

Design optimization of PM type motor for improving torque performance considering the demagnetization of magnet

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This paper presents a new design method of permanent magnet (PM) type motor for improving the driving performance with consideration of the demagnetization of PM. To apply accurate magnetic properties of PM which are highly dependent on temperature, thermal-magnetic coupled analysis is performed with heat sources such as copper loss and iron loss. The optimization problem is formulated to minimize losses which are calculated by input current and fluctuation of magnetic flux density, as well as maximize the torque performance of motor. Since the magnetic and thermal characteristics of motor are quite sensitive to shape of PM, ferromagnetic material and coil, topology optimization based on level set method is employed to obtain detailed geometrical change. A design example of motor with NdFeB magnet which has a tendency to be demagnetized on high temperature is provided to verify the effectiveness of the proposed method.

Keywords: design optimization, permanent magnet type motor, demagnetization, thermal-magnetic coupled analysis, topology optimization