MT 26
International Conference
on Magnet Technology
Vancouver, Canada | 2019

Contribution ID: **941** Type: **Poster Presentation**

Mon-Af-Po1.21-02 [89]: Analysis of Design and Mechanical Properties of AISG with Brush and Slip-Ring Structure

Monday, 23 September 2019 14:30 (2 hours)

Currently, the ISG is commercialized and under active research in the 48V hybrid system. However, in a typical vehicle using a 12V system, the starter motor and generator are operated separately. In this paper, we report the development of a general advanced integrated starter-generator(AISG) for vehicles using 12V power supplies. The specifications of the power source are lower than that of conventional integrated starter-generator(ISG). It is not easy to implement in a 12-V battery system of a typical car without using a separate power conversion device, such as a converter. combining a starter motor and an alternator into one integrated system has many advantages. The first one is improving the fuel economy by stopping the engine during deceleration, unlike existing starter motors. The reason is that the conventional starter motor uses a DC motor, which is much lower in efficiency than a permanent magnet (PM) motor. Second, the torque of the motor can be reduced, and the price can be reduced. Rare earths account for approximately 40% to 50% of the price of PM motors. The AISG system in this study reduces the torque burden by using a torque increase mechanism instead of reducing rare-earth use. The motor used in the AISG is a permanent magnet-assisted-wound field synchronous motor(PMA-WFSM) that includes a brush and slip ring. A permanent magnet inside the rotor core of a PMA-WFSM increases the air gap flux density and relaxes the magnetic flux saturation of the core. As a result, the torque of the electric motor can be increased and a coordinated operation with the planetary gears leads to higher performance. The effect of increasing the torque by including permanent magnets in the design was validated using finite element method (FEM) analysis. In addition, analysis of the mechanisms was performed vis-à-vis the various mechanical structures.

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Session Classification: Mon-Af-Po1.21 - Motors III