A THREE PHASE PWM CONTROLLER WITH DC POWER LINK

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This report is submitted in partial fulfillment of the requirement for the award of Bachelor of Electronic Engineering (Industrial Electronics) with honours

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Sesi Pengajian : 2007/2008

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Specially.....

To my beloved parents

And to all my friends

For their

Love, Encouragements, and Best Wishes

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ABSTRACT

This project main purpose is to build a three-phase PWM controller with DC power link. This project use to design a controller and the DC power link supply that connect with controller that produce PWM "Pulse Width Modulator" signal in order drive three-phase or single-phase induction motor. Thus, the power supply will also drive the induction motor come from DC power link, as general PWM is a modulating technique that generates variable-width pulses to represent the amplitude of an analog input signal. The problem that normally found was the PWM itself, wrong prediction of PWM signal will make the situation difficult. Thus, any of the requirement fall outside the standardize approaches, then it will becomes custom design and the circuit will become more complex. Hence, the objective of this project is to design a three-phase PWM controller with DC power link. The PWM will produce signal that will drive the single or three phase induction motor and power supply is use to drive the induction motor that come from DC power link. As these project methodology, first of all study is the important part where it required to study the PWM background, the circuit and the component that are related that will going to used in order to produce a PWM signal. Thus, as for this project the Pspice is the important software to use in order to run simulation of PWM circuit. Then from the simulation the component that are suitable use can be determine. At the end of this project, the PWM controller will operate either in single or three-phase motor.

ABSTRAK

Tujuan utama projek ini adalah membina satu tiga fasa PWM pengawal dengan DC pendawai hubungan. Projek ini direka bentuk untuk membina alat kawalan dan DC mendawai hubungan yang dihubungkan dengan alat kawalan yang menghasil PWM "Lebar Denyut Pemodulat" signal tersebut akan mengawal tiga atau satu fasa motor aruhan. Oleh itu, bekalan kuasa juga mengarah motor aruhan didatangkan DC mendawai hubungan, PWM yang sebagai umum adalah satu berpinda nada teknik yang menghasilkan pemboleh ubah lebar nadi untuk mewakili amplitud satu analog isyarat input. Masalah yang biasanya didapati ialah PWM sendiri, ramalan salah PWM memberi isyarat akan membuat keadaan sukar. Oleh itu, mana-mana keperluan jatuh di luar darjat pendekatan, kehendak ia kemudian menjadi corak amalan dan kehendak litar menjadi lebih kompleks. Oleh itu, objektif projek ini adalah mereka bentuk satu tiga-berfasa pengawal PWM dengan DC mendawai hubungan.PWM akan menghasilkan signal yang akan memandu satu atau tiga fasa motor aruhan dan bekalan kuasa ialah menggunakan untuk memandu motor aruhan itu datang dari DC mendawai hubungan. Sebagai kaedah projek ini, pertama kajian keseluruhan adalah penting di mana ia dikehendaki untuk mengkaji latar belakang PWM, litar dan komponen yang berkaitan akan digunakan untuk menghasilkan isyarat PWM. Oleh itu, bagi projek ini Pspice adalah perisian yang penting digunakan untuk menganalisis simulasi litar PWM.Kemudian daripada simulasi komponen yang bersesuaian untuk digunakan dapat ditentukan. Pada akhir projek ini, pengawal PWM akan beroperasi sama ada dalam tunggal atau tiga fasa enjin.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDICES

CHAPTER I

INTRODUCTION

1.1 Introduction of Project

Nowadays, people are talking about how to reduce electrical usage for daily usage. This because, electrical is one of our part life where people need the electricity to generate the electronic or electrical equipment such as Television, radio, computer, and etc. Furthermore, in big industry they will use the electricity for twenty four hours every day, month and year. As the result the electrical bill will be outrageous. As for normal people they are really concern about paying the electrical bill where they will think how to reduce the electrical bill when running electronic equipment. As for example, one of our important lives is the cell phone. Can we imagine how this small electronic device capable to power up more than 24 hours and more. The solution there is PWM mechanism inside the circuit to maintain and control the DC battery voltage. Thus, that is the reason why the cell phone can last longer.

Another approach is the computer itself, previously when the first computer was establish there was no PWM circuit inside the computer to control the voltage usage and it used transistor, mosfet and etc to control the voltage. However, with the latest technology available now days, even computer are implement to use the PWM in order to operate the computer. These PWM is implementing inside the motherboard where it use to control the voltage activity through the processor. Therefore, the voltage usage for the processor, ram and etc was reduce.

PWM (Pulse Width Modulation) is a modulation technique that generates variable-width pulse to represent the amplitude of an analog input signal. Hence, the PWM technology was already available since 1970s and they have become more accepted and broadly apply. Thus, the PWM offer many advantages compare over linear regulation.

PWM is widely used in the common "Switch mode" power supplies that convert AC power to DC for computer, controlling the speed of a DC motor and the brightness of a bulb. This because the switching power supplies are more efficient and smaller in size than linear regulators of similar rating.

PWM can be used to reduce the total amount of power delivered to a load without losses that are normally incurred when a power source is limited by resistive means. This because the average power delivered is proportion to the modulation duty cycle. With a sufficiently high modulation rate, passive electronic filters can be used to smooth the pulse train and recover an average analog waveform.

High frequency PWM power control system can easily realizable with semiconductor switches. The discrete on/off stated of the modulation are use to control the state of the switch which correspondingly control the voltage or current across through the load. The major advantage of this system is the switches are either off and not conducting any current, or on and have ideally no voltage drop across them. The product of the current and the voltage at any given time defines the power dissipated by the switch, thus (ideally) no power is dissipated by the switch. Realistically, semiconductor switches such as MOSFETs or BJTs are non-ideal switches, but high efficiency controllers can still be built.

PWM is also often used to control the supply of electrical power to another device such as in speed control of electric motors, volume control of Class D audio amplifiers or brightness control of light sources and many other power electronics applications. For example, light dimmers for home use employ a specific type of PWM control. Home use light dimmers typically include electronic circuitry which suppresses current flow during defined portions of each cycle of the AC line voltage. Adjusting the brightness of light emitted by a light source is then merely a matter of setting at what voltage (or phase) in the AC cycle the dimmer begins to provide electrical current to the light source (e.g. by using an electronic switch such as a triac). In this case the PWM duty cycle is defined by the frequency of the AC line voltage (50 Hz or 60 Hz depending on the country). These rather simple types of dimmers can be effectively used with inert (or relatively slow reacting) light sources such as incandescent lamps, for example, for which the additional modulation in supplied electrical energy which is caused by the dimmer causes only negligible additional fluctuations in the emitted light. Some other types of light sources such as light-emitting diodes (LEDs), however, turn on and off extremely rapidly and would perceivably flicker if supplied with low frequency drive voltages. Perceivable flicker effects from such rapid response light sources can be reduced by increasing the PWM frequency. If the light fluctuations are sufficiently rapid, the human visual system can no longer resolve them and the eye perceives the time average intensity without flicker (see flicker fusion threshold).

PWM is also used in efficient voltage regulators. By switching voltage to the load with the appropriate duty cycle, the output will approximate a voltage at the desired level. The switching noise is usually filtered with an inductor and a capacitor. One method measures the output voltage. When it is lower than the desired voltage, it turns on the switch. When the output voltage is above the desired voltage, it turns off the switch. Variable-speed fan controllers for computers use PWM.

However, as this project will concentrate on generating single or three phases PWM.

1.2 Objectives Project

The objectives of this project are:

i) To design dummy function generator that act same as function generator to generate sine and triangular wave and implement it to PWM circuit to obtain the PWM.
ii) To design the circuit that can generate PWM with different phase.
iii) Study the PWM characteristic and what it need in order to get the PWM
iv) Study and implement the successful generated PWM with related device

1.3 Problem statement

Nowadays, many new technologies that develop in electronics device were use PWM in the system to make it efficient in terms of energy saving. Where, PWM can be used to reduce the total amount of power delivered to a load without losses that normally occurred when power source is limited by resistive means. This because the average power delivers is proportional to the modulation duty cycle. In my situation, if the input was wrong it will made the situation worse where the PWM cannot be obtain and the result will not show any of the pulse instead it will show unwanted wave. Furthermore, to generate PWM it required pure sine wave so it can only obtain the pulse. However, this is the challenge were I able to study and made an analysis of how to get the PWM.

1.4 Scope of work

The project scopes are as following:

1. Research for PWM
   - Find information from books, internet and supervisor point of view.
   - Made an analysis about the project
   - Study what it need in order to design the PWM
2. Design the circuit
   - Design the circuit using the Pspice or multisim
   - Test run and troubleshoot the circuit
3. Fabricate the hardware
   - Design the layout using proteus 9.1
   - Fabricate the circuit and make measurement to know the differences between simulation results
   - Design overall hardware and do final touch up for the circuit if needed

4. Test run and troubleshoot