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Optimization of a Flux Switching Permanent Magnet Machine Using Laminated Segmented Rotor

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Abstract : Flux switching permanent magnet machines are considered for wide range of applications because of their outstanding merits including high torque/power densities, high efficiency, simple and robust rotor structure. Therefore, several topologies have been proposed like the PM exited flux switching machine, hybrid excited flux switching type, and so on. Recently, a novel laminated segmented rotor flux switching permanent magnet machine was introduced. It features flux barriers on rotor structure to enhance the performances of machine including torque ripple reduction and also torque and efficiency improvements at the same time. This is while, the design of barriers was not optimized by the authors. Therefore, in this paper three coefficients regarding the position of the barriers are considered for optimization. The effect of each coefficient on the performance of this machine is investigated by finite element method and finally an optimized design of flux barriers based on these three coefficients is proposed from different points of view including electromagnetic torque maximization and cogging torque/torque ripple minimization. At optimum design from maximum developed torque aspect, this machine generates 0.65 Nm torque higher than that of the not-optimized design with an almost 0.4 % improvement in efficiency.

Keywords : finite element analysis, FSPM, laminated segmented rotor flux switching permanent magnet machine, optimization
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