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ACPWM Control For Induction Motor

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ABSTRACT: This research aims to develop a new speed control method for a single-phase ac induction motor. It provides a low-cost, high-efficiency drive capable of supplying a PWM modulated sinusoidal voltage to a single-phase ac induction motor. An 8051-family microprocessor controls the circuit operation.
The device is intended to replace the commonly used triac phase angle control drives. The circuit may power a single- phase alternating current induction motor (or a broader alternating current inductive/resistive load) with variable alternating current voltage. The voltage provided to the load, like in triac control, can be changed from zero to maximum value. It, on the other hand, employs a pulse width modulation (PWM) approach, which, when contrasted to the phase angle control utilized for triacs, yields.

KEYWORDS: Low-cost, High- efficiency, Maximum output, Energy Saving.

I. INTRODUCTION

Induction motors are widely utilised in industrial, commercial, and household applications. It is employed in a varietyof applications due to the motor's low cost and great efficiency. Broad speed range and toughness. Because of their simple and sturdy construction without a mechanical commutator, AC machines are more useful than DC machines in most applications today. Residential washing machines, fans, and car window lifts, as well as traction control systems and other industrial drives, are all examples of motor control applications.

The use of induction motors fed by static frequency inverters is rapidly expanding in many industrial applications. As a result, the electric motor is the most significant component. A full manufacturing unit consists of three basic components: a working machine, a gearbox device, and an electric motor. An electric motor provides power. The transmitting device delivers power from the electric motor to the driven. The electric motor is characterised as a single alternating current (AC) motor. In this project, a microcontroller-based system is used to regulate the speed of an induction motor using the pulse width modulation technique. When an alternating current motor is linked to an alternating current line, its speed is fixed.

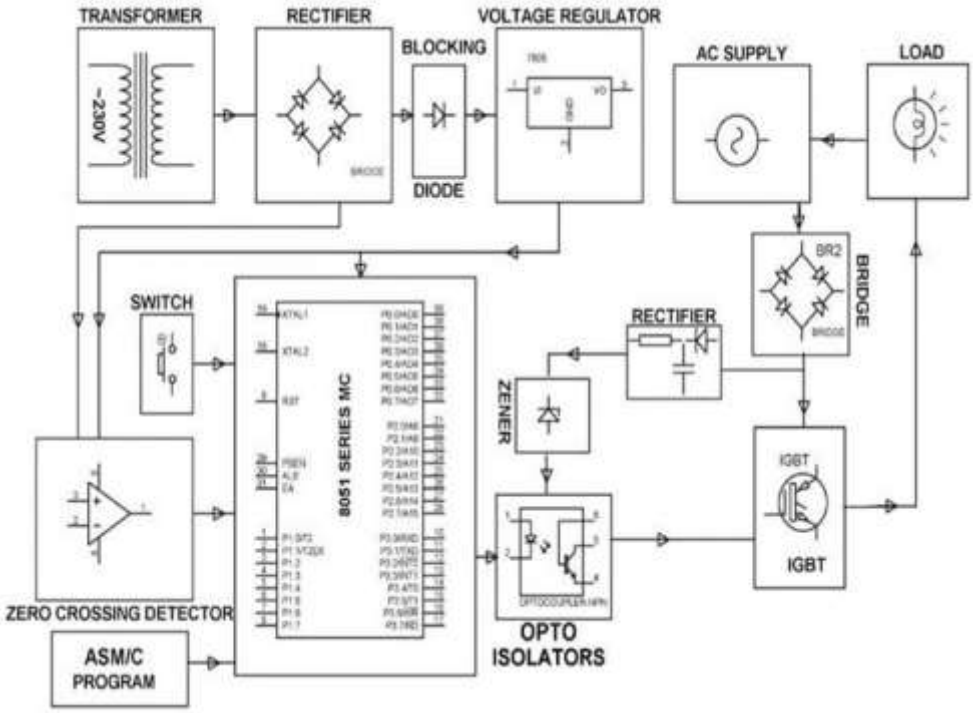
In many applications, the motor speed must now be changed. As a result, the pulse width modulation technology is more efficient and gives a greater level of performance. The frequency of the motor can be changed to modify its speed. An induction motor is analogous to a polyphase transformer with a shorted secondary. As a result, at typical supply voltage, as in transformers, the initial current Laken by the primary is quite substantial for a brief period of time. In contrast to DC motors, high starting current is caused by the absence of back emf. When an induction motor is turned on directly from the power source, it consumes 5 to 7 times its full bad current and produces only 1.5 to 2.5 times its full bad torque. This high beginning current causes a significant voltage drop in the line, which can interfere with the operation of other devices connected to the same line. As a result, starting induction motors with greater ratings (usually above 25kW) straight from the power source is not recommended.

An induction motor, also known as an asynchronous motor, is an alternating current (AC) electric motor in which the electric current required to produce torque in the rotor is obtained through electromagnetic induction from the magnetic field of the stator winding. The rotor of an induction motor might be wound or squirrel-cage. The revolving flux is referred to as the "Rotating Magnetic Field" (RMF). According to Faraday's law, the relative speed of the stator RMF and the rotor conductors creates an induced emf in the rotor conductors. Now, induced current in rotor will also produce alternating flux around it.

II. RELATED WORK

[1] "AC PWM SPEED CONTROL SYSTEM" by Khaled A. Madi Ali and Mohammad E. Salem Abozaed is found in the Proceedings of the International Multiconference of March 17–19, 2010, Engineers 2010 vol. Induction motors are utilised more frequently in a variety of industrial and commercial applications because they offer a number of advantages and are a dependable way to transfer electrical energy into mechanical motion. This study surveys the literature on induction motor uses.[2]Hamid A. Toliyat and Rahul Khokar, Texas A&M University's Electric Machines & Power Electronics Laboratory Department of Electrical Engineering 26 Feb. 2014.This essay examines the many converter techniques that have been put out for changeable speed single phase induction motor drives. The study presents a number of novel converter approaches. In this paper, various converters have been contrasted. The adjustable frequency PWM inverter is the ideal option for single-phase induction motor drives among various converter topologies.[3] P. Pawar, Neha Sarjerao Chavan, and Ashwini Balaku Shinde Technique for "Speed Control of Induction Motor Using PWM" Published on September 4, 2015 in the Harsha Engineering Research and Technology International Journal. This essay examines the benefits of induction motor speed regulation in the literature. Its low-cost design and great efficiency drive an ac induction motor using PWM regulated sinusoidal voltage. In comparison to expensive converters, it requires less active and passive components.

III. BLOCK DIAGRAM



In this study, a novel speed control method for single-phase AC induction motors is tested. It has low-cost, high- efficiency drives that can deliver PWM-modulated sinusoidal voltage to a single-phase induction motor. A microcontroller from the 8051 family controls the operation of the circuit. The gadget aims to replace frequently employed TRIAC phase angle control drives. The circuit can provide an induction motor (either an inductive or resistive load) with a single phase and variable AC voltage.

IV. WORKING OF ACPWM CONTROL SYSTEM FOR INDUCTION MOTOR

The voltages are adjusted from zero to maximum in an ACPWM control system for an induction motor. This system's voltage control structure is nearly same, and voltages are controlled by triac devices like fan regulators or dimmers.

However, in this case, the higher order of harmonic content will be reduced by using IGBTs and an OPTO isolator. Thewade bur bar or 220V ac is directly connected to this system. When it comes to 220V ac, a transformer steps down the voltage to 9 or 6 V, which is then converted to de through a bridge rectifier. Finally, these de voltages are regulated into5 V de with the aid of a voltage regulator. Due to the fact that this system uses basic electronics and Simple power electronics components, including microcontrollers and zero crossing detectors, are therefore powered by voltage regulator LM7805.

Similar to this, after converting into de and filtering, power electronics components like OPTO isolators and IGBTs are powered up directly through 220V ac. The collector,

emitter, and gate are the three terminals of an IGBT (insulatedgate bipolar transistor). This transistor enters conduction mode and current flows from collector to emitter when thegate is activated via PWM. PWM is produced by the pic microcontroller, which is programmed in the c programming language using the microbe software. The microprocessor, which controls the duty ratio of the PWM wave more effectively and intelligently, is the system's primary controller. The OPTO isolator, which provides the logic high or low signal to the IGBT gate, is directly connected to this microcontroller. Galvanic isotron is additionally provided by OPTO isolator. A bush button has been employed in this ACPWM control system for induction motors to change the duty ratio or cycle. When the switch is depressed, the microcontroller modifies the duty cycle of the triggering pulse, and then IGBTs adjust the output voltages. Here, a lamp has been connected for testing purposes; as output voltages change, its light also changes, allowing us to visually inspect if the output voltages have been rising or falling.

V. APPLICATIONS AND ADVANTAGES OF ACPWM CONTROL SYSTEM FOR INDUCTION MOTOR:

[1] By using this system, we can reduce the higher order of harmonic contents and can run the single-phase acmotor at different speeds.

[2] This system could be used for controlling the speed of washing machines, ventilators, compressor anddishwasher.

[3] This system is more compact, more reliable and less costly as compared to other speed controls systems.

VI. CONCLUSION

Induction motor speed may be effectively controlled using a microcontroller-based system and pulse width modulation. Users can adjust the induction motor's speed using the PWM approach in accordance with their need’s region.

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