CONTROLLER DESIGN FOR PILOT PLANT BASED ON TRANSIENT RESPONSE CRITERIA

Thesis is presented to fulfill the requirements of Advanced Diploma in Electrical Engineering of MARA Institute of Technology

By:

KHAIRIL ANWAR B. ABDUL RAZAK
SUHAIRI B. ABDUL GHANI

MAY, 1993

DEPARTMENT OF ELECTRICAL ENGINEERING
SCHOOL OF ENGINEERING
MARA INSTITUTE OF TECHNOLOGY
0450 SHAH ALAM
SELANGOR
MALAYSIA

ACKNOWLEDGMENTS

We would like to convey our sincerest thanks to the following persons involved either directly or indirectly in making this project successful;

1. Dr. Syed Abdul Kader Al-Junid our project adviser who has been a great person in supervising, guiding, and encouraging us throughout the whole duration of this project.

2. Mr. Mohd. Din who has been very helpful and has given us a lot of technical support and advise.

3. Mr. Ismail Musirin who provided us with the finishing touches for the completion of our project.

Finally, our dearest friends and colleagues for their support.

ABSTRACT

This project was done to obtain the approximate controller settings which are the Proportional, Integral and Derivative (**PID**) parameters for the various processes based on the FEEDBACK PCS327 Process Control Simulator.

The design is based on the transient response criteria of the different processes. Based on this criteria, tuning relations method is used. Field tuning is often required since process models are never exact. The tuning relations for **PID** controllers that were used include the widely-used *Ziegler and Nichols* method and *Cohen and Coon* method utilizing the process reaction curve. These different methods were compared to ascertain the most suitable PID control method for the various processes involved.

In order to design the controller, the various effects of the tuning parameters on the selected plant or systems were analyzed. Suggestions are further made according to which tuning method yields better initial parameter. The initial tuning parameters should have acceptable transient response specifications such as delay time (t_d), rise time (t_r), peak time (t_p), settling time (t_s) and peak overshoot (M_p).

CONTENTS

1.0 INTRODUCTION

Controller design is an important aspect in obtaining the optimum performance in specific processes or systems. There are various controller design methods that could be utilized to obtain good control of various systems. Among the numerous control system applied in the industry and other sectors are the control of flow, pressure, temperature, level, position, speed, and etc. A simple form of controller for example would be the thermostat, that is used to regulate the temperature of refrigerators, air-conditioning units, ovens and furnaces.

1.1 Control Systems

A system could be defined as "a coordinated unit of individual elements to perform a specific function" (Gupta 1987). These systems could either be electrical, hydraulic, pneumatic, mechanical, analog, digital and any other elements interacting together. The output of a system corresponds to the input according to certain rules.

A system is said to be dynamic when either one of its elements is capable of storing energy or some similar capacity. An input applied would be subjected to a lagging response according to the various aspects or states. The different states passes through a transient condition before settling at a certain steady state value accordingly.

A control system could be defined as "a combination of elements or sub-systems which tends to maintain a quantity or a set of quantities termed output, suitably related to another quantity or a set of quantities termed input" (Gupta 1987). Referring to Fig. 1.1, the input to the control system could either be a signal or a set of signals