DESIGN AND IMPLEMENTATION OF A FUZZY CONTROLLER BASED AUTOMATIC VOLTAGE REGULATOR FOR A SYNCHRONOUS GENERATOR

Thesis presented in partial fulfilment for the award of the Bachelor in Electrical Engineering (Hons) of INSTITUT TEKNOLOGI MARA

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ABSTRACT

Fuzzy controllers are increasingly being accepted by engineers and scientists as alternative for classical controllers. The process involved in fuzzy controllers closely imitates human control processes. Human responses to any action or input are not governed by transfer function and neither are those from fuzzy controllers. This study involves the design and application of fuzzy control to the problem of automatic voltage regulation of a synchronous generator.

The method explored here deals with the use of binary input-output Fuzzy Associative Memories (FAM) for control. Error and rate of change of voltage are monitored and used to maintain a constant output voltage. Software routines were written in 'Borland C' language and the Fuzzy Logic Controller (FLC) was designed using the FuzzyTECH Precompiler software. The fuzzy controller was implemented in an IBM compatible personal computer to control a 2.5kVA synchronous generator in the Power Laboratory at the Faculty of Electrical Engineering, ITM.

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CHAPTER 1
INTRODUCTION

1.1 Introduction

A synchronous generator or alternator is normally equipped with an automatic voltage regulator (AVR), which is responsible for keeping the output voltage constant under normal operating conditions at various load levels. It is utmost important that the AVR of the synchronous generator to have a high efficiency and fast response. Until now, the analog proportional-integral-derivative (PID) controller is generally employed for the AVR due to its simplicity and low cost. In this controller, however, it is necessary to adjust the gains of the PID controller in the field. Furthermore, it is not responsive enough to the change of its gains when the operating status is varied [1].

The availability of inexpensive microprocessors has provided a shift for the conventional method toward sophisticated digital controls [2]. Microprocessor based control system has a great deal of flexibility and also allows easy implementation of sophisticated control algorithm such as those of self-tuned PID regulators [3]. However, in view of their large computational requirements and software complexity, the second method was also found to be inappropriate in which the degree of improvement obtained needs to be examined carefully.

In recent years, fuzzy theory has emerged as a powerful tool in various control system applications. Researchers are starting to use fuzzy control in various power systems application areas [1,4]. The application of fuzzy logic control techniques appears to be very useful whenever a well-defined control objectives cannot be specified or the system to be controlled is a very complex one. Under traditional laws of logic, something either belongs to a set or does not, thereby leaving no room for ambiguities. Answers to questions are often "maybe" instead