論　文　要　旨
Thesis Abstract

(yyyy/mm/dd)　2019 年　09 月　13 日

※報告番号	甲第 251 号	氏　名 (Name)	DONGWOO LEE

主論文題名　（Title）

Dynamics and Stability Analysis of IPMSM Position Sensorless Control for xEV Drive System

内容の要旨　（Abstract）

In this thesis, the new method has been studied for the improvement of dynamic characteristics and stability on the sensorless control of an interior permanent magnet synchronous motor (IPMSM) used as traction motors of electrified vehicle (xEV) today. The xEV is divided into four main categories: battery electric vehicle (BEV), hybrid electric vehicle (HEV), plugin hybrid electric vehicle (PHEV) and fuel cell electric vehicle (FCEV). The inverter control for IPMSM-drives intended for xEV applications has specific features such as reliability and robustness, high torque at low speed and a high power at high speed, wide speed range, fast torque response, high efficiency over the wide speed and torque range, high efficiency for regenerative breaking, and so on. Among other things, high reliability and robustness of the control system are basic and essential for a driver safety. To do this, although the fault of sensors utilized traction motor control occurs, the compensation method to ensure normal operation has been proposed continuously. To achieve high performance of xEV traction motor, the precise inverter control using sensor signals is necessary. The sensors comprise four elements: voltage sensor, current sensor, temperature sensor and position of rotor sensor. Conventionally, the position sensor is attached to the rotor shaft mechanically. From this cause, the position sensor has a high probability of sensor fault due to high variation of temperature. Therefore, the algorithm transition from sensored to sensorless control and continuously motor control when the position sensor fault occurs are requested.

This thesis presents the fault detection strategy using difference value between sensor signal and estimated signal. To detect the sensor fault, the sensorless algorithm is operated in parallel. And, the method for fast fault detection and algorithm transition proposes to ensure the stability of control system when the position sensor fault occurs. Also, the design method of controllers for the stable and fast response in sensorless control is analyzed. On the basis of a designed sensorless drive, the new strategies which improve the dynamics of controller and the stability of sensorless control in transient state have been proposed. The effectiveness and feasibility of proposed algorithm and analysis results are verified by computer simulation and experimental results.

※official use only