MODELLING AND SIMULATION STUDIES TO DESIGN AND CONSTRUCT A LOW-COST VARIABLE SPEED DRIVE FOR SINGLE PHASE INDUCTION MOTORS

UPUL DISSANAYAKE , SANATH ALAHAKOON* AND SUNIL ABEYRATHNE

Department of Electrical and Electronic Engineering, Faculty of Engineering, University of Peradeniya, Peradeniya

Single-phase induction motors are popular everywhere in industry as well as in domestic use due to the robustness of the machines. The other reason of wide usage of Single-Phase Induction Motor (SPIM) is the unavailability of three-phase power supply everywhere. The traditional SPIM drives are mostly fixed-speed drives. Wherever it is required a variable speed drive with SPIM, the usual practice is to go for a mechanical gearing arrangement with less efficiency and high cost.

The main target of this research is to design and implement a low cost variable speed drive for SPIM, where a micro controller based power electronic drive system will be used for the purpose of speed control. Thus it will be easy to implement the variable speed control for variety of SPIMs. By introducing variable speed drive for SPIM, starting and running capacitors can be removed. This will increase the life span of the motor system and hence reduce the maintenance cost of the system. Introducing a power electronic driver also reduce the losses at starting since the driver can control the starting current of the machine. It can also provide protection at starting.

As the first step of this study a dynamic simulation model for SPIM was developed, and simulation results were obtained for an existing SPIM whose internal circuit parameters such as resistances, inductances, etc. are available, to compare them with the experimental results. The modeling and simulation is very important because in this stage the behavior of the machine can be observed under applied voltages. This will help to identify and hence to solve some of the problems before initializing the prototype implementation.

By analyzing the results obtained from the simulation and considering the dynamic model of the SPIM, it is possible to determine the optimum voltages (in both magnitude and phase) that have to be applied across main and auxiliary windings of the machine and the parameters of the controller. Since this information is available the power electronics will be controlled to produce the required voltages for the machine windings. A micro controller or a similar device can be employed to control these power electronic drives. This part of the project is still under progress.