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Investigation of SMPM Motor with Segmented Eccentric Magnet Pole

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It is well known that the shape of a magnet pole has a significant influence on the air-gap flux density distribution, back-electromotive force harmonic and torque ripple in surface-mounted permanent magnet (SMPM) motors. In general, reducing the torque ripple by changing the shape of the permanent magnet (PM) has a negative effect on the electromagnetic torque and increased cost. This paper proposes a novel segmented PM pole with optimized Halbach array having different eccentricities, i.e., the inner and outer arcs of the segmented PM have different centers. Eccentric segmented magnet pole with Halbach array is carried out, which aims to unite the advantages of section Halbach array and eccentric magnets to achieve low torque ripple and high usage efficiency, while avoiding the decrease of the fundamental amplitude of air-gap magnetic flux density and the torque ripple cause by inter-pole leakage flux. In this paper, each magnet poles have segmented and eccentric magnet with Halbach array is proposed. The expression of air-gap flux density with eccentric magnet pole with Halbach array and radial magnetization eccentric magnet, through suitable selection of the eccentric distance, harmonic contents of radial flux density can be reduced a lot and can achieve low torque ripple, high electromagnetic torque and low magnet usage.

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