SPEED CONTROL OF INDUCTION MOTOR USING TRIAC

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Abstract- The main objective of this project is to control the speed of Induction Motor at lower cost and efficient performance. Induction Machines, the most widely used motor in industry, have been traditionally used in open-loop control applications, for reasons of cost, size, reliability, ruggedness, simplicity, efficiency, less maintenance, ease of manufacture and its ability to operate in dirty or explosive conditions. Main work is to control the speed of induction motor, which is being done by triac voltage controller.

Keywords- Induction Motor, Speed Control, Triac

I. INTRODUCTION

For lightning and general purposes in homes, offices, shops, small factories single phase system is widely used as compared to three phase system as the single phase system is more economical and the power requirement in most of the houses, shops, offices are small, which can be easily met by single phase system. The single phase motors are simple in construction, cheap in cost, reliable and easy to repair and maintain. Due to all these advantages the single phase motor finds its application in vacuum cleaner, fans, washing machine, centrifugal pump, blowers, washing machine, small toys etc.

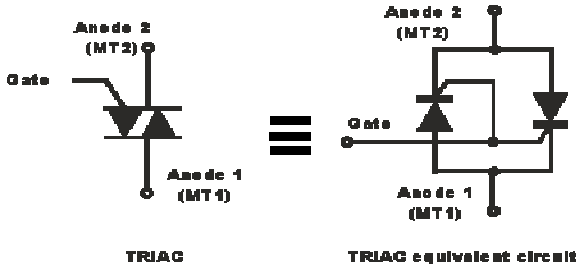

Fig. 1 General circuit for triac

The construction of single phase induction motor is almost similar to the squirrel cage three phase motor except that in case of asynchronous motor the stator have two windings instead of one as compare to the single stator winding in three phase induction motor. The stator of the single phase induction motor has laminated stamping to reduce eddy current losses on its periphery. The slots are provided on its stamping to carry stator or main winding. In order to reduce the hysteresis losses, stamping are made up of silicon steel. When the stator winding is given a single phase ac supply, the Magnetic field is produced and the motor rotates at a speed slightly less than the synchronous speed Ns. The construction of the stator of asynchronous motor is similar to that of three phase induction motor except there are two dissimilarity in the winding part of the single phase induction motor

Firstly the single phase induction motors are mostly provided with concentric coils. As the number of turns per coil can be easily adjusted with the help of concentric coils, the mmf distribution is almost sinusoidal. Except for shaded pole motor, the asynchronous motor has two stator windings namely the main winding and the auxiliary winding. These two windings are placed in space quadrature with respect to each other. The construction of the rotor of the single phase induction motor is similar to the squirrel cage three phase induction motor. The rotor is cylindrical in shape and has slots all over its periphery. The slots are not made parallel to each other but are bit skewed as the skewing prevents magnetic locking of stator and rotor teeth and makes the working of induction motor more smooth and quieter. The squirrel cage rotor consists of aluminium, brass or copper bars. These aluminium or copper bars are called rotor conductors and are placed in the slots on the periphery of the rotor. The rotor conductors are permanently shorted by the copper or aluminium rings called the end rings. In order to provide mechanical strength these rotor conductor are braced to the end ring and hence form a complete closed circuit resembling like a cage and hence got its name as “squirrel cage induction motor”. As the bars are permanently shorted by end rings, the rotor electrical resistance is very small and it is not possible to add external resistance as the bars are permanently shorted.

The absence of slip ring and brushes make the construction of single phase induction motor very simple and robust. Thus we have to control the speed of induction motor using triac voltage controller. We can obtain various type of speed by using microcontroller.

II. CIRCUIT DIAGRAM

This is the circuit diagram for AC phase controller using TRIAC.

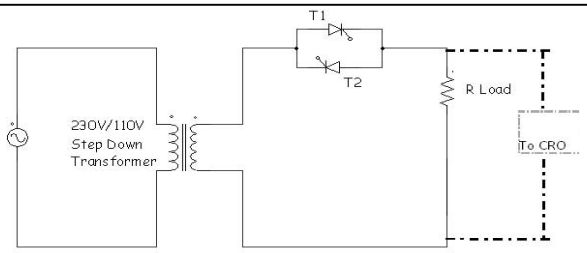

Fig. 2 Circuit Diagram

III. SIMULATION DIAGRAM

This is the simulation diagram for Induction motor.

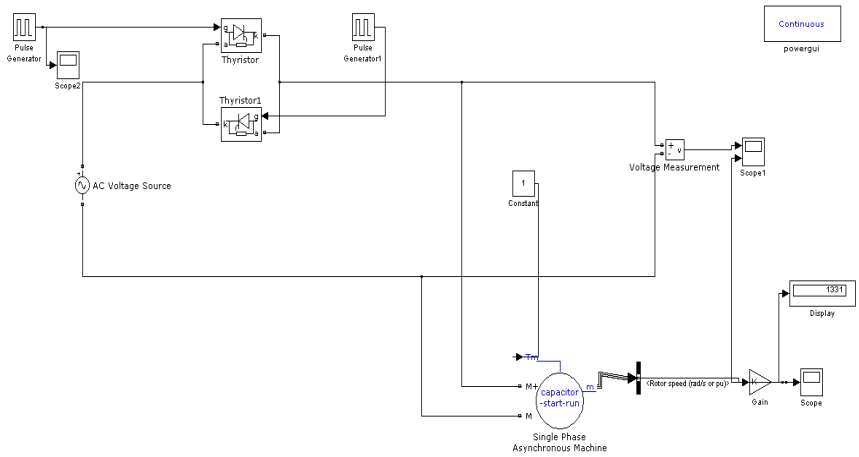

Fig. 3 Simulation Diagram in MATLAB software

IV. PARAMETERS USED

Frequency of sin wave =50Hz
Power = 0.25*746= 186.5 VA

Supply rms voltage =110 V

V. RESULTS

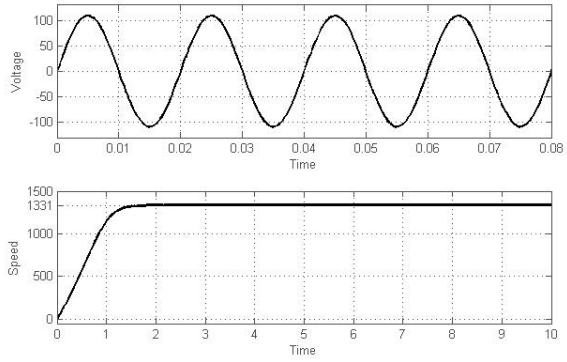

Fig. 4 Characteristics for Voltage and Speed when delay= 0°

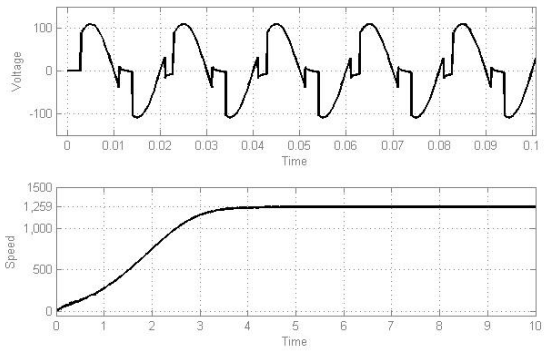

Fig.5 Characteristics for Voltage and Speed when delay= 45°

CONCLUSION

After Simulation it is clear that we can change or vary the speed of induction motor by varying gate firing angle. When 0° delay is given we will gate speed = 1331 rpm and When 45° delay is given we will gate speed = 1259 rpm that means we can vary the voltage as well as speed of induction motor using triac.

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