Finite Element Modeling of Five Phase Brushless Motor for High Power Density Application

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Abstract

The demand for high reliability motor drives increases every day, especially in aircraft where traditional, nonelectric systems (hydraulic, pneumatic) are being replaced by electrical actuators following the More Electric Aircraft (MEA) trend. Its pursuing involves the adoption of protective design concepts such as fault-tolerant or redundant approaches, aiming to minimize mission failure probabilities. Multi-phase motor drives are gaining a growing interest to this extent, because they permit a boost in torque and power density, allowing the design of very compact high efficiency drives with intrinsic fault-tolerant capabilities. This paper presents a five-phase permanent magnet brushless motor developed for high power density application. The FEM model done in COMSOL Multiphysics® was used to calculate, average air gap flux density, maximum flux densities in the rotor and stator, and back-emf waveforms.

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Figures used in the abstract

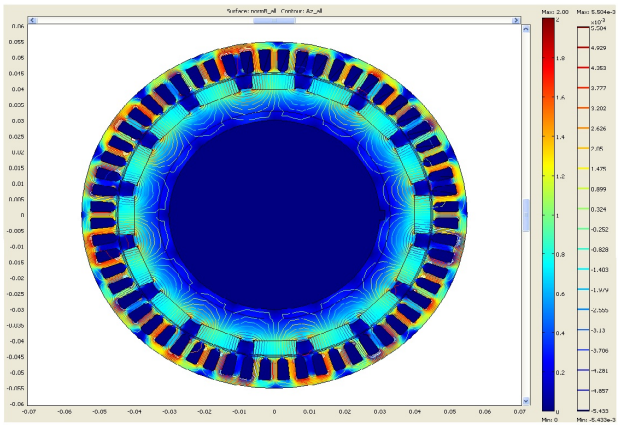

Figure 1: Flux Density Distribution

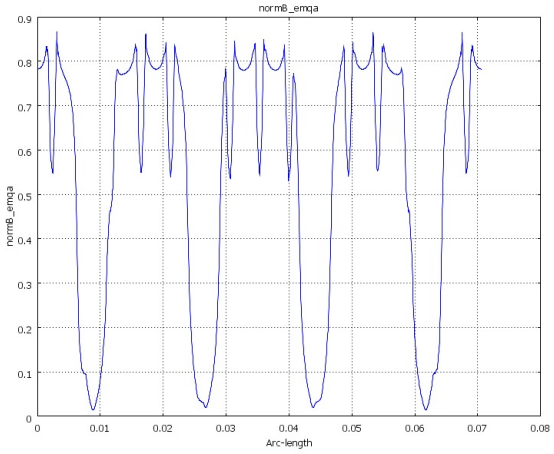

Figure 2: Airgap Flux Density

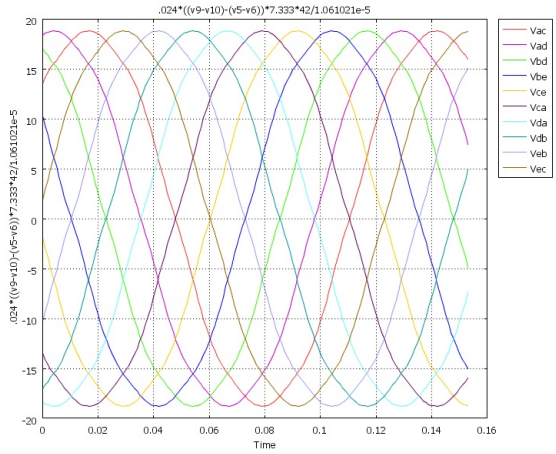

Figure 3: Back emf wave form obtained