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Mon-Mo-Po1.06-05 [67]: Design and Analysis of a New Synchronous Reluctance Machine with the Aid of Grain Oriented Silicon Steel Cores

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As the price of rare earth permanent magnet (PM) is very high, developing of high performance electrical machines with non rare earth PM is have received extensive attention, and synchronous reluctance machine (SynRM) has show good performance when comparing with other electrical machines. The torque ability of SynRM is proportional to its saliency ration which is determined by the rotor topology and rotor material. In this paper, a new SynRM with the aid of grain oriented steel is adopted. the main magnetic structure of new SynRM is similar to that of traditional SynRM. In this SynRM the main core are made by the traditional non oriented silicon steel and the grain oriented steel is used to fill in the part of magnetic barrier in each layer. the rolling direction of grain oriented steels filled in the new SynRM is parallel to the direction of d-axis of the rotor core, thus the main magnetic flux flows can be increased along the rolling direction of the filled material and the d-axis reluctance can be decreased greatly. On the other hand the magnetic reluctance of the new SynRM along the q-axis direction is kept the same since the magnetic permeability of the grain orient steel vertical to the rolling direction is very low and there is some air gap existed. Therefore the saliency ratio can be increased and thus the torque can be increased. In this paper, a new SynRM is designed and optimized for the electric vehicle application, its main parameters and performance have been compared with a traditional SynRM based on the finite element method (FEM). Compared with the traditional SynRM, the torque of new SynRM has been improved about 7% with only very low material cost required.

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