

An Analytical Formula for Back EMF Waveform of a Counter-rotating Dual-Rotor Non-Slotted Axial Flux Permanent Magnet Synchronous Machine

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Abstract

Fractional slot concentrated winding (FSCW) permanent magnet (PM) machines are taken more attention in low-speed applications because of their great advantages. This paper proposes a new structure for an FSCW double rotor axial flux PM synchronous machine (DRAFPMSM) with counter-rotating rotors. In addition, an analytical formula for the Back EMF waveform of the proposed structure is presented. The accuracy of the formula is investigated by designing a 40 Watts sample machine. The rotors of this machine rotate with speeds of 600 and 428 rpm in opposite directions. The Back EMF of the sample machine is calculated using the suggested formula. In addition, the Finite Element Method (FEM) is used to determine the Back EMF waveform. Comparison of the obtained results confirms that the new formula yields the Back EMF precisely such that the results well match to those of FEM.

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