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## **Wed-Mo-Po3.12-07 [102]: Design of IPMSM for Electric Oil Pump considering PM Irreversible Demagnetization at Saturation Temperature**

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When designing a motor, the motor should be designed to withstand harsh conditions, for it to operate at any extreme environment. For the motor that uses permanent magnet (PM), its irreversible demagnetization is undesired characteristic that has negative effect on motor performance. As interior PM synchronous motor (IPMSM) is often used for high torque density generation, its operation characteristic regarding PM irreversible demagnetization is considered as an important factor. In most cases however, PM irreversible demagnetization is analyzed considering ambient temperature of the motor. But for accurate analysis, the temperature of the PM should be taken into account, not the ambient temperature. Therefore, assumption on PM temperature is carried out based on operation and cooling condition of the motor. By employing derived PM temperature for motor analysis, more accurate operation characteristic will be derived in terms of both output performance and PM irreversible demagnetization. Then, the design parameters of the motor can be revised to reduced undesired phenomenon of the motor.

In this paper, design of Interior Permanent Magnet Synchronous Motor (IPMSM) for Electric Oil Pump (EOP) considering PM irreversible demagnetization is discussed. To begin with, base EOP motor is analyzed to satisfy operation requirement at its operating temperature. The saturation temperature of the motor is derived using MotorCAD, which is a powerful tool for electromagnetic and thermal performance analysis, based on the operating condition as well as the cooling condition for each operating points. With the derived saturation temperature, irreversible demagnetization of PM is analyzed under its load condition. Based on the analysis, design of the EOP motor is revised to enhance the demagnetization effect, and its PM irreversible demagnetization ratio is derived. Finally, the characteristic of the improved model is compared to that of the base model.

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