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Microcontroller based system for Power factor Control of Squirrel Cage Induction Motor (SCIM)

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Abstract— Since majority of loads are of inductive nature, that take lagging reactive power which decreases the system power factor, so they require some amount of reactive power supplied by static condensers or by other devices which neutralize (totally or approximately) the lagging reactive power (VAR) only. Thus power factor of a squirrel cage induction motor can be maintained at high value, preferably near unity, in spite of variation of load on the motor, by employing a Pulse Width Modulated (PWM) voltage fed inverter controlled by a microcontroller.

Keywords: Pulse Width Modulated (PWM) voltage fed inverter, microcontroller, lagging reactive power, harmonic.

I. INTRODUCTION

THE PWM voltage fed inverter is connected to three phase 50 Hz system to which the squirrel cage induction motor (SCIM) [1] is also connected through the Direct On Line (DOL) starter. The PWM inverter can generate lagging reactive power (VAR) resulting in operation of the induction motor with high power factor despite variation of load from light to full rated value. In addition to generation of reactive power, the inverter can generate an input harmonic current wave which, being in antiphase, may neutralize harmonic component in the supply line currents.

II. BRIEF LAYOUT OF THE SYSTEM

Here we try to give an overall idea of our designed system. Our basic objective is to conveniently control the power factor at a value, preferably unity. We use an integrated system consisting of PWM voltage fed inverter controlled by microcontroller [2], line synchronization circuit, pulse amplifier, timing logic and control circuit. The real time data (voltage and current) collected by the integrated system from the line is analyzed by the PIC microcontroller.

The Pulse width of the inverter [3] is controlled by the microcontroller which can be programmed for reference value of power factor. The PWM inverter can therefore be represented by an equivalent circuit consisting of a three phase capacitor bank exchanging reactive power with the load.

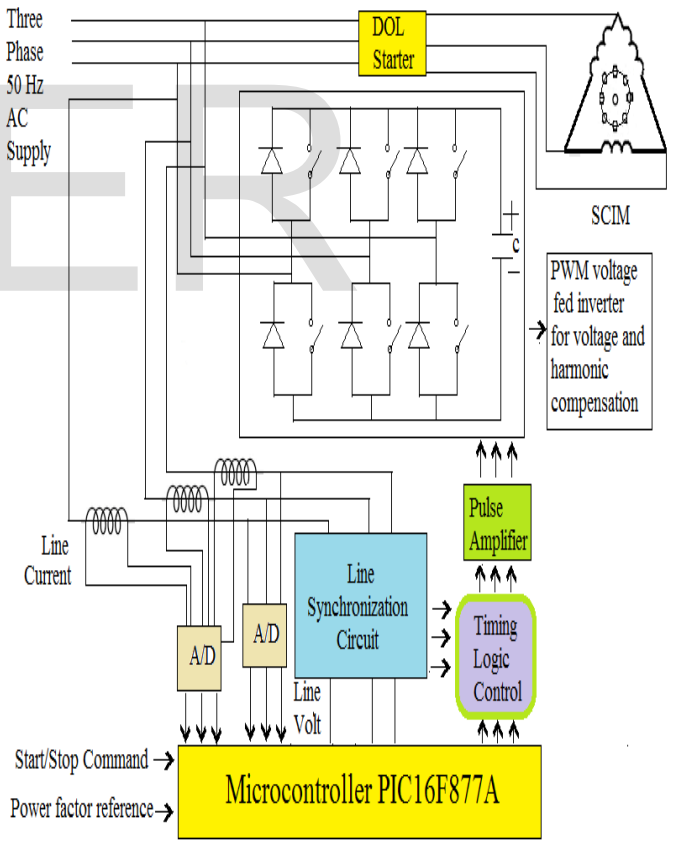

Fig.1 General block diagram of the system

III. SOFTWARE IMPLEMENTATION

The entire program is written in Hitech-C language and is compiled using HI-TECH PICC. 9.83 compilers and the corresponding HEX file is generated using Proteus Design suite 8 professional. The hex file is then burnt into the PIC16F877A microcontroller [2] using MPLAB IDE and In Circuit Debugger (ICD). The hex file should be located in the same folder as the project file. The ICD's Ethernet cable pins are connected to the appropriate pins on the PIC in order to load a program. It is also necessary to have the PIC running (i.e. under +5V power) when programming.

CONCLUSION

Squirrel cage induction motors which are widely used in industry on account of low price, low maintenance cost, simple and robust construction suffer from the disadvantages of poor power factor when running on light load, typical value of power factor at full load being 0.85. The system based on microcontroller as presented above will be useful in maintaining high value of power factor for squirrel cage motors and will be helpful in conservation of electrical energy by preventing extra joule's heating loss due to drawing of reactive power from the a.c. supply lines.

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REFERENCE

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[2] Mazidi, Muhammad A., PIC Microcontroller and Embedded Systems, First edition, Pearson, 2008.
[3] S.N.Biswas, Industrial Electronics, Dhanpat Rai Publishing Company (P) Ltd.