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# Tue-Af-Po2.20-01 [54]: An Optimal Design to Prevent Demagnetization of Dy-free Magnet for a Traction Motor

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Neodymium (Nd) magnets have been applied for a traction motor owing to its considerable maximum energy product. In addition, heavy rare earth elements such as Dysprosium (Dy) are added to the Nd magnets for withstanding severe conditions of a traction motor that includes high temperature and strong demagnetizing field. However, the employment of Dy causes critical issues regarding environmental problems and price fluctuations due to unstable supply.
To resolve the issues, application of Dy-free magnets, which eliminate the Dy content of magnets, have been dealt with recently. Especially, an optimal design of motor shapes has been studied to prevent irreversible demagnetization due to a low coercivity of the Dy-free magnet. Nevertheless, these studies should be supplemented since partial demagnetization on diverse operating points has not been considered thoroughly.
Meanwhile, an optimal design for preventing demagnetization should be based on finite element analysis (FEA) to improve the reliability of the analysis. However, excessive computation cost is required for FEA-based demagnetization analysis on diverse operating points. To overcome the deficiency, optimization algorithms is requisite to derive an optimal solution within the limited computation cost.
This paper demonstrates an optimal design to prevent demagnetization of Dy-free magnets applied for a traction motor. The demagnetization of Dy-free magnets including partial demagnetization were considered on diverse operating points. Furthermore, in order to derive the optimal solution among numerous candidates of variables, an optimal design was performed applying a novel optimization algorithm, which is intelligent multi-start mesh adaptive direct search based on kernel support vector machine.

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