

UNIVERSITI TEKNOLOGI MARA

**THE DESIGN AND APPLICATION OF AN
INTELLIGENT STEPPER MOTOR SPEED
CONTROLLER**

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ABSTRACT

This thesis described a new system to control the speed of a stepper motor. Stepper motors are mainly used for position control, therefore the concept of using it for a speed control could replace the conventional method of using servomotor. Three chosen controllers were successfully designed and developed. The three controllers: PID, fuzzy proportional derivative (FuzzyPD) and fuzzy proportional integral (FuzzyPI) were implemented and their performances were investigated. The core techniques for testing their performances include various transient analysis, load test and comparative studies. Results shown in this thesis indicate that all of the three controllers worked rather well and their responses were fast and accurate. Comparatively, the PID controller provided the fastest response but the fuzzy controllers were more consistent with minimum overshoots.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Stepper motor is a type of motor that produce specific degrees of rotation based on phase input voltages. Stepper motors are available in many important electrical equipments being used presently. For example in home appliances, health equipments and scientific research equipments. CD-drive and floppy disk drive in a computer system uses stepper motor for accurate disk positioning. Automotive industries use stepper motor in their robotic parts for better positioning of robotic arms. A typical industrial robot which could produce six degrees of freedom is a common example of stepper motor application in industries (Hollinger *et. al.*, 1992).

The application of stepper motor has increased over the past years due to several factors: robustness, precision, simplicity, accuracy, repeatability, small size at low price and digital compatibility. There are three types of stepper motor: permanent magnet, variable reluctance and hybrid. All of these perform the same function but some differences among them may be important in certain application. In many industrial applications, implementing speed control would normally use servomotor or DC motor. Their inherent linear speed and torque characteristics provide user with minimal hardware implementations. However, continuous usage of these motors require high maintenance since the motor carbon brushes regularly wear out. The motors also require several modifications in terms of hardware configuration when applied at different levels of loads. As a result, the concept of stepper motor speed controller starting to gain acceptance as an alternative method in replacing servomotor and DC motor. Stepper