ABSTRACT

The main subject matter of this dissertation is to develop parameter adaptive rotor flux oriented current fed induction motor drive systems for controlled speed operation. The parameter adaptive approaches do not require special test signals and softwares in a big way. Three easy-to-implement schemes are suggested. One scheme is based on airgap power estimation method and takes into account of the non-linear magnetic state while tracking the actual rotor resistance. The other two methods constitute model reference adaptive controllers. They are based on the inverter input voltage and torque producing component of the stator current. The effectiveness of these methods is examined by extensive simulation and experimentation with two laboratory type induction machines. The experimental set up makes use of two microcomputers (i-8006 with i-8007) and a PC/AT with Burr Brown's PCI system having multi-channel 12 bit data acquisition modules for implementing the control algorithms.

Prior to the description of parameter corrective algorithms, a control system suitable for a CSI-fed induction motor under rotor flux orientation is designed and tested by suitable simulation model. Then the influence of rotor resistance variation in the presence of magnetizing flux saturation has been extensively investigated. A two-parameter saturation model (two-term quintic non-linearity) is used in all these studies. It is further shown how the machine performances under field oriented condition are affected by inclusion of saturation

characteristics. Analytic expressions as well as digital simulation procedures are presented to study the performance of the drive system.

Robustness of the drive system has been studied applying the concept of Kharitonov's theorem and then justified from the simulation results of the system for both parametric and torque disturbances.

'Bond Graph' and 'Nodal method' provide an organised way to write equations for a dynamic system. Tedious way of writing equations and their arrangement and re-arrangement for framing state equations can be avoided in the proposed simulation techniques. Simulation studies based on systematic modelling and framing of the system equations using the above two methods for the operation of a speed controlled CSI-IM system under normal and abnormal conditions have also been provided.

KEY WORDS

Induction machine, CSI-fed, d-q-axis, Flux and current vectors, Saturation, Parameter estimation and adaptation, Modelling and simulation, Robustness, H_∞-norm, Bandwidth, Stability margin, Multi-microprocessor-based control, PCI system, Data acquisition, Resolution, Nodes, Corrector currents, Effort, Flow, Gyrator, Bonds.