

# Three-phase Inverter Using Microcontroller for Speed Control Application on Induction motor

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**Abstract** - This paper presents a PWM-controlled three-phase inverter designed for controlling the speed of a three phase induction motor. Inverter has very important role as a power conditioning on the electric power system and industrial field. The speed of the induction motor can be controlled by changing the voltage frequency input of the induction motor. The three phase inverter is implemented by using a Power MOSFET and the PWM signal is generated by a Microcontroller. The inverter performance is measured by simulation and experimental test. Inverter circuit is simulated using PSpice software to investigate the inverter behavior and performance. The testing is conducted using two induction motors with different rpm specification. The testing result shows that the Microcontroller can control well the motor speed in no-load mode with various speed references.

## 1. INTRODUCTION

Induction motor is the most widely electrical machine used in industry, due to its simple construction, sturdy, cheap, and easy maintenance. The induction motor have shifted the use of DC motor in the industry. However, induction motor has several parameters that are non-linear, especially the rotor resistance which varies for different operating conditions. It causes speed control on induction motor is more difficult in comparison with speed control on DC machine.

Common application of induction machine is for constant speed rotation by direct connection to the grid, rotor speed is determined by the grid system frequency. For variable speed application of induction motor, power conditioning device is required [1].

Speed control of an induction machine can be made by any change of pole number or input voltage frequency of induction motor. However, changing of its pole number is unfractical. Changing of input voltage frequency is realized by using a power conditioning or inverter. The use of inverter is a simple and easy way for controlling speed of induction motor and it has been broadly used on industry application [2],[3].

Inverter converts DC voltage into AC voltage where magnitude and frequency voltage can be varied as required. AC voltage generated is a square waveform or trapezoid. The application of filter device is required to produce pure sinusoidal waveform.

Voltage output regulation of inverter can be done in two ways. First, by adjusting the DC input voltage but the switching frequency is constant. Second, by adjusting the switching frequency while the DC input voltage is constant. In the second method, the effective AC voltage generated is a function of the pulse width of the switching. Now is called Pulse Width Modulation (PWM). [2]

## II. THREE-PHASE INVERTER CIRCUIT

The basic circuit of three-phase inverter is presented in Figure 1. It has two capacitors to generate  $N$  points for each capacitor voltage  $V_i / 2$  remains constant. There are three sides of the switch, namely: switch S1 and S1 + S2 + and S2- as well. Both sides of the switch, the switch S1 and S4, S3 and S4, and S5 and S2. Each switch, S1 and S4, or S3 and S4, or S5 and S2, can not operate simultaneously, because there will be short circuit. ON and OFF from both sides of the switch is determined by the PWM modulation technique [4],[5].

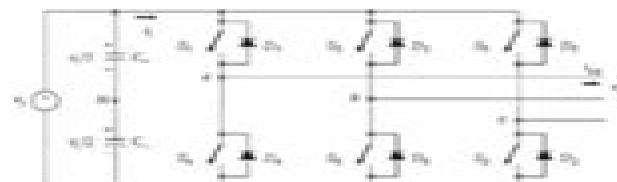


Figure 1. Three phase Inverter Circuit

To produce the output voltage ( $V_o$ ) in three phases, eight switching conditions configuration as shown in Table 1 should be applied.

# Three Phase Inverter Using Microcontroller

**Yong Guang Li,Yong Li,Wei Guo Pan**

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**Based Delta Modulated PWM for Three Phase Inverter** Ayu Annur Fetrah Yusoff,2012 One of the PWM schemes proposed for the control of inverters supplying ac drive is Delta Modulation Presently microcomputer has been used as an alternative to the standard Delta Modulation PWM technique Even though the microcomputer is considered as power computing machine their weakness is that to communicate with peripheral equipments they must use specialized circuit added as an external chips By utilizing the features of microcontroller they can just fit inside other device like the inverter or other appliance and also they does not need any other specialize external component for its application The microcontroller

based delta modulated PWM for 3 phase inverter has been proposed in this project in order to get better solution for the control of inverter The simulation of Delta Modulation techniques is carried out using PROTEUS ISIS 7 0 in order to get six modes of delta modulated PWM switching scheme Then the microcontroller PIC18F4550 circuitry to generate Delta PWM is assembled The circuit from the simulation can produce the necessary Delta PWM signal to control the inverter *IETE Technical Review* ,2000 Standard Handbook for Electrical Engineers Donald Fink,H. Wayne Beaty,2006-09-15 The Standard Handbook for Electrical Engineers has served the EE field for nearly a century Originally published in 1907 through 14 previous editions it has been a required resource for students and professionals This new 15th edition features new material focusing on power generation and power systems operation two longstanding strengths of the handbook that have recently become front burner technology issues At the same time the entire format of the handbook will be streamlined removing archaic sections and providing a quick easy look up experience **Wescon/95** ,1995 Computational Aspects of Electromechanical Energy Converters and Drives International Association for Mathematics and Computers in Simulation. International Conference,Réal-Paul Bouchard,Guy Olivier,Ecole polytechnique (Montréal, Québec). Département de génie électrique et de génie informatique,1993

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