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Research paper

An Overview of Microprocessor Control of Inverters

Dr. B. Rajender[1*], B. Sathyavani[2], K. Balakrishna[3], Dr. R. Arulmurugan[4]

[1.2.3.4] AssociateProfessor, Department of EEE, S R Engineering College, Warangal
**Corresponding author E-mail:boinirr@gmail.com*

Abstract

Microprocessor technique empowers us to apply diverse control strategies in the present control systems, including control of electric drives. In the drive controller, the flag processors with inbuilt simple digital converters, clocks, beat width modulators and different gadgets, which streamline drive control, are regularly used.The different control methodologies are utilized to control the drives yet the improvement in semiconductor technology helped the utilization of power gadgets in the drives. The demand for reduced, solid and mechanized drives existed and the advancement of drive has occurred the correct way in assortment of utilizations like power supply, pulling forces, vehicles, and so forth which has no limits for the improvement. PC made the control techniques simple yet past that the microprocessor based single stage drives are demanded in the remote regions. Demand of control of power existed for a long time which drove early advancement of drives. Power handling capacities and exchanging speed of power drives has been expanded with improvement in semiconductor technology.The ongoing advancements in electrical drive technology are spurred by the expanding necessities of mechanical applications for higher execution, better unwavering quality, and lower cost. They are because of the advances in a few zones specifically power electronics, control theory, and microprocessor technology.

Keywords: *Variable Speed Drive, Induction Motor Drive, Microprocessor, speed sensing.*

1. Introduction

Amid the most recent two decades, power electronics has increased noteworthy advances in a few segments. New power switches with better attributes have been presented (GTOs, MOSFETs, IGBTs), and new converter arrangements and additionally productive replacement plans (resonant converters) have been contemplated and tested. Various propelled control calculations for AC drives (self-controlled synchronous motor, field-oriented control, and so forth.) have been created. Today, power electronic systems have achieved an uncommon high level of intricacy with the goal that their control turns out to be increasingly modern.

The control of a power electronic framework requires a few elements of an alternate sort: flag separating, direction, drive flag age, estimation, observing, assurance, and so on. For quite a while, the execution of these capacities has depended for the most part on simple technology utilizing a hardwired approach. Control circuits were fabricated utilizing operational amplifiers (operation amps), nonlinear integrated circuits (ICs), and digital les. The last were utilized particularly to actualize consecutive and combinatory rationale works in converter control circuits. The advancement of microprocessors has advanced the utilization of digital technology in the control of power electronic systems utilizing a product approach that gives more prominent adaptability and better performance.

2. Literature Review

Paresh.C.Sen et.al have proposed a microprocessor based control of an induction motor with motion direction. In this they have built up the speed control arrangement of an induction motor drive utilizing a Motorola 6800 microprocessor and they have demonstrated that motor current-slip recurrence relationship for consistent motion control is nonlinear and is hard to execute utilizing hardwired rationale hardware, so such a nonlinear capacity can be helpfully actualized by utilizing a microprocessor control framework by putting away the nonlinear capacity as a look-into table in the PC memory. From the testmodel and test results, they have defended that microprocessor-control framework is adaptable and it permits an extensive variety of working speeds.

K.S.Rajashekara and Joseph Vithayathil have proposed a microprocessor based sinusoidal PWM inverter by DMA exchange. In this they have talked about the execution of three stage sinusoidal heartbeat width balanced inverter control system utilizing microprocessor. In this to spare CPU time, the DMA technique is utilized for exchanging the changing example from memory to the beat enhancer and disengagement circuits of individual thyristors in the inverter connect.

3. System Design Details and Control of Drive

Fig.1 demonstrates the point by point system outline to control the drive of the single-stage induction motor powered by the inverter. The power electronics incorporate an enhanced strategy for PWM control. There is a quick control in light of the microprocessor. Changes in the PWM controlled process limit the most elevated current loss of the transistor and motor with better sinusoidal waveforms. The system controller creates the suitable recurrence and plentifulness signal of the stream utilizing the microprocessor. Figure 2 demonstrates the single-stage transistor connect inverter.

The activating of the transistor grouping is 1-4 and 2-3, which supplies energy to the induction motor.

The control of an electronic power system requires a few elements of various sorts: signal sifting, direction, control signal generation, measurement, monitoring, insurance, and so on. The usage of these capacities has for some time been primarily in light of analog technology utilizing a wired approach. Control circuits have been built utilizing operational amplifiers (operational amplifiers), non-linear integrated circuits (ICs) and advanced records. The last have been utilized specifically to execute consecutive and combinational rationale works in the control circuits of the converter. The improvement of microprocessors has advanced the utilization of computerized technology in the control of electronic energy.

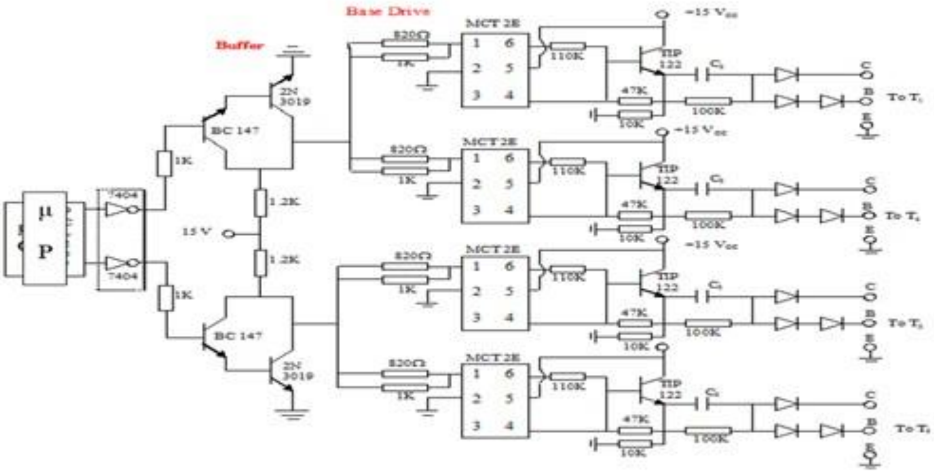

Fig. 1: Complete circuit diagram of Induction Motor Drive

PWM signals from the microprocessor are connected to the inverter, the cradle will expand the present limit required to drive the transistors, and the isolator will isolate the power circuit from the control circuit. The TIP 122 settings help to give the best possible stage and enhancement, yet these signals are utilized as base signals to trip the transistor on the scaffold. In light of the proposed control system, the microprocessor is utilized as a control component. The microprocessor gives high or low advanced control information at its port.The time of outstanding the information high is controlled by utilizing the low level computing construct programming. The settled interim of which the beat stays high at the port and furthermore stays low for settled interim of time. The time frame over which is kept high relies upon the defer time. This yield of the port is utilized to drive the base of power transistor and thus the proportional power is controlled by utilizing this technique. The proportional power gives open - loop control conspire has been defined for the speed control of the induction motor drive feed arrangement from the voltage source inverter. The speed of the induction motor relies upon the beat width given to the base of the power transistor.The bigger the beat width progressively the speed and the other way around. The closed loop technique is not utilized in this in light of the fact that the microprocessor if self-controls the beat width through programming and thus speed is controlled.

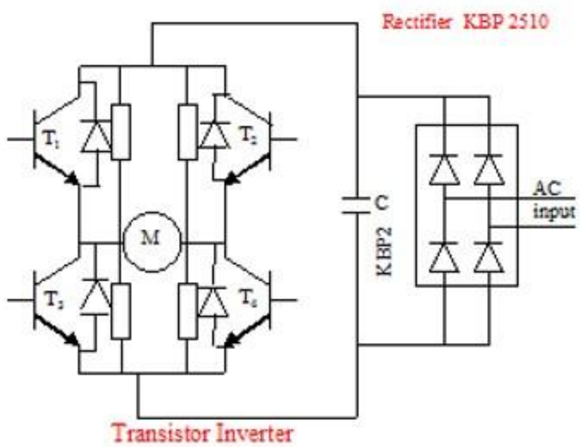

Fig.2: Transistor Inverter Bridge

A. Rectifier Module

A rectifier module is a combination of diode bridge and capacitor bank. The bridge is framed by combination of 4 power diodes (1N4006) which changes over AC signal to DC. A dc filter capacitor bank is associated over the input to the inverter and serves to filter the input voltage and provide a low impedance way for the high frequency currents created by the inverter during PWM switching.

B. Snubber design

The snubber circuit consists of simple technique using register, capacitor in parallel with power module and parasitic inductance is set in series with power module. The snubber circuit is effective during the turn-off of the transistor and snubber inductance is effective during turn-on.Snubbers are required in light of the fact that transistor have safe operating territory limitations during turn-off to avoid catastrophic second breakdown failure.With inductive load transistor exchanges the heap current to the opposite oncoming criticism diode in same period of inverter. At the point when the transistor current falls opposite diode can begin to direct load current. The snubber inductance in the inverter stage presently create an overshoot voltage which shows up over the transistor during the transistor fall time and gatherer voltage begins to rise. The snubber capacitor begins to charge. The charging current is from the transistor charging the capacitor to be maximum. In the meantime input diode begins to lead and current is exchanged from snubber to diode. The choice of snubber capacitance limits the pinnacle overshoot which reduces turn-off losses.

4. Signal Conditioning

A. Speed Sensing

The basic block diagram of speed sensing is appeared in Fig.3. The opto-interrupter device is utilized for speed measurement with the assistance of which two heartbeats were created within one revolution of motor. These heartbeats were feed to the frequency to voltage converter (F to V). The yield of the F to V converter is scaled in the middle of 0 - 5 V for speed scope of 0-1400 rpm, which is perused the A/D converter and scaled appropriately through programming to display revise speed. The reaction of speed sensor is nonlinear at initial stage (i.e. at low speed) and afterward it follows linearity.

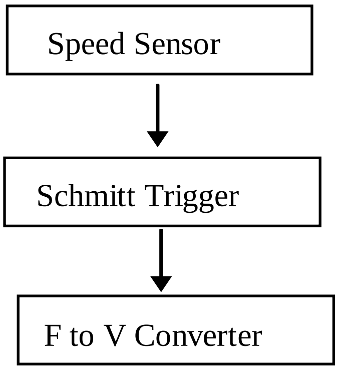

Fig. 3.L Block diagram of speed sensing

B. AC Voltage Sensing

The AC voltage measurement was carried out by using the peak detector circuit. The variation in the voltage of the peak detector according to the line voltage changes encouraged to one of the ADC channel and is additionally changed over to genuine voltage by scaling the yield voltage of peak detector through software

Current Sensing

For current measurement simple technique is utilized, which consists of advance up transformer whose primary is shortcircuited by the shunt wire and the current through the shunt is given to the motor. The voltage drop over the shunt wire is proportional to the present passing through it, which is the current of the motor and auxiliary voltage is proportional to the motor current. The yield voltage varies from 0 to 5 volt for variation of current from 0 to 5 ampere. There is linear relationship between input current and yield voltage. The scaling is just essential.

Steps in stream generation

1.Initilization of ports of 8255

2.Clear port

3.Keep port A pin low for given postponement

4.Store information in any register and decrement till it wind up zero.

5.Make port A pin high and keep it high for given deferral

6.Store information in any register and decrement till it moves toward becoming 1

7.Continue this procedure.

8.For changing speed, fluctuate beat width at port A.

Continue with the changed width and speed.

5. Plc 207 Dac-Adc Interfacing card

The PLC-207 AD/DA card is utilized for ADC or DAC reason [9, 10, 11, 12, 13, 14]]. The card I minimal effort high execution analog interface card appeared in fig. 4 which utilizes successive approximation strategy. This provides 25 thousands examples for every sec. acquisition rate It is a 12 bit card with precision of 0.015 %. This provides quick yield channel settling time 30 μS with high precision. It can acknowledge 8 inputs and 12 monolithic multiplying DA yield channel with 0-5V. The PCL207 provides powerful software driver which is anything but difficult to use for routine programes.

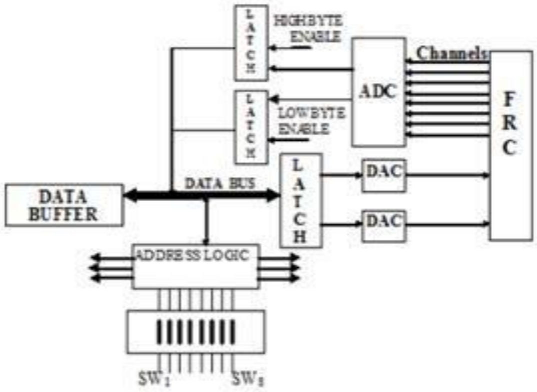

Fig.4:. Block Diagram of the PLC 207 Card

6. System Performance

The system performance is tried for steady load and it is discovered that the speed of the system remains consistent. With the assistance of the tachometer the speed of the system is estimated at consistent load. Keeping the steady load the beat width of the firing of the transistor is varied with the assistance of the software. It is discovered that if beat width is progressively the speed of the drive is additionally more and vice-versa. In any case, the system is open loop and any adjustment in the heap that may deviate from the desired speed. This system is quite suitable for the steady speed operations. The tachometer reading demonstrates that there is no deviation of speed limits of the drive in any event and in addition highest heartbeat width. The performance is studied with the assistance of simulated technique for the different heartbeats. The fig.5 demonstrates the chart of speed Torque characteristics for the different PWM plans. From the diagram it is seen that initial starting torque is higher and as the speed increases the torque diminishes which gives solid help for the designed drive. The similar characteristics behavior is seen with the simulation characteristics. After comparison it is discovered that the consequences of speed-torque characteristics of the designed drive using microprocessor gives the outcome relatively similar performance to that of simulation. The speed efficiency characteristics are appeared in the fig.6 for simulation drive and additionally for designed drive. From the characteristics it is discovered that experimental drive has less efficiency because of the losses in the machines otherwise designed drive and simulated drive efficiency remains relatively same.

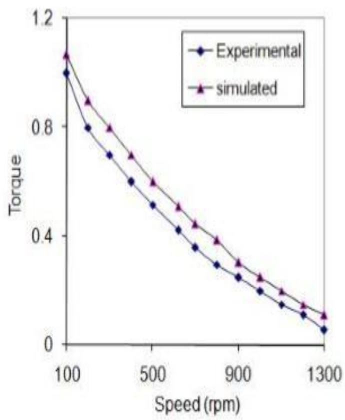

Fig 5: Speed-Torque character for the simulated and Experimental drive

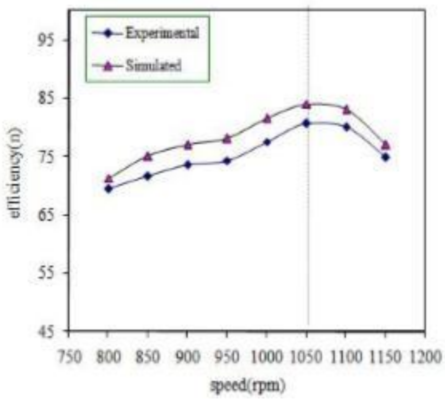

Fig.6: Speed - Efficiency characteristics for the simulated and experimental drive.

7. Conclusion

The utilization of a Variable Speed Drive for a speed control application more often than not offers an energy efficient and economical solution. PWM inverter drives, are available for applications where the speed control exactness is required. This minimized inverter had its equipment reduced to a minimumthrough the utilization of H-bridge inverter. The variable speed drive with variable frequency and voltage control technique will offer, amazing failure cost solutions for light commercial and consumer applications.

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