

## **Design and optimization of electromagnetic torque for a surface-mounted PMSM by using subdomain model and GA in electric vehicle application**

### **Abstract**

This paper presents a highly structured optimization strategy for 12-slot/8-pole surface-mounted permanent magnet synchronous machines (SMPMSM) with radial magnetization pattern. The main goals of the optimization process are to determine the optimal motor geometry, and achieving the minimum torque ripple and maximum average electromagnetic torque, simultaneously. The first function is used to obtain the maximum electromagnetic torque, and thus obtaining higher efficiency and the second function is used to achieve the minimum torque ripple. A computing framework that ensemble the genetic algorithm (GA) and subdomain model (SDM) with weighted equations is proposed to determine the optimal design of SMPMSM. After the optimization process, the optimal design of PM motor demonstrates much lower torque ripple with reasonable electromagnetic torque as compared with that of the initial design. The comparison of parameters and motor performances between the initial and the optimal designs of 12-slot/8-pole PM motors with the computing framework are validated in terms of electromagnetic torque under BLAC operation using SDM. Thus, the framework of SDM and GA is verified in reducing the usage of magnet materials and the electromagnetic torque ripple of SMPMSM, which is highly viable for electric vehicle. Therefore, the proposed ensemble framework of GA and SDM can determine the optimal settings of geometry design for SMPMSM in order to produce optimum motor performance.

### **Keywords:**

Electric vehicle, Electromagnetic performance, Genetic algorithm, Permanent magnet synchronous machine, Subdomain model, Surface-mounted