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Power Loss Reduction through Single Phase Induction motor

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***Abstract*—In industrial units like a punching press and drilling machinery, most of the induction motors often run at no load or partial load. The rated efficiency of an induction motor is high when it runs under the full load. Therefore, even a modest improvement in the energy efficiency of induction motor drives can imply huge energy-saving. Using the proposed scheme, the voltage at the stator terminals is reduced during no load or small duty ratio load conditions, and electrical energy is saved. The experimental results are almost similar to the simulation results.**

Index Terms— ***Single Phase Induction motor, Energy saving, Full Load, No load.***

I. INTRODUCTION

Shaded-pole motors use an unusual method to get their rotor spinning. This motor has pole pieces projecting from it which carry copper straps called shading coils. However, these straps only cover part of the pole. These straps cause the magnetic field to move back and forth across the pole piece's face. This movement of the magnetic field causes the rotor to move.

Split-phase induction motors are so named because they have two windings, one for starting and one for running. The starting winding is constructed so as to get higher reactance from the stator. As the current builds up in the starting winding it leads the current in the running winding, which creates a rotating field. These are also sometimes referred to as resistance-start motors. Capacitor-start induction motors are very similar to split-phase induction motors, so much so that they are sometimes categorized as a sub-type of split-phase motors. Capacitor-start single-phase induction motors work in much the same way as split-phase motors except that they add a capacitor. The capacitor works in concert with the starting winding, also called the auxiliary winding, to create a field that is about 90 degrees out of phase with the running winding. This causes the single-phase motor to behave like a two-phase motor, which provides greater accelerating torque per ampere starting off than split-phase motors. Capacitor-start Single-phase Induction motors are used mainly in home appliance. If the efficiency is improved in capacitor-start Single phase Induction motor the demand will slightly decrease.

Split-capacitor single-phase induction motors employ a very similar design to capacitor motors. Their starting winding also attaches to a capacitor. However, the capacitor in this type of single-phase induction motor is always energized, which allows these motors to provide more power to the motor and therefore a greater running capacity than other capacitor-type motors.

The Volt pet Hertz control methods is the most popular method of scalar control that controls the magnitude of the variable like frequency, voltage, or current. The command and feedback signals are DC quantities that are proportional to the respective variables. This scheme is defined as a Volts per Hertz control because the voltage applied command is calculated directly from the applied frequency to maintain the air-gap flux of the machine constant. In steady state operation, the machine air-gap flux is approximately related to the ratio Vs/fs, where Vs is the amplitude of motor phase voltage and fs is the synchronous electrical frequency applied to the motor. The characteristic is defined by the base point of the motor. Below the base point, the motor operates at optimum excitation because of the constant Vs/fs ratio. Above this point the motor operates under-excited because of the DC-bus voltage limit.

II. PROPOSED SYSTEM

The proposed system of single phase induction motor is represented as block diagram shown in fig.1.

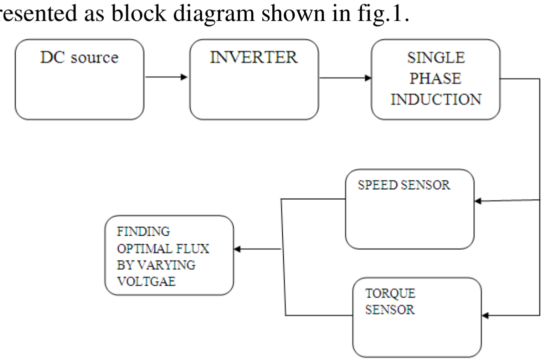

Fig.1. Block Diagram of Proposed System

Single phase induction motor run in different operating load condition. Voltage can be varied according to the load. To run the motor a minimum voltage is to apply. Using pulse width modulation signal voltage is varied between 30% to 100% of rated voltage. The minimum voltage 30% of rated

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voltage want to apply because below 30% of rated voltage winding will get damage. So it is nessceray to apply minimum voltage of the induction motor.

From dc source constant voltage is applied to the inverter. To trigger the gate, pwm pulse is generated using TL 494 Ic. The output of the inverter fed to the single phase induction motor.the speed of the induction motor is sense by the tachometer. If the speed is varied according to the load condition, the voltage is correspondingly varied. A constant dc voltage is applied and frequency set by Dtc. For the no load or partial load condition minimum voltage ie 35% of rated voltage is enough to drive the motor. And the efficiency of the motor is improved.

III. HARDWARE IMPLEMENTATION

The below mentioned items are used in experimentally.

1. Dc supply
2. TL494 Ic
3. Opto copuler
4. IR2110Ic
5. IRF450Ic
6. IN4148
7. Inverter
8. Induction motor.

From the dc supply 5v and 12v supply is taken and fed to the driver circuit and PWM pulse generation circuit. Opto coupler is used to separate the both driver circuit and gate pulse circuit. If any distortion takes any one circuits will not affect the rest circuit. The output of the driver circuit is fed to the mosfet and the PWM pulse is used trigger the gate of the mosfet. The output of inverter is square pulse. 12v dc supply is inverted to the ac supply.

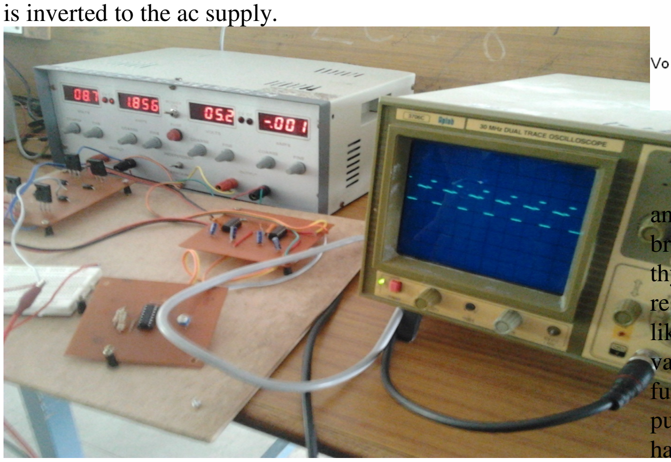

Fig.2. Snap shot of hardware implementation

From the CRO, it is clear that the output of the inverter is square pulse.

In pulse width modulation (PWM) frequency is kept constant as shown in Fig.3. T_{on} and T_{off} are varied such that total time is kept constant. In PWM, design of filter is keep constant. Off time is varied to vary the output voltage.

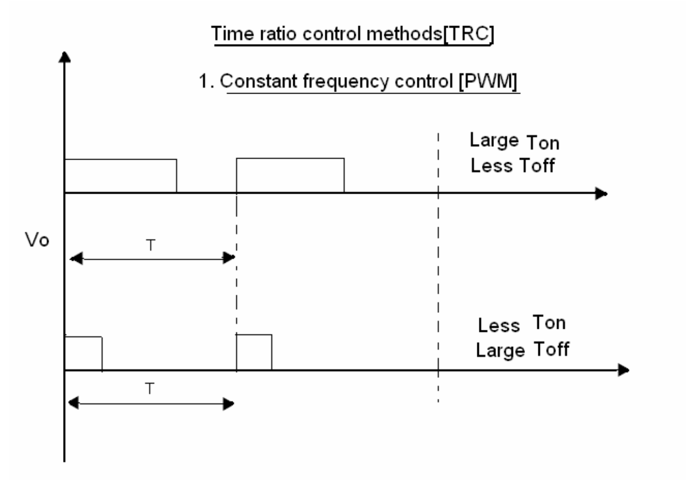

Fig.3.Constant frequency control

Two types of Frequency Modulation are constant Ton control and constant Toff control. In constant Toff control, the off period is kept constant. On time is varied to vary the output voltage. In constant Toff control, the OFF period is kept constant. ON time is varied to vary the output voltage.

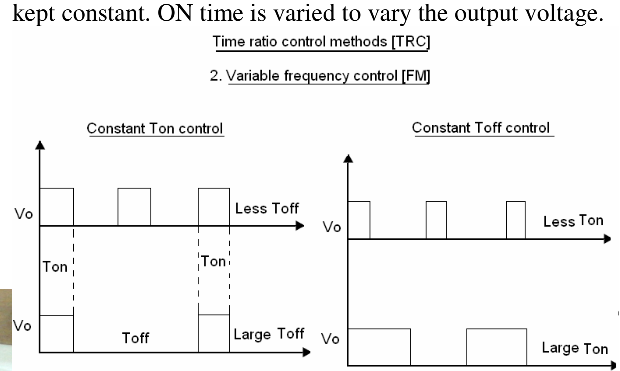

Fig.4.Time Ratio Control

The voltage control is obtained by advancing the firing angle of thyristors on one side of the bridge in the single phase bridge. The voltage control is obtained by switching the thyristor ON and OFF several times in a half cycle. This results in several equally spaced pulses in a half cycle. Just like in a dc chopper the voltage control can be obtained by varying the pulse width. Thus the magnitude of the fundamental voltage can be controlled in two ways: (a) The pulse width is varied having the same number of pulses in a half cycle, and (b) The number of pulses are varied retaining the width of the pulses. The number of pulses and the width of the pulses can be easily controlled. This is done by mixing a triangular wave of higher frequency with a square wave of desire frequency. The number of pulses in the half cycle depends on the ratio of frequency of triangular wave to that of square wave. The width of the pulse depends upon the ratio of amplitudes of triangular wave and square wave.

Output voltage variation in the inverter is required in applications like speed control, UPS etc. the voltage control may be achieved using three methods.

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- Voltage control at the input
- Voltage control at the output of the inverter
- Voltage control within the inverter.

The voltage at the input side can be controlled by using a phase-controlled converter. It operates at low power factor at the input side. The disadvantage of dc chopper is that they have high switching losses. The ac voltage at the output can be controlled by having a transformer with tap changing. The voltage control within the inverter is called pulse width modulation.

IV. CONCLUSION

In industrial units like a punching press and drilling machinery, most of the induction motors often run at no load or partial load. The rated efficiency of an induction motor is high when it runs under the full load. Therefore, even a modest improvement in the energy efficiency of induction motor drives can imply huge energy-saving. Using the proposed scheme, the voltage at the stator terminals is reduced during no load or small duty ratio load conditions, and electrical energy is saved. The experimental results are almost similar to the simulation results.

REFERENCES

1. Ahmed, N.A., Amei, K., & Sakuri, M. (2009). A new configuration of single-phase symmetrical PWM ac chopper voltage controller - IEEE Transactions on Industrial Electronics, vol.46, No.5, pp 942-952.
2. Ahmed, N.A., Amei, K., & Sakuri, M. (2011). AC Chopper voltage controller-fed single phase induction motor employing symmetrical PWM control technique – Electric Power Systems Research 55 (2000), Elsevier, pp-15-25.
3. Asaii, B., Gosden, D.F., & Sathiakumar, S. (2006). Neural Network Applications in Control of Electric Vehicle Induction Machine Drives - IEE Transactions on Power Electronics and Variable Speed Drives, Conference publication No.429, pp273-278.
4. Freeman, J.A., & Skapura, D.M. (2002). Neural Networks Algorithms, Applications, and Programming Techniques, Pearson's Education, Asia, Ed. 6.
5. Hongxiang, Y., Min, L., & Yancho, J. (2004). An advanced harmonic elimination PWM technique for AC choppers – 35th Annual IEEE Power Electronics specialist's conference, pp161-165.