

ABSTRACT

Rotor-Flux-Oriented Control depends upon many parameters of an induction motor. In contrast, Stator-Flux-Oriented Control requires fewer parameters of an induction motor, i.e. stator voltage, stator current, and stator resistance. Hence, it would be straightforward to design a robust adaptive controller for a three-phase induction motor.

Therefore, the thesis presents a new method of designing a robust adaptive controller for a three-phase squirrel-cage induction motor with a nameplate specification as 1HP-380V-50Hz-150 rad/s. This robust adaptive controller is based on the Stator-Flux-Oriented control since it has the merit of utilizing fewer parameters of an induction motor in comparison to the Rotor-Flux-Oriented Control. The robust adaptive controller is then implemented on a seven-level cascaded H-bridge inverter with common-mode voltage reduction to enhance the performance of the controller.

In particular, the contents of the thesis are briefly described below:

+ Firstly, three new methods to reduce common-mode voltage for multi-level inverters are proposed. They are then implemented on a seven-level cascaded H-bridge inverter.

- a) Phase Modulation-PM.
- b) Phase Shift Keying-PSK.
- c) Frequency Modulation-FM.

+ Secondly, the design of a Robust Adaptive Controller for a three-phase induction motor by using internal models are presented.

+ Thirdly, three new sliding mode control methods for a three-phase induction motor are proposed with the aim of reducing oscillation around the slide surface, motor speed identification using neural network, and system stability with noise.

- a) Sliding Mode Control based on RBF network.
- b) Sliding Mode Control based on low pass filter.
- c) Sliding control based on nominal model.

+ Finally, Simulation and Experimental results are obtained from matlab/simulink. In addition, Lyapunov theory is applied to test the stability control system. Specifically, Experimental results are collected from the DSP TMS320F28335 card and are then compared with a PID controller with no load and various load condition.