DC MOTOR POSITION CONTROL WITH PID CONTROLLER

EZMIKIEL BIN LINGGIN

18 NOVEMBER 2005

"I hereby declared that I have read through this report and found that it has comply the partial fulfillment for awarding the degree of Bachelor of Electrical Engineering (Industrial Power)."

Signature : .....

Supervisor's Name : Chong Shin Horng

Date : 18 November 2005

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EZMIKIEL BIN LINGGIN

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Fakulti Kejuruteraan Elektrik
Kolej Universiti Teknikal Kebangsaan Malaysia

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"I hereby declared that this report is a result of my own work except for the excerpts that have been cited clearly in the references.."

Signature : .....

Name : EZMIKIEL B. LINGGIN

Date : 18 NOVEMBER 2005

Dedicated to my beloved family…..

ACKNOWLEDGEMENT

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I would also like to take this opportunity to thank my beloved family for their encouragement, care and moral support.

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ABSTRACT

DC Motors are motors that run on direct current from battery or dc power supply. Motors of all serve to convert electrical energy into mechanical energy. The dc motors are well suited for many applications, including manufacturing equipment, industrial robots and ext. Here got in different size and cost. The cost to get this dc motors are very cheep if compare with ac motor. Now day we know lot of motors get damage because not proper maintenance. So hear, I would like to explain way the motor easy damage. The way to improve the system position of motor is with used PID controller. So this controller can be reacted and control the situation whether motor running or not. From this project, the proper reason this project is helping for to stop, to detect, does control the system. Therefore, this project aims to enable us to investigation ways to reducing the effect of the interactions motors. Other than that, this project also helping all in studying in purpose of situation and position of dc motor with using PID controller.

ABSTRAK

DC Motor adalah salah satu daripada motor yang berkendali dengan menggunakan bekalan elektrik arus terus atau pun daripada bekalan bateri. Ia adalah salah satu daripada mesin yang menukarkan tenaga elektrik kepada tenaga mekanikal. Kebanyakan dc motor adalah sesuai digunakan pada peralatan pembuatan, industri robot dan sebagainya. Ia terdapat dalam berbagai saiz dan kos untuk memperolehinya adalah rendah berbanding daripada motor arus ulang-alik. Pada masa kini, kebanyakan motor mengalami kerosakan atau pun ianya mudah rosak disebabkan ianya tidak dikawal dengan baik. Dari itu, disini ingin saya jelaskan bahawa salah satu teknik untuk mengawal keberkesanan dan kedudukan motor adalah dengan menggunakan pengawal PID. Penggunaan pengawal tersebut membolehkan kita mengawal segala kedudukan motor semasa ianya beroperasi atau tidak. Dengan ini, projek ini adalah bertujuan untuk membantu kita untuk memerhati, mengesan dan mengawal segala keadaan motor tersebut. Ia juga berfungsi untuk mengurangkan kesan interaksi motor tersebut dengan baik. Selain itu, projek ini dapat membantu kita dalam pembelajaran untuk memahami dengan baik akan keadaan dan kedudukan dc motor dengan menggunakan pengawal PID.

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CHAPTER 1

INTRODUCTION

1.1 General Introduction

Control engineering is one of the subjects, which are perceived as being the theoretical and most difficult to understand. The fact the mathematics play an important role in building control-engineering courses has made it difficult for student to relate the practicality of control engineering.

In most cases, student found that formal definition and theories of control engineering such as analysis and design are merely theories and cannot be used in industries. Common question that arise among students in relation to control engineering subject are the significant of mathematical model, time response analysis, design requirement etc. Some even question on the concept of transfer function and how it is related to the physical system.

One of the ways to enlighten the students understanding of control theory through practical laboratory experiments. Usually laboratory sessions are considered as a light from theoretical lectures and consequently catch the interest of even the

latest motivated students. Numerous diverse practical demonstrations and laboratory session exist for supplementing control theory.

1.2 Objective

The main objective of this project is to develop and design a PID control in controlling the dc motor at desire position response with the input voltage and physical parameter a given. Implement in simulation and graphical display using LabVIEW 7.1. The second objective of this project is to develop a package for learning purpose in controlling the system using P, PI, PD and PID control.

1.3 Scope.

a) Simulation software using LabVIEW 7.1.

b) Using P, PI, PD, PID controller in controlling dc motor position control.

c) Using transfer function equation to calculate and get the %OS, Tr, Ts & εss from the graph plotting function.

1.4 Problem Statement.

Basically, Industrial application use DC motors because the speed-toque relationship can be varied to almost any useful from both motor and regeneration applications in either direction of rotation. DC Motor are some of the motors used in Robotic machines, Lift motor, crane motor and atc. So, the motors must be operate in perfect condition to avoid the machine can't smoothly movement. DC motor also its need to use any addition controller to control the performance rotation the motor on starting condition.

Mostly of industry uses the DC motor without controller causes to saving the cost. The effect of this case, the parts mostly damage (DC motor burn) at certain times especially when the motor always start and stop condition and also the performance or motion of motor is not smoothly and precisely. So, when use the controller we can reduce the problem them (damage).

For this case, using the PID controller it not only to reduce this problem but can easily control or adjust at any situation especially for time, speed, rotation, position in long time for starting and running a DC motor condition. By using PID mode, we can monitor the condition of the motor and then control it so that the motor can run in stable condition and the performance or motion of motor is very smoothly and precisely.

In addition, I suggest LabVIEW to create this program because LV is a good language to create a program because it easy to create and possible to develop practical programs very quickly and can interface with hardware as shown Figure 1.1.

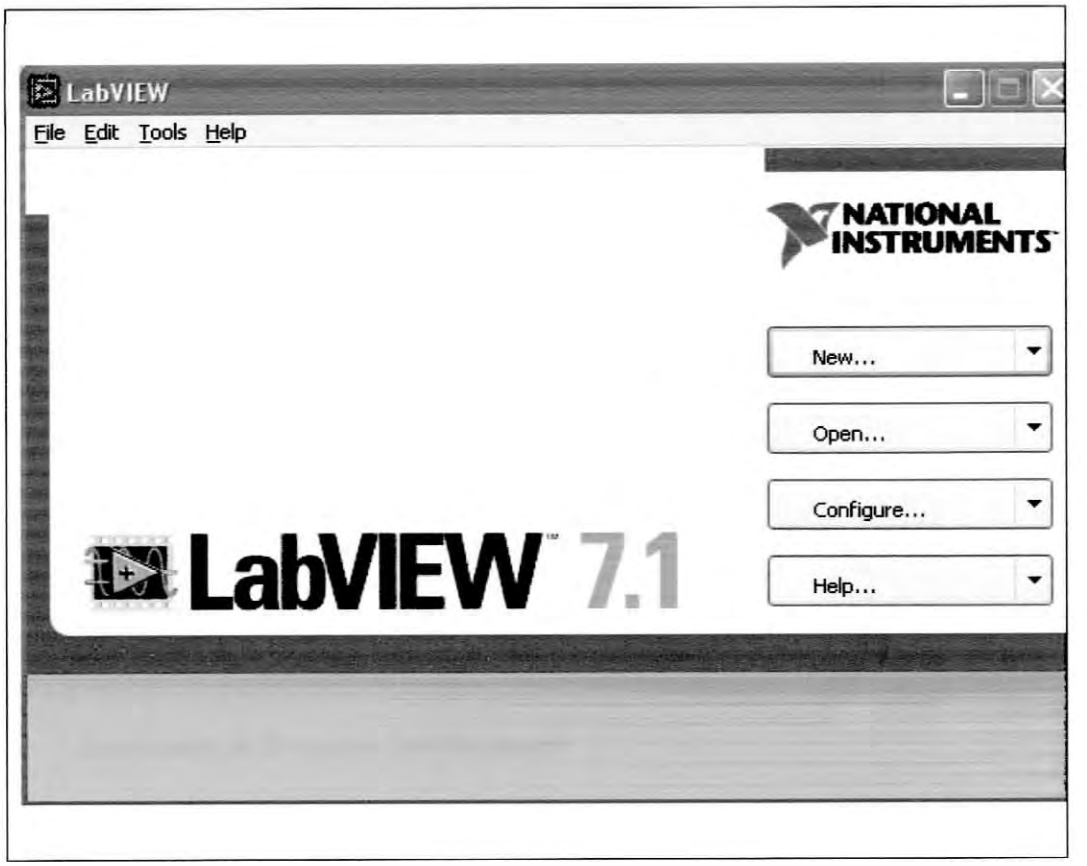

Figure 1.1 : LabVIEW7.1 software.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction Dynamo Development

The first generators and motors were called dynamos or dynamoelertric machines. Dynamo is from the Greek word dynamis which means power. Webster defines dynamoelectric as "relating to the conversion of mechanical energy into electrical energy or vice versa". The word motor is from the Latin word motus which means one that imparts motion or prime mover. The dynamo was the result of the efforts of several people, in different countries, in the mid-nineteenth century, to make electricity work for them.

2.1.1 Definition:-

Dynamo:	From the Greek word dynamis, which means power.
Dynamoelectric:	Relating to the conversion by induction of mechanical energy into electrical energy or vice versa.

Dynamoelectric machine: A dynamo or generator.

Motor: From the Latin word motus, one that imparts motion, prime mover. A device that changes electrical energy into mechanical energy.

Generator: A device that changes mechanical energy into electrical energy. Although the terms AC and DC generator are in common usage, a generator is normally considered to be a device that provides DC current.

Alternator: A device that changes mechanical energy into an alternating current electrical energy, an AC generator.

2.1.2 Landmarks Of Electric Motor Development:-

1820 - The discovery of electromagnetism Hans Christian Oersted, Danish.

1827 - The statement of the law of electric conduction,Ohm's law George. S Ohm, German.

1830 - The discovery of electromagnetic induction Joseph Henry, American.

1831 - The discovery of electromagnetic induction Michael Faraday, English.

1867 – The first practical dynamo, about 1867.

2.2 Basic of Motor Theory.

In Ancient Romans, with their advanced civilization and knowledge of the sciences, had been able to develop a steam motor, the course of history would have been much different.

The development of the electric motor in modern times has indicated the truth in this theory. The development of the electric motor has given us the most efficient and effective means to do work known to man. Because of the electric motor we have been able to greatly reduce the painstaking toil of man's survival and have been able to build a civilization which is now reaching to the stars.

The electric motor is a simple device in principle. It converts electric energy into mechanical energy. Over the years, electric motors have changed substantially in design, however the basic principles have remained the same. In this section of the Action Guide we will discuss these basic motor principles. We will discuss the phenomena of magnetism, AC current and basic motor operation.

2.2.1 Magnetism.

Now, before we discuss basic motor operation a short review of magnetism might be helpful to many of us. We all know that a permanent magnet will attract and hold metal objects when the object is near or in contact with the magnet. The permanent magnet is able to do this because of its inherent magnetic force which is referred to as a "magnetic field".

In Figure 2.1 , the magnetic field of two permanent magnets are represented by "lines of flux". These lines of flux help us to visualize the magnetic field of any

magnet even though they only represent an invisible phenomenon. The number of lines of flux varies from one magnetic field to another. The stronger the magnetic field, the greater the number of lines of flux which are drawn to represent the magnetic field. The lines of flux are drawn with a direction indicated since we should visualize these lines and the magnetic field they represent as having a distinct movement from a N-pole to a S-pole as shown in Figure 2.2.

Another but similar type of magnetic field is produced around an electrical conductor when an electric current is passed through the conductor as shown in Figure 2.2. These lines of flux define the magnetic field and are in the form of concentric circles around the wire. Some of you may remember the old "Left Hand Rule" as shown in Figure 2.2. The rule states that if you point the thumb of your left hand in the direction of the current, your fingers will point in the direction of the magnetic field.

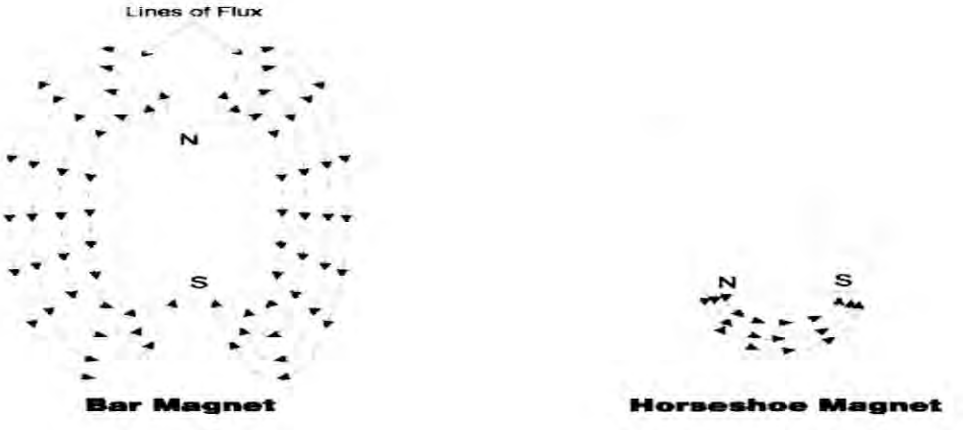

Figure 2.1 : The lines of flux of a magnetic field travel from the N-pole to the S-pole.

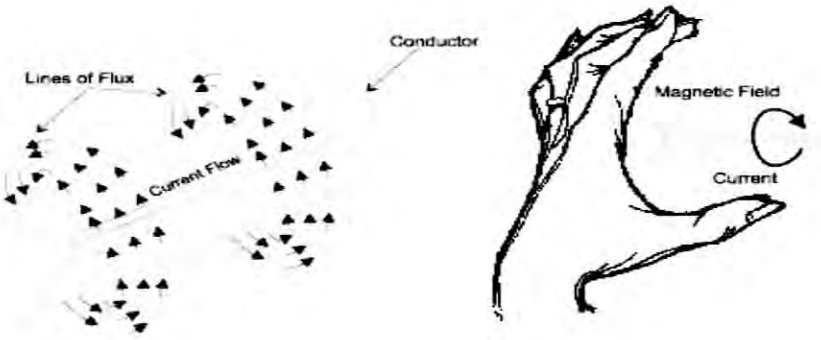

Figure 2.2 : The flow of electrical current in a conductor sets up concentric lines of magnetic flux around the conductor.

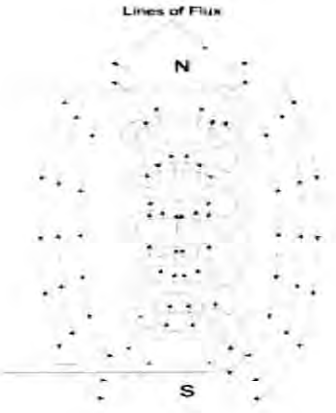

Figure 2.3 : The magnetic lines around a current carrying conductor leave from the N-pole and re-enter at the S-pole.

When the wire is shaped into a coil as shown in Figure 2.3, all the individual flux lines produced by each section of wire join together to form one large magnetic field around the total coil. As with the permanent magnet, these flux lines leave the north of the coil and re-enter the coil at its south pole. The magnetic field of a wire coil is much greater and more localized than the magnetic field around the plain conductor before being formed into a coil.

This magnetic field around the coil can be strengthened even more by placing a core of iron or similar metal in the center of the core. The metal core presents less