper, a simple and heuristic global optimization – Differential Evolution has been used. Variables considered are lamination details such as slot dimensions, stack diameters, air gap length, and generator stator and rotor stack length. Two operating conditions have been considered - voltage and speed variations. Constraints included were reactive power supplied to the grid and limiting fault current and torque. The optimization has been executed separately for three objective functions - maximum efficiency, weight reduction, and grid fault stator currents. Subsequent calculations led to the conclusion that designs determined through differential evolution help in determining an optimum electrical design for each objective function.

Keywords : design optimization, performance, DFIG, differential evolution
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