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Wed-Mo-Po3.05-08 [35]: Maximizing Efficiency of IPMSG in the Engine Generator System of a Plug-in Hybrid EV and Its Comparison with SPMSG

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Recently, eco-friendly vehicles such as pure electric vehicles (EVs), hybrid EVs and plug-in hybrid EVs (PHEVs) have been the subject of many studies in a dramatically accelerated effort to increase the total driving distance on a single charge. Among of PHEV components, increasing the efficiency of the engine generator system (EGS) is a key challenge in this effort. In the EGS, a generator and an engine are mechanically linked, where the generator is operated from output power of the engine while the PHEV is operating. In order to increase the efficiency of EGS, the generator should be driven with high efficiency at optimal operating points, which are selected based on their efficiency using an experimental engine test. These operating points are called the optimal operating line (OOL), and the efficiency of the generator should be maximized on the OOL. Therefore, this paper proposes to maximize the efficiency of the generator in the EGS of a PHEV.
Meanwhile, permanent magnet synchronous generators are well-known as suitable candidates in PHEV because of their performance characteristics such as high power density and efficiency. According to PM arrangement, a surface-mounted PM synchronous generator (SPMSG) and an interior PM synchronous generator (IPMSG) are classified. In this paper, both of them have been designed and applied to optimal design to maximize the efficiency on the OOL based on finite-element analysis, where intelligent mesh adaptive direct search was used as the optimization algorithm. The generators were experimentally tested and compared in terms of torque density, efficiency, total harmonic distortion and torque ripple. Since the performance of IPMSG is better than that of SPMSG, it was selected and built into the vehicle. Finally, the IPMSG built-in PHEV has been tested and validated. A full paper will describe the above-mentioned studies in detail. This work is funded by the Korea Automotive Technology Institute.

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