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Paper

## Thermal Analysis of a Permanent Magnet Synchronous Motor for Electric Vehicles

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記事の概要抄録

The thermal issue of electric vehicles is an important criterion for the design of the motor and for choosing the adequate cooling system to assure propels electrical performance and reliability. The thermal behavior of motor depends on the heat sources and on the motor geometry. This paper presents the thermal analysis of permanent magnet synchronous motor (PMSM) for electric vehicles traction application. The thermal design technique used is the analytical lumped circuit. An analytical copper and iron loss model is presented also two cooling systems are applied to this model, cooling by air and water. A comparison is carried out so choosing the best solution. The equivalent circuit of the motor is implemented and simulated with MATLAB simulator. The results obtained show the effectiveness of the designed motor and its good satisfaction of the specification book.

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データが取得できませんでした。



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The thermal issue of electric vehicles is an important criterion for the design of the motor and for choosing the adequate cooling system to assure propels electrical performance and reliability. The thermal behavior of motor depends on the heat sources and on the motor geometry. This paper presents the thermal analysis of permanent magnet synchronous motor (PMSM) for electric vehicles traction application. The thermal design technique used is the analytical lumped circuit. An analytical copper and iron loss model is presented also two cooling systems are applied to this model, cooling by air The permanent magnet synchronous motor is cross between an induction motor and a brushless DC motor . Like a brushless DC motor, it has a permanent magnet rotor and windings on the stator. However, the stator structure with windings constructed to produce a sinusoidal flux density in the airgap of the machine resembles that of an induction motor. Permanent magnet synchronous motors' power density is higher than induction motors with the same ratings since there is no stator power dedicated to magnetic field production. Today, these motors are designed to be more powerful while also having A Permanent Magnet Synchronous Motor for TractionApplications of Electric Vehicles. Y.K. Chin, J. Soulard. Royal Inshtute of Technology (KTH) Depiutment of Electrical Engineering Permanent Magnet Drives (PMD) Research Group Stockholm, Sweden. A6shrcl- This paper presents the design of a Permanent Magnet Synchronous Motor @MSM) for traction applications of electric vehicles (EVs). The design is based on the stator. geometry of an existing commercial available induction traction. motor. The rotor configurationsconsidered in. In this section, the thermal analysis used in the design process is described Two commercially available thermal design packages, Motor-CAD and FEMLAB, are used in om. 1038. I. A 30 kW high-speed permanent magnet synchronous motor-generator was designed, built and tested. The basic electromagnetic design was developed by Professor James Kirt-ley, while much of the mechanical design was done by engineers at SatCon. Finally, several quantities predicted by the elec-tromagnetic analysis and loss models were experimentally measured, to evaluate the valid-ity of the theory. On the basis of this work it is believed that compact permanent magnet synchronous motor-generators for flywheel energy storage systems can exhibit efficiencies near 95%, and can operate with idle losses as low as 12 W. Thesis Supervisor: Jeffrey H. Lang Title: Professor of Electrical Engineering and Computer Science.