
بسم الله الرحمن الرحيم

Design and Implementation of Triangular Carrier Based PWM Strategy for Six Switch 3-Phase Invertors

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Dedication

To Our Parents,

Thank you for your continue encouragement and support.

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In the name of ALLAH, who is the most merciful, the most compassionate; the one and only supreme power, the one whose will makes everything possible, and the one without whose will the simplest is impossible.

All thanks to our beloved Family members for their prayers, guidance, support and care. They dreamed for our future and advised us to work hard to fulfill their dreams. Without their financial support it would not have been possible for us to become supreme professionals. Actually we can't express those thanks through just a bunch of words.

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Abstract

Over the past two decades technological advancement in power electronics and an increasing demand for high performance industrial machinery has contributed to rapid developments in motor control. There are different PWM techniques to control motor speed by changing voltage and frequency. From all these techniques Triangular Technique is best choice. Triangular Technique modulation is usually based upon conventional Six Switches Three Phase Inverter. We have introduced new idea by implementing three phase inverter based upon Six Switches inverter.

For simulation we used MATLAB and generated signals are sent to the gate drive circuit with the help of Controller and parameters of IM are measured with the help of LAB View.

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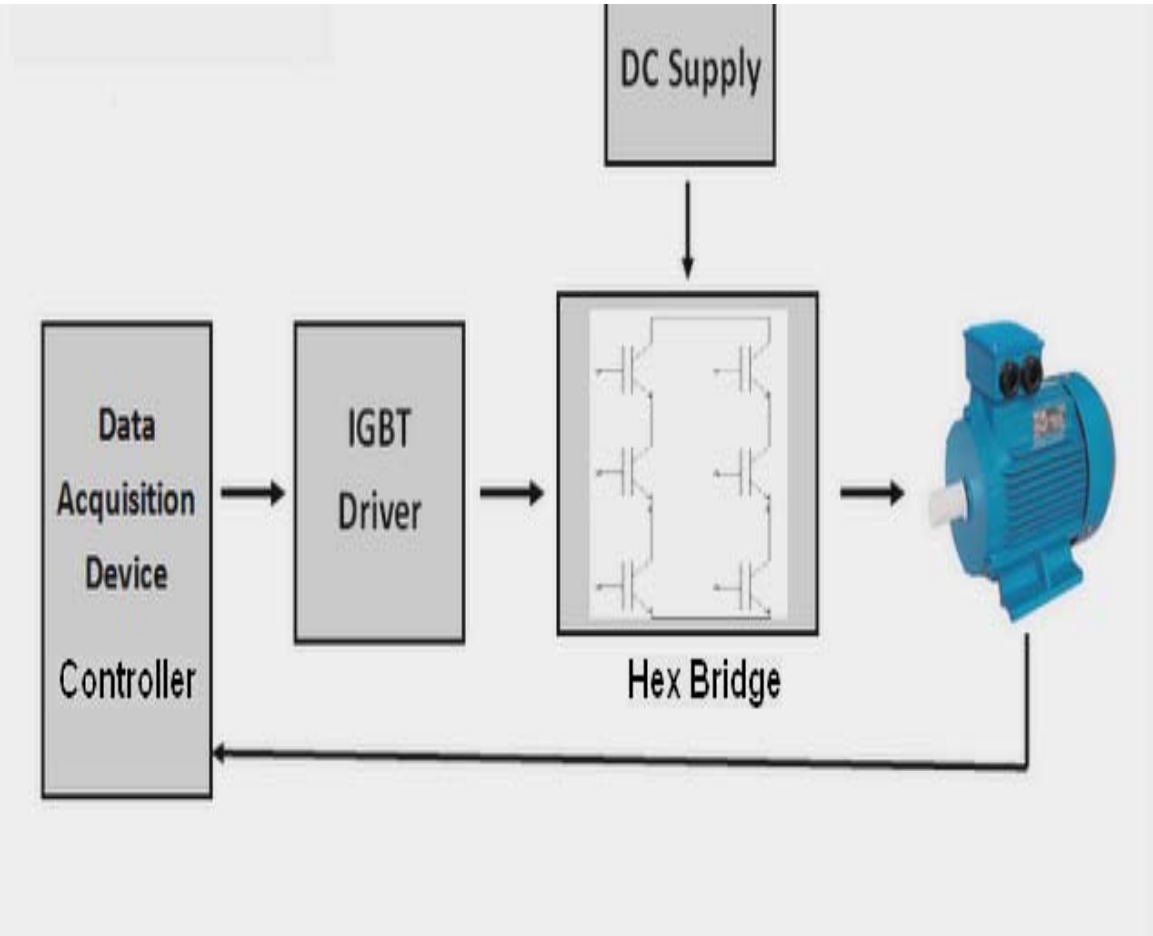

Figure 1.1 CICUIT DIAGAM

1.1 Overview

Major improvements in modern industrial processes over the past 50 years can be largely attributed to advances in variable speed motor drives. Prior to the 1950's most factories used DC motors because three phase induction motors could only be operated at one frequency. Now thanks to advances in power electronic devices and the advent of DSP technology for providing fast, reliable and cost effective control of induction motors now at common place.

Previously DC motors were commonly used where variable speed applications were required. Control of DC motor was based on armature and field current control methods. DC motors are quite expensive. Also they contain commutators and brushes they require periodic maintenance and can not be used in high speed and high voltage applications or harsh conditions. Thus induction motors are desirable.

In the last two decades, with the evolution of power semiconductor devices and power electronic converters, the IM is also well established in the controlled-speed arena. High performance Digital Signal Processor (DSP)'s introduction makes complicated control algorithms, such as flux vector control, available, which means that Alternating Current (AC) motors can be applied to accurate motor speed control as DC motor. Meanwhile, an AC induction motor, compared with a DC motor, is relatively inexpensive, since the windings consist of metal bars which are cast into steel laminations that make up the remainder of the rotor and the stator windings can easily be inserted in slots in stator laminations. An induction motor, at least the cage variety, has no brushes, no moving parts other than the rotor, and virtually no maintenance. As a result, AC motors are progressively replacing DC machines in variable-speed applications.

Three phase voltage-fed PWM inverters are recently showing growing popularity for multi-megawatt industrial drive applications. The main reasons for this popularity are easy sharing of large voltage between the series devices and the improvement of the harmonic quality at the output as compared to a two level inverter. In the lower end of power, GTO devices are being replaced by IGBTs because of their rapid evolution in voltage and current ratings and higher switching frequency. Pulse Width Modulation variable speed drives are increasingly applied in many new industrial applications that require superior performance. Variable voltage and frequency supply to AC drives is invariably obtained from a three-phase voltage source inverter. A number of Pulse width modulation (PWM) schemes are used to obtain variable voltage and frequency supply. The most widely used PWM schemes for three-phase voltage source inverters are carrier-based sinusoidal PWM and space vector PWM (SVPWM). There is an increasing trend of using Triangular PWM because of their easier digital realization and better dc bus utilization. The Triangular Pulse Width Modulation of a three level inverter provides the additional advantage of superior harmonic quality and larger under-modulation range that extends the modulation factor to 90.7% from the traditional value of 78.5% in Sinusoidal Pulse Width Modulation.

1.2 PHASE CONVERTER:

A phase converter is a device that converts electric power provided as single phase to multiple phase or vice-versa. The majority of phase converters are used to produce three phase electric power from a single-phase source, thus allowing the operation of three-phase equipment at a site that only has single-phase electrical service. Phase converters are used where three-phase service is not available from the utility, or is too costly to install due to a remote location. A utility will generally charge a higher fee for a three-phase service because of the extra equipment for transformers and metering and the extra transmission wire.

1.3 THREE PHASE CONVERTER:

Three-phase electric power is a common method of alternating-current electric power generation, transmission, and distribution. It is a type of polyphase system and is the most common method used by grids worldwide to transfer power. It is also used to power large motors and other heavy loads. A three-phase system is generally more economical than others because it uses less conductor material to transmit electric power than equivalent single-phase or two-phase systems at the same voltage. The three-phase system was introduced and patented by Nikola Tesla in 1887 and 1888.

In a three-phase system, three circuit conductors carry three alternating currents (of the same frequency) which reach their instantaneous peak values at different times. Taking one conductor as the reference, the other two currents are delayed in time by one-third and two-thirds of one cycle of the electric current. This delay between phases has the effect of giving constant power transfer over each cycle of the current and also makes it possible to produce a rotating magnetic field in an electric motor.

Three-phase systems may have a neutral wire. A neutral wire allows the three-phase system to use a higher voltage while still supporting lower-voltage single-phase appliances. In high-voltage distribution situations, it is common not to have a neutral wire as the loads can simply be connected between phases (phase-phase connection).

Three-phase has properties that make it very desirable in electric power systems:

- The phase currents tend to cancel out one another, summing to zero in the case of a linear balanced load. This makes it possible to eliminate or reduce the size of the neutral conductor; all the phase conductors carry the same current and so can be the same size, for a balanced load.
- Power transfer into a linear balanced load is constant, which helps to reduce generator and motor vibrations.
- Three-phase systems can produce a magnetic field that rotates in a specified direction, which simplifies the design of electric motors.

Three is the lowest phase order to exhibit all of these properties.

Most household loads are single-phase. In North America and a few other places, three-phase power generally does not enter homes. Even in areas where it does, it is typically split out at the main distribution board and the individual loads are fed from a single phase. Sometimes it is used to power electric stoves and electric clothes dryers.

1.4 SINGLE TO THREE PHASE:

Many quality used industrial machines are available at attractive prices that have 3 phase electric motors. Most residential homes do not have access to 3 phase electric power at a reasonable price. If the home shop builder decides to use these machines they must either replace the 3 phase motors with single phase motors or find a way to use the single phase power at their house to run them. This article explains how to build a rotary phase converter that will convert your single phase 220 VAC electric power to 3 phase 220 VAC to power your industrial machines.