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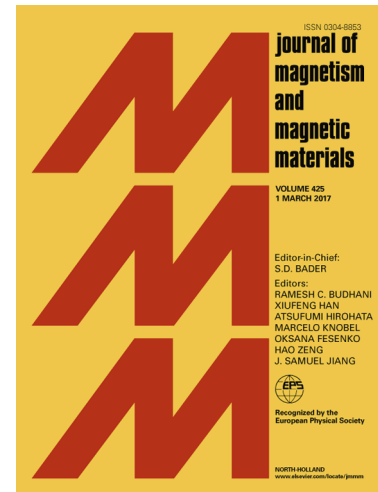
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# Topology optimization for design of segmented permanent magnet arrays with ferromagnetic materials

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## Abstract

This paper presents multi-material topology optimization for the co-design of permanent magnet segments and iron material. Specifically, a co-design methodology is proposed to find an optimal border of permanent magnet segments, a pattern of magnetization directions, and an iron shape. A material interpolation scheme is proposed for material property representation among air, permanent magnet, and iron materials. In this scheme, the permanent magnet strength and permeability are controlled by density design variables, and permanent magnet magnetization directions are controlled by angle design variables. In addition, a scheme to penalize intermediate magnetization direction is proposed to achieve segmented permanent magnet arrays with discrete magnetization directions. In this scheme, permanent magnet strength is controlled depending on magnetization direction, and consequently the final permanent magnet design converges into permanent

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