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# Design-Analysis and Optimization of 10 MW Permanent Magnet Surface Mounted Off-Shore Wind Generator

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**Abstract :** With advancing technology, the market environment for wind power generation systems has become highly competitive. The industry has been moving towards higher wind generator power ratings, in particular, off-shore generator ratings. Current off-shore wind turbine generators are in the power range of 10 to 12 MW. Unlike traditional induction motors, slow-speed permanent magnet surface mounted (PMSM) high-power generators are relatively challenging and designed differently. In this paper, PMSM generator design features have been discussed and analysed. The focus attention is on armature windings, harmonics, and permanent magnet. For the power ratings under consideration, the generator air-gap diameters are in the range of 8 to 10 meters, and active material weigh ~60 tons and above. Therefore, material weight becomes one of the critical parameters. Particle Swarm Optimization (PSO) technique is used for weight reduction and performance improvement. Four independent variables have been considered, which are air gap diameter, stack length, magnet thickness, and winding current density. To account for core and teeth saturation, preventing demagnetization effects due to short circuit armature currents, and maintaining minimum efficiency, suitable penalty functions have been applied. To check for performance satisfaction, a detailed analysis and 2D flux plotting are done for the optimized design.

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