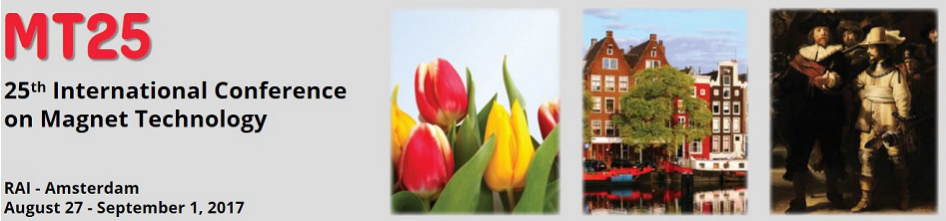

Contribution ID: **523** Type: **Poster Presentation of 1h45m**

Nonlinear Sensorless Control including Zero Speed of Permanent Magnet Synchronous Motor Drives

Thursday, 31 August 2017 13:45 (1h 45m)

An internal permanent magnet synchronous motor (IPMSM) has a high output density per volume but has non-linear characteristics due to a beta angle control. Moreover, it is also difficult to precisely control by changing the motor parameters in a nonlinear manner with magnetic flux and torque according to load and temperature characteristics during operation. Therefore, we propose a new sensorless method based on a stability of Lyapunov that drives robustly IPMSM from zero speed by detecting the stability of the motor operation in real-time according to these changes. Lyapunov stability theory is crucial to stability analysis in control theory. In particular, if the parameters of the system are uncertain in robust stability analysis, it is necessary to find an appropriate evaluation value using the Lyapunov equations. This paper shows how this approach can be used to apply algorithms to tune parameters in motor systems. To do this, we first derive a differential equation for the error, and use the Lyapunov function candidate (LFC) to prove that the error dynamics equation is asymptotically instable. To ensure convergence of the error to zero, the Lyapunov function is chosen as follows. "ˆ" is estimation value.
V(Flux_dˆ, Flux_qˆ, Estimated_speed) = 1/2{(Flux_dˆ-Flux_qˆ)ˆ2 + (Flux_qˆ)ˆ2 + 1/r(Estimated_speed)ˆ2}
When this LFC is developed by definition of the function, for known values of the initial rotor position, Rs, Ls, Lamda_f), the observer can converge to the correct rotor position. The results of simulation and experiment should be included in the full paper. The proposed algorithm has been verified via simulation and experiment, and the results show that this method has been successfully implemented over all speed range. And the method is able to produce estimates of position and speed with a precision good enough to replace position sensor.

Submitters Country

Republic of Korea

Primary author: JOO, Kyoung-Jin

Co-authors: Dr KIM, Seung-Joo (Korea Testing Certification); LEE, Ju (Hanyang University)

Presenter: JOO, Kyoung-Jin

Session Classification: Thu-Af-Po4.05

Track Classification: E1 - Motors