**Estimation of Permanent Magnet Temperature using d-axis Current for IPMSM**

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### Background

Permanent magnet that is used interior permanent magnet synchronous motor used to be irreversibly demagnetized when the motor operate at high temperature. Therefore, the motor is designed considering irreversible demagnetization of permanent magnet. However, it is difficult to design motor because we can't forecast the exact temperature of permanent magnet when the motor operate. In addition, it is difficult to measure the temperature of permanent magnet using thermocouple because of rotating the rotor. So, this paper proposes the method which it estimates the temperature of permanent magnet using reduction of d-axis current to know irreversible demagnetization of the permanent magnet.

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### Permanent Magnet Temperature Estimation Algorithm

**Convention**
- Torque command
- Current command
- Torque generation
- Decrease in linkage flux of PM
- Increase in PM temp.
- Torque Error (command & real value)

**Proposal**
- Torque command
- Current command
- Torque generation
- Decrease in linkage flux of PM
- Increase in PM temp.
- Estimation of torque

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### Conclusion

- This paper will propose two methods for estimation of PM temperature. One is temperature estimation using torque equation and the other is temperature estimation using voltage equation.
- This paper will show the surface PM synchronous motor’s (IPMSM’s) PM temperature estimation, though the title of this paper is to estimate the temperature of interior PM synchronous motor’s (IPMSM’s) PM.

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