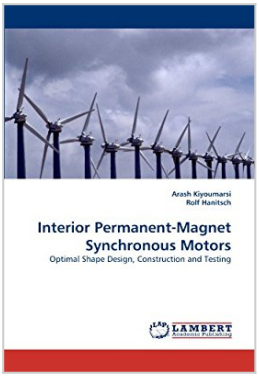

Interior Permanent-Magnet Synchronous Motors: Optimal Shape Design, Construction and Testing

By Arash Kiyoumarsi, Rolf Hanitsch

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Brushless permanent magnet (PM) motors can be divided into the PM synchronous AC motor (PMSM) and PM brushless DC motor (PMBDCM). The former has sinusoidal airgap flux and the back EMF, thus has to be supplied with sinusoidal current to produce constant torque. The PMBDCM has the trapezoidal back EMF, so the rectangular current waveform in its armature winding is required to obtain the low torque ripple. Generally, the magnets with parallel magnetization are used in the PMSM while the magnets with radial magnetization are suitable for the BDCM. The interior PM (IPM) synchronous machine is being studied as a promising candidate for high-power starter/alternator in future internal combustion engine vehicles. The other many popular applications of IPM machine are traction, machine tool, spindle drives, air conditioning compressors and electrical vehicles. Torque ripple minimization in PM motors is conventionally obtained by either good motor design or appropriate control strategies. In design optimization programs, a reliable and detailed analysis of the torque and back-EMF of the machine should be performed.

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About the Author
Arash Kiyoumarsi is an assistant professor of electrical engineering at the Dept. of Electrical Engineering, Faculty of Engineering, University of Isfahan, Iran. Rolf Hanitsch is a Dr.-Ing. habil. professor of electrical engineering in the Institute of Electrical Machines and Renewable Energies, at Technical University of Berlin, Germany.

Arash Kiyoumarsi is an assistant professor of electrical engineering at the Dept. of Electrical Engineering, Faculty of Engineering, University of Isfahan, Iran. Rolf Hanitsch is a Dr.-Ing. habil. professor of electrical engineering in the Institute of Electrical Machines and Renewable Energies, at Technical University of Berlin, Germany.

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