IJIRMET ISSN (Online): 2456-0448
International Journal Of Innovative Research In Management, Engineering And Technology
Vol. 3, Issue 2, February 2018

SPEED CONTROL OF INDUCTION MOTOR USING PWM METHOD

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Abstract: ***Normally in the speed control of ac motor we use either voltage controller are variable frequency method to control the speed of motor. By controlling the voltage, we cannot achieve starting torque. In variable frequency method, the voltage is constant so the core loss will be high. To avoid all this loss we need to control the voltage and frequency simultaneously. For this condition, we use pwm sinewave pulse generator integrated circuit. This is very simplest method comparing with other pulse generating method and this method doesn't need any software program (non-programmed) configuration.***

Keywords - ac motor control, pwm sinewave, non-programmed.

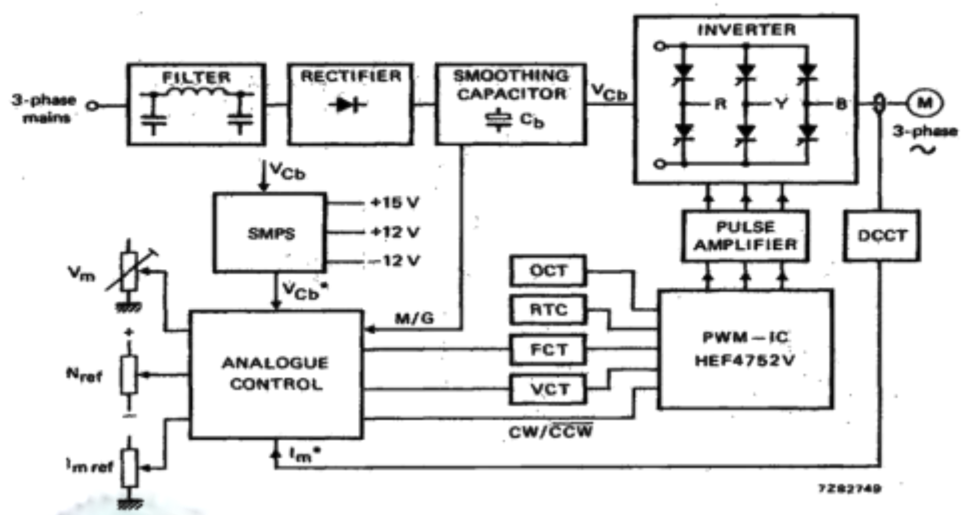
I. INTRODUCTION

In today's world we are aware of how to control the power loss in all electrical equipment . But even today we doesn't aware of some power loss in motor. In the lab we use auto transformer to control the supply voltage , by controlling the voltage from 180volt to 230v we can achieve the speed control but if we reduce more than this we can not achieve a starting torque. The reason for this is the torque proportional to square of the voltage , so at staring time the motor needs the high torque , to achieve this condition the supply voltage should be nearer to the rated voltage. So the voltage regulation method suits for resistive load not for inductive load. In this method the power loss is high. In variable frequency the core loss is high. Because the eddy current loss and hysteresis loss is directional proportional to frequency. In pole change method is widely use in last decay in all industry, in this method we use more complicated equipment to achieve the condition. Rotor resistance control will also the power loss is high. So the next step is pwm control method , in this also we can generate only squared wave and this too a ramp response wave . which means we can control step by step not at any value of frequency . To avoid all this drawback the (v/f) method is used, to achieve this condition we use pwm square wave generator which is equalent sinewave to . This is best method because the drawbacks are less in it. Although this method is widely used based on requirement, which is programmed to microcontroller. But if we use ac motor controller integrated circuit to develop the pulse and the pulse in this is square wave which rms value equal to sine wave, but we are using the intergrated circuit which is non programmable and the process is also easy we can develop 0 to 133 hetz. So the best method is found out and discuss below

Working ;

The ac motor controller integrated circuit hef4752v is used for 6 pulse pwm generator. Which will generate three phase signal , and this are RYB. Each has positive and negative cycle the phase angle between them is 180°. The phase to phase difference is 120°, for one half cycle three IGBT will work. From r to r- the phase angle

R	r	180 degree
Y	y	180 degree
B	b	180 degree
R	Y	120 degree
Y	B	120 degree
B	R	120 degree



II. PWM Waveforms Generation

The inverter output voltage. However, the relative complexity of control makes this modulati PWM is used to control the voltage and reduce the harmonic contents in the inverter output. In particular, sinusoidal PWM has been show to give minimum harmonic contents in th on strategy difficult to implement. Many types of sinusoidal Pulse width modulation system have been developed in the past; these were designed with analogue components as they are easy to design and can be implemented with relatively inexpensive components. Nevertheless, there are several drawbacks with analogue systems including aging, temperature drift and reliability. Regular adjustment is required in those cases. Furthermore, any upgrade is difficult, as the design is hardwired. Digital systems, on the other hand, offer improvement over analogue circuits. The mentioned drawbacks as drift and external influences are eliminated since most functions are performed digitally. In this article a voltage source inverter (V.S.I) is developed for use in pulse width modulation speed control systems for three phase a.c motor. This system uses the technique of sine-wave modulated pulse width modulation and employs a purpose- designed L.S.I circuit type HEF 4752V manufactured by Phillips which has been developed specially for signal generation in such systems, and overcomes all the previous disadvantages . The LSI integrated circuit HEF 4752V is used to control asynchronous motors inverters, basing on PWM principle. The circuit summarizes three signals out of phase by 120° , to which the average varies sinusoidal in time . The modulation of the output waveform is achieved by opening and closing the upper and lower switching element in each phase of the inverter. Closing the upper element gives a high output voltage, and closing the lower element gives low output voltage. The basic function of the PWM I.C is to provide open and close the switching elements in the appropriate sequence to produce a symmetrical three-phase output. The HEF 4752V uses a totally digital approach and it is provide three complementary pairs of output drive waveforms which, when applied to a three-phase bridge inverter, produce a symmetrical three-phase output. The output waveforms are pulse width modulated using double edged modulation such that the average voltage difference between any two of the output phases varies sinusoidally. The integrated circuit has four clock inputs FCT, VCT, RCT, and OCT which are used to control the output waveforms The four clock inputs have the following functions: • FCT (Frequency clock trigger): this determines the stator frequency (fout), thereby controlling the motor speed. The clock frequency of FCT is related to output frequency of inverter as [2]: (2) fFCT = 3360×fout The output frequency of the inverter can be controlled from 0 to 133 Hz by varying frequency of FCT. • VCT (Voltage clock trigger): this determines the stator frequency/voltage ratio. The level of the average inverter output voltage at given output frequency is controlled by the VCT clock input. The change in the output voltage is achieved by varying the modulation depth of the carrier. Increasing fVCT reduces the modulation depth and hence the output voltage, while decreasing fVCT has the opposite effect. The relation between fVCT and fOUT is given by: fVCT (nom) = 6720×fout(max) With VCT fixed at fVCT (nom), the output voltage will be linear function of the output frequency up to fout(max). • RCT (Reference clock trigger): this set the inverter maximum switching frequency. The reference clock input RCT is a fixed clock used to set the maximum inverter switching frequency fs(max) . The clock frequency fRCT is related to fs(max) as, (4) fRCT = 280×fs(max) The absolute minimum value of the inverter switching frequency fs(min) is set by the IC at 0.6× fs(max) • OCT (Output clock trigger): this sets the minimum pulse-width allowable. Ooperating in conjunction with the data input K, the output delay clock OCT is used to set the interlock delay period which is required at the change over between the complementary output at each phase. With K high the inter-lock delay period is given by 16 fOCT (ms), where fOCT is in kHz [9]. The digital signal CW controls the direction of motor rotation. When the input CW is high, the phase sequence is r, y, b and when low it becomes r, b, y. The IC HEF4752V has 12 inverter drive output, out of which 6 outputs have been used and these outputs are connected to the base of power transistors for implementing to the inverter bridge.

III. CONCUSION

Speed control of induction motor drives are being widely used in various industrial applications. PWM inverters are the most preferred for these applications since control of votage and frequency at balanced ratio and this also avoid harmonics are all achieved within the inverter itself. In this article a voltage PWM inverter using Volts per hertz control was realized. The experimental waveforms for a 1.5 KW induction motor drives are given and the circuit operation of this inverter in the PWM technique is clearly explained . It has been shown that the system presented offers the advantage of relatively good performances and simple control circuitry. References

Reference;

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