URN etd-0407109-183702-94
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Statistics This thesis had been viewed 63 times. Download 0 times.
Department
Year 2007
Semester 1
Degree Master
Type of Document Master's Thesis
Language zh-TW.Big5 Chinese
Title Low Speed Control of PMSM
Date of Defense 0000-00-00
Page Count 84
Keyword
low speed
in-parallel interlaced sampling
observer

Abstract
The thesis aims at designing the drives for permanent magnet synchronous motors at low speed range. Incremental-type encoder is widely used for speed detection in servo system. However, the system usually becomes unstable at low speed range due to the speed controller using average speed estimation method. To improve the system performance, three algorithms are studied in the thesis, in-parallel interlaced sampling, the encoder resolution increasing, and instantaneous speed observer design.
The architecture of in-parallel interlaced sampling may provide larger speed-loop bandwidth to get higher resolution. To increase the encoder resolution, the phase delay method for square waveforms is proposed. This method will raise the frequency of the encoder pulses such that the encoder resolution will be increased. A digital filtering system is employed to filter out the noise on the encoder signal. As a result, the effect of phase delay method on encoder pulses is shown.
The error between the motor speed and the designed observer output is applied to a PID controller such that the torque disturbance of the motor system will be compensated. As a result, the instantaneous low motor speeds will be effectively obtained.
Advisory Committee Ming-Shyan Wang - advisor

Files No Any Full Text File.
Date of Submission 2008-08-08