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SynRM Rib optimal Design method for High-Power Density

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Recently, As environmental problems such as global warming have appeared, MPES (Minimum Energy Performance standard) that regulates the efficiency of industrial induction motor is being implemented centered on developed countries. MPES limits the use of induction motors less than a certain efficiency to improve the energy efficiency. There are cases where the use of induction motors below IE4 level is restricted. Unfortunately, the research to improve the efficiency of induction motors have reached saturation point. As an alternative, the research of SynRM was activated. the SynRM has a merit of economical advantage compared to an induction machine because it does not use a permanent magnet, and it also has a merit in durability with a simple structure. the opearating principle is that using reluctance torque generated by the difference between d-axis and q-axis inductance. Generally, the d-axis,q-axis inductance was directly connected in the output of the SynRM. Generally, output density of SynRM is proportional to the number of layers. However, if the number of layers is increased, the mechanical strength becomes weak, so high-speed rotation becomes impossible. In this paper, we propose a design method of 3D printing manufacturing method and SynRM designing method. First we have designed many layers for SynRM that has maximum output density but also has minimum mechanical strength. To compensate for the mechanical strength, 3D printing structure is placed inside the layer. In the case that made only using iron core, it is impossible to drive cause by mechanical stress. but the 3D printing structure is placed inside the core, it is confirmed that the 3D printing structure is dispersed in the stress concentrated on the iron core. To prove this design technique, the motor is manufactured and tested. As a result, the validity of the design method was verified.

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