CHAPTER 7

Conclusion and Future Developments

7.1 Conclusion

Considering all the above research work and the results obtained, it can be concluded as follows. After power electronics start to pay a big role in the industry, VSD become much popular in speed control of Induction machines. Several advanced controlling techniques have been introduced and employed, especially for three phase induction machines during last few decades after rapid inventions in power electronics.

Variable Speed Drive constructed by this project with PIC 18F4431 which is dedicated for motor control applications. Software program generates PWM outputs to create required voltage wave forms and frequency at outputs of the IGBT power module. Output voltage and frequency can be set by varying the potentiometer position. Instant of potentiometer form of temperature controller can be used to vary output voltage and frequency.

7.2 V/f Control with Velocity Feedback and Current Feedback

In open-loop V/f control, the rotor is assumed to follow the rotating flux generated in the stator, with a certain degree of slip present depending upon the load. In many applications, the load can vary widely and the resulting motor speed will vary accordingly. To improve speed control, a form of speed feedback can be added.

A simple implementation of closed-loop speed control is illustrated in Figure 7.1 The reference speed is still set by a potentiometer or any other controller, as above. However, instead of directly using the reference speed to determine the drive frequency, it is compared to the actual motor speed to generate a speed error signal. Actual motor speed is established by a speed measurement with a tachometer signal.

The speed error signal is then used as an input to a Proportional-Integral (PI) controller, which determines the desired drive frequency to the motor windings. The standard V/f process determines the amplitude of the drive waveform. The drive frequency and amplitude are then used to update the PWM duty cycles of the six PWM channels that drive the three-phase bridge. Current feedback may also be used concurrently with velocity feedback.

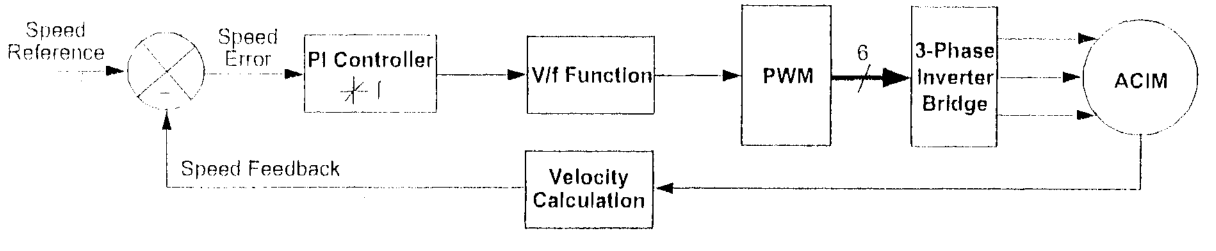

Figure 7.1 - Block diagram of VSD with feed back control

7.3 Additional features for VSD

Following features can be included in to the firm ware and software

Key activity

The main loop continuously checks key activity which is handled by the key service routine. Two push button switches toggle the motor between Run and Stop states and forward and reverse direction. When switching directions, the motor is first allowed to coast from its present angular velocity to zero and then accelerated to the reference speed in the opposite direction. This controlled manner of changing directions prevents high-current transients that could cause a fault.

Fault Signals Monitoring

Three fault signals can be monitored: overcurrent, overvoltage and over temperature. The overcurrent and overvoltage faults use the hardware fault inputs to directly inhibit the PCPWM outputs on a cycle-by-cycle basis.

Over Current fault

A shunt resistor in the negative DC bus gives a voltage proportional to the current flowing through the three motor phases. This voltage is amplified and compared with a reference signal using an external comparator. If the DC bus current signal exceeds the reference level, the fault input pin is driven low, indicating an overcurrent fault. Fault is indicated by blinking LED.

Over Voltage fault

The DC bus voltage is attenuated using a voltage divider and compared with a fixed reference signal using an external comparator. The fault input pin is used to monitor the overvoltage condition. Fault is indicated by blinking LED.

Over Temperature fault

The IGBT power module can have a Negative Temperature Coefficient (NTC) thermal sensor that monitors the junction temperature of the IGBTs. This NTC can be connected to analog input through an analog optocoupler and is continuously measured the junction temperature of the IGBTs. If it exceeds reference value, overtemperature fault is indicated by blinking LED.

7.4 Pay back period for VSD

Cost of Electronic Items =Rs 7,500.00

Cost of Electrical Items =Rs 2,000.00

Cost of casing ,Heat sink ect. =Rs 1,500.00

No of labour hours for assembling and testing of VSD = 20 hr.

Therefore cost of labour = 20 X 200.00 + Rs. 4,000.00

Other over heads cost = Rs 3,000.00

Total cost of VSD =18,000.00

By considering 20% profit = 3,600.00

Value of VSD =21,600.00

Simple Pay back period

By considering VSD will be installed for blower motor of package air conditioner having cooling capacity 50 kW, it will save the minimum of 5% of total electrical consumption.

Approximate Electrical energy saving per hour = 15 kW/hr X 0.05 =0.75 kW/hr

Electrical energy saving per day, by considering 6 hours operation =. 0.75 X 6 = 4.5 kW/hr

Cost of saving per day = 4.5 X 11.90 = Rs. 53.55

[Unit cost of Electricity is Rs. 11.90 (1 kW/hr = Rs. 11.90)]

Simple pay back period = 21,600.00/53.55 = 404 days