UTeM
UNIVERSITI TEKNIKAL MALAYSIA MELAKA

PID SPEED CONTROL DESIGN FOR SYNCHRONOUS DC MOTOR DRIVES

MUHAMMAD FARIS BIN ROSLAN

B071710133

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2021

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

PID SPEED CONTROL DESIGN FOR SYNCHRONOUS DC MOTOR DRIVES

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electronic Engineering Technology (Industrial Electronic) with Honours

by

MUHAMMAD FARIS BIN ROSLAN

B071710133

950215045265

FACULTY OF ELECTRICAL AND ELECTRONIC ENGINEERING

2020

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

PID SPEED CONTROL DESIGN FOR SYNCHRONOUS DC MOTOR DRIVES

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electronic Engineering Technology (Industrial Electronic) with Honours

by

MUHAMMAD FARIS BIN ROSLAN

B071710133

950215045265

FACULTY OF ELECTRICAL AND ELECTRONIC ENGINEERING

2020

DECLARATION

I declare that this project entitled “PID Speed Control Design for Synchronous DC Motor Drives” is the result of my own research except as cited in the references. The project report has not been approved for any degree and has not been submitted for any other degree at the same time.

Signature : 

Name : MUHAMMAD FARIS BIN ROSLAN

Date : 18/1/2021

APPROVAL

I hereby declare that I have reviewed this project report and in my opinion, this project report is adequate for the award of the degree of Bachelor of Electronic Engineering Technology (Industrial Electronic) with Honours in terms of scope and consistency.

Signature : shahrizal

Supervisor Name : EN. Ts SHARIZAL BIN SAAT

Date : 18/1/2021

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

Tajuk:PID Speed Control Design for Synchronous DC Motor Drives

Sesi Pengajian: 2021

Saya **MUHAMMAD FARIS BIN ROSLAN** mengaku membenarkan Laporan PSM ini disimpan di Perpustakaan Universiti Teknikal Malaysia Melaka (UTeM) dengan syarat-syarat kegunaan seperti berikut:

1. Laporan PSM adalah hak milik Universiti Teknikal Malaysia Melaka dan penulis.
2. Perpustakaan Universiti Teknikal Malaysia Melaka dibenarkan membuat salinan untuk tujuan pengajian sahaja dengan izin penulis.
3. Perpustakaan dibenarkan membuat salinan laporan PSM ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. **Sila tandakan (X)

☐	SULIT*	Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia sebagaimana yang termaktub dalam AKTA RAHSIA RASMI 1972.
☐	TERHAD*	Mengandungi maklumat TERHAD yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan.
☒	TIDAK TERHAD	

Yang benar,

.....

MUHAMMAD FARIS BIN ROSLAN

Alamat Tetap:
NO.15,JALAN GELAM RIA 2,TAMAN SERI GELAM
TANJONG KLING,76400.MELAKA

Tarikh: 18/01/2021

Disahkan oleh penyelia:

shahrizal .....

TS SHAHRIZAL BIN SAAT

Cop Rasmi Penyelia

Ts. SHAHRIZAL BIN SAAT
Pensyarah
Jabatan Teknologi Kejuruteraan Elektronik & Komputer
Fakulti Teknologi Kejuruteraan Elektrik & Elektronik
Universiti Teknikal Malaysia Melaka

18/01/2021

DEDICATION

I very thankful and feel very happy when my dissertation work to the first is my beloved mother and father especially Puan Norsiah Binti Lasim and Roslan Bin Yahaya and to all my friends. They every time gave me a moral support to complete this project and always push for tenacity ring in my ears. My sisters Nur Adilah Binti Roslan and Nadzirah Binti Roslan always teach me to complete this thesis and always have my side.

What they have done, I will always appreciate. Who have support me throughout the process I also dedicate this dissertation. They have been my best in my family.

ABSTRACT

Speed synchronization is the most important parameter when this project is need to synchronous the specific of rotation. PID parameter to obtain the best performance based on the time response analysis. DC motor demanding and sophisticated application, the PID controller designed accordingly. The main objective of this project are, to investigate of several PID controller tuning method gain parameter. Other than that, is to evaluate between modelling and experimental hardware result. This project that can be used P-proportional, I-integral, D-derivative which is PID control the algorithm to control of DC motor. Such that, to perform several PID controller tuning method gain parameter. Some problem when to complete this project, that using the mathematical model because with any application those methods cannot deal. The increase in the diversity and power values of semiconductors has led to rapid developments of simple control devices DC motor. In methodology, for elaboration of the flowchart needs to designing in simulation and list out the component that need to used. Then, software setup and hardware and testing and combination between hardware and software the system successful until this project finish. Speed control is the important in industry. This is because this project has more advantages, low cost and simple to control. Other than that, can easily to maintenance. In conclusion, to summarize it this project is concern about to test PID speed control with synchronous DC motor drives.

ABSTRAK

Penyegerakan kelajuan adalah parameter terpenting apabila projek ini perlu segerak dengan putaran tertentu. Parameter PID untuk memperoleh prestasi terbaik berdasarkan analisis tindak balas masa. Permintaan motor DC dan canggih, pengawal PID dirancang dengan sewajarnya. Objektif utama projek ini adalah, untuk menyiasat beberapa parameter keuntungan kaedah penalaan pengawal PID. Selain itu, adalah menilai antara pemodelan dan hasil perkakasan eksperimen. Projek ini yang boleh digunakan P-proportional, I-integral, D-derivative iaitu PID mengawal algoritma untuk mengawal motor DC. Pengawal PID. Dengan demikian, untuk melakukan beberapa parameter penalaan kaedah penalaan pengawal PID. Beberapa masalah ketika menyelesaikan projek ini, iaitu dengan menggunakan model matematik kerana dengan aplikasi apa pun kaedah tersebut tidak dapat ditangani. Peningkatan kepelbagaian dan nilai daya semikonduktor telah menyebabkan perkembangan pesat peranti kawalan mudah motor DC. Dalam metodologi, untuk penjelasan carta alir perlu merancang simulasi dan menyenaraikan komponen yang perlu digunakan. Kemudian, penyediaan perisian dan perkakasan serta pengujian dan gabungan antara perkakasan dan perisian sistem berjaya sehingga projek ini selesai. Kawalan kelajuan adalah perkara penting dalam industri. Ini kerana projek ini mempunyai lebih banyak kelebihan, kos rendah dan mudah dikendalikan. Selain daripada itu, boleh dilakukan penyelenggaraan dengan mudah. Sebagai kesimpulan, untuk meringkaskannya, projek ini adalah untuk menguji kawalan kelajuan PID dengan pemacu motor DC segerak.

ACKNOWLEDGEMENT

First and foremost, I want to thank God for giving me the power and the idea to complete this project. As I used to welcome in Arabic, “Alhamdulillah” all praise be to Allah. And don’t forget to all of my family especially my parents Puan Norsiah Binti Lasim and my father Roslan Bin Yahaya, who every time they give me a support, who has continuously inspired, and encouraged me every single moment of my life. I still received a strong moral and spiritual encouragement from them besides their financial assistance. My supervisor, who is En TS. Sharizal Bin Saat has a good and very kind person has generously provided me with a great opportunity to continue my degree until end it up. He should received the majority of my thanks gratitude for what I have achieved today. I also admire his co-operation and concern that he showed during the entire course of my degree. Last but not least, I always in my pray for who have support me until now. And thanks to everyone, who is not mentioned here, direct or indirect during the completion of my research work.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

1.1 Project Background

This project, focusing the Speed Design for synchronous DC motor drives. The system will be first take electrical energy and produce a speed of motor drives. Mechanical energy into electrical energy is the direct current (DC) motor is a device that used in many industries in order. Speed synchronization is the most important parameter when this project is at least 2 unit of DC motor need to synchronous at the specific speed rotation. In this project, experimental will be carry out to evaluate and compare tuning P(Proportional), I(Integral), D(Derivative) , PID parameter to obtain the best performance based on time response analysis. The microcontroller that used is Arduino Uno and the software of simulation is proteus and the Microsoft excel to displayed the output speed of motor.

The controllers may be speed PID controller of many types of traditional and numerical controllers, designed to control the speed of the DC motor to perform a variety of tasks. The PID controller is planned accordingly for this project with PWM current controller to create a better controller for DC motor demanding and sophisticated application. This Arduino Uno had chosen due to a simple board, easy to handle and it's a lower cost. This board using Arduino ide software also can be program.

1.2 Problem Statement

There is some problem when to complete this project, that using the complicated mathematical model because with any application those methods cannot deal. The growth in semiconductor diversity and power values has led to rapid advances in simple DC motor

devices. This is allowing non-specialist of the controller action because the three terms are reasonable intuitive. The steady state error are the actual value of a system when the response has reached the steady state difference between the desired values.

1.3 Objectives

Basically, this project is lists four main objectives goals:

i. To investigate performance of several PID controller-tuning method gain parameter.
ii. To evaluate different between modelling simulation and experimental hardware result.

1.4 Scopes of Project

This project that can be used to control the PID speed control of synchronous DC motor drives used the microcontroller Arduino Uno. As a main performance is a main factor, this project the efficiency and performance of a speed of DC motor with implementation will discuss methodology regulation. Thus, as mentioned below, the emphasis of this project is:

i. Compare of uncontrolled system the performance propose PID.
ii. Implementing the programming code in the Arduino ide.
iii. To compare two DC motor drives of speed (RPM) when put a load.

1.5 Contribution of Research

In the areas below, contributions to the future of this project are made:

i. Speed control is the most important in industry. This is because this project has more advantages, low cost and simple to control. Other than that, can be easy to maintenance.

ii. This project is used Arduino Uno Board. So, it's the simple board to use the main used controller. Many industries tried to save the budget and they can take this project to use it.

iii. The design of PID controller is easy to implement since can tune three parameters and can tuning method will be performed.

1.6 Thesis Outline

This project have been done five (5) chapters, which every chapter summarized as below:

Chapter 1

The project summary will be explained in this chapter and problem statements, scopes and objective. Speed control of motor, and PID controller are the main control in this project.

Chapter 2

Chapter 2 also, will fully focused on the literature review and explained about this project. All the journals or articles that can get at mendeley will include some attachment guide as reference to help complete this project.

Chapter 3

This chapter will come out the methodology to complete this project. The outcome parameters and list out all equipment. The discussion in this chapter discussed used in Visual Basic, flowchart overview this project and the completion with the hardware.

Chapter 4

This chapter will come out all of the analysis and result the data form my project. The data of speed already list out from serial monitor from Arduino ide. Then, get a time response, with pid, without pid by using a matlab and the graph have been show in this chapter.

Chapter 5

This chapter have been done overall from initialize hardware until collect the data. The objective have been achieve.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

In this chapter will come out in the article some fundamental and good ideas for this project. To complete this project, need to studies on journal to get some ideas or knowledge and skills needed. This project about PID Speed Control for Synchronous DC motor drives that is similar brief or idea on previous that come out from article. So, in this chapter, know how to complete this project and what software algorithm to use.

2.2 Related Studied

Although the hold charge is higher than the incitement of the DC engine, it has usually been used as a sector of the industry with no standing. (Suman and Giri, 2016). In general, Integral Derivative (PID) controls have been used to control the speed and location of the DC motor framework. (Kim *et al.*, 2010). The AC engine was considered a constant speed engine, while the DC engine was considered a variable speed engine (Asnaini, 2008).

2.3 Dc Motor

The dc motor consist of a stator, rotor and commutator. Which is contains magnet, bearing and the stator is the housing of the motor (Sarma, 2017). Commutator is receives current through brushes when the wire in the rotor of coil are connects. While the rotor turns the commutator to ensures its can be the current flow in properly direction. It is has a wide speed control range and has a good speed control respondence.

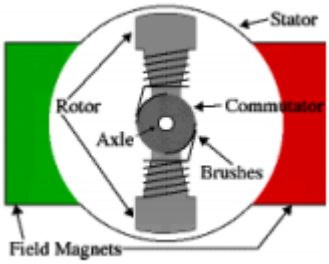

Figure 2.1 Part DC motor 1

The AC motor was considered as a constant speed motor while the DC motor was considered to be a variable speed of motor. Many industries are used DC motor because the speed of torque characteristics. All of industry is growth rapidly to demand for control system has increased. This because to get a better performance and to more accurate and faster control systems. Many methods can for controlling the DC motor and I choose to apply PID controller. It also can used (PWM) pulse width modulation to easily control the speed of DC motor. The pulse of square wave of constant voltage but varying the duty cycle by supplied the power to DC motor.

2.4 PID Controller

Proportional, integral and derivative responses and summing those three components to generate the output is the main to aim of the PID controller is to sense the sensor signal and evaluate by calculating the desired output (Gandhi, Singh and Daxini, 2015). The actuator output but also by the external factors which are called the disturbances is the system affected most of the time. To eliminate the effects by disturbances, usually designed by PID controller. Figure 2.2 is shows PID controller the typical by block diagram.

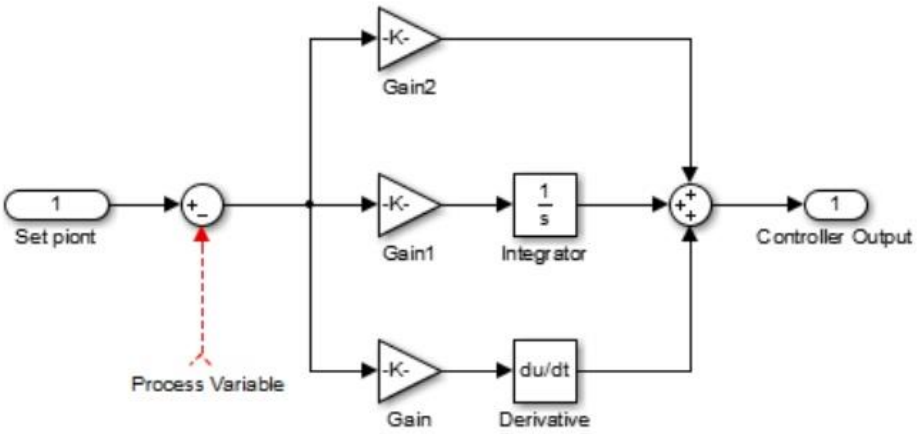

Figure 2.2 PID Block Diagram (Gandhi, Singh and Daxini, 2015)

Table 2.1 Closed Loop Responses (Gandhi, Singh and Daxini, 2015):

Parameters	Rise Time	Overshoot	Settling Time	S-S Error
Kp	Decrease	Increase	Small Change	Decrease
Ki	Decrease	Increase	Increase	Eliminate
Kd	Small Change	Decrease	Decrease	No Change

1. Rise Time: The desired level for the first time it takes for the plant output Y to rise beyond 90%.
2. Overshoot: Normalized against the steady state, how much greater is the peak level than the steady state (Qian, 2012).
3. Settling Time: The time it takes for the system to converge the steady state.
4. Steady-state Error: The desired output is the difference between the steady-state (Qian, 2012).