Speed Control of Three Phase Induction Motor by Variable Frequency Drive

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Abstract

There are several terms used to describe devices that control speed. Variable frequency drive uses power electronics vary the frequency of input power to motor, thereby controlling motor speed. AC motor drives are widely used to control the speed of pumps, blower speeds, machine tool speeds, conyeyor systems speeds and others applications that require variable speed with variable torque. A modern industrial power system may include variable frequency drive (VFD) loads at several locations. The complete system consists of an ac voltage input that is put through a diode bridge rectifier to produce a dc output which across a shunt capacitor, this will, in turn, feed the PWM inverter. The PWM inverter is controlled to produce a desired sinusoidal voltage at a particular frequency, which is filtered by the use of an inductor in series and capacitor in parallel and then through squirrel cage induction motor.

Keywords-
Pulse width modulated inverter; diode rectifier; IGBT; Capacitor; three phase induction motor

INTRODUCTION

Variable frequency drive (VFD) usage has increased dramatically in HVAC applications. The VFDs are now commonly applied to air handlers, pumps and tower fans. A better understanding of VFDs will lead to improved application and selection of both equipment and HVAC systems. This paper is intended to provide basic a understanding of common VFD terms, VFD operation and VFD benefits. In addition to this paper will discuss some basic application guidelines regarding harmonic distortion with respect to industry standards. A modern adjustable speed AC machine system is equipped with an adjustable frequency drive that is a power electronic device for speed control of an electric machine. It controls the speed of the electric machine by converting the fixed voltage and frequency of the grid to adjustable values on the machine side. There are many types of inverters, and they are classified according to number of phases, use of power semiconductor devices, commutation principles, and output Waveforms. The new standard has been greatly expanded and is now "recommended practices and requirements" rather than just guidelines.

Considerable input was received from the electric utilities and, as a result, stringent limits have been placed on individual as well as total current harmonic distortion. Considerable importance is given to the customer utility interface. The limits on voltage distortion and line notching remain unchanged.

The most common solution employed for adjustable-speed drives (ASDs) is the voltage-source-inverter (VSI)-fed induction motor. The inverter generates a pulse width modulation (PWM) output voltage,

presenting many advantages: high efficiency (up to 98%), low sensitivity to line transients, open-circuit protection, constant high input power factor, multimode application capability, small relative size, common bus regeneration, wide speed range, and excellent speed regulation. In order to decrease the switching losses, fast switching devices like insulated gate bipolar transistors (IGBTs) are used. As a consequence, IGBT-based drives have smaller heat sinks, which make the whole drive enclosure smaller, thus reducing overall cost.

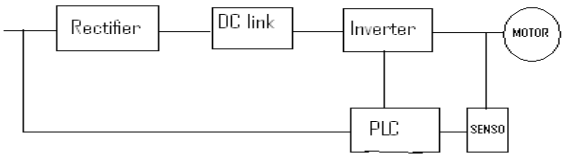
The combination of simpler, faster control circuits and higher carrier frequencies allows higher performance drives with high starting torque and especially good performance at low speeds.

The developed hardware is tested on a three phase ,415V , 50Hz induction motor. according to the requirement a program is written and is fed to the Programmable logic controller(PLC) for necessary action.

The inverter output current is regulated by a sine wave reference, generated by pwm technique, and the IGBTs are triggered at constant delay angle. The waveforms are analyzed and studies on digital display operator.

II. BLOCK DIAGRAM AND ITS EXPLAINATION

Fig 1. Block diagram of proposed system.



The block diagram of the proposed speed control of three phase induction motor by variable frequency drive is shown in fig. 1, the block diagram has the following blocks

(1) Three phase full bridge rectifier.

(2) Three phase full bridge MOSFET based inverter.

(3) Control circuit.

(4) Speed sensing unit.

(5) DC regulated power sup

III. CONCLUSION

The device used in this having very low switching losses, and having very fast ouperating speed. These devicess are smaller in size their by reducess the overall cost. Higher operating speed gives higher performance that is high starting torque and good performance at lower speeds.By this drive we can save the power up to the maximum limit by controlling the speed of the motor by VFD.

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