THE DESIGN OF A SELF-TUNING CONTROLLER (STC) BASED ON POLE PLACEMENT

Thesis is presented in partial fulfillment for the award of the
Bachelor of Electrical Engineering (Honours)
INSTITUT TEKNOLOGI MARA

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ABSTRACT

The design of a self-tuning controller (STC) based on pole placement is proposed in this paper. The slowly varying process parameters are identified using the recursive lease squares estimation method. The objective is to change the controller setting based on the system parameters that have been estimated when changes occur in the systems. Many techniques can be applied in the controller design. However, in this paper the pole placement method is utilised. The analysis of the controller is done through simulation using MATLAB. However in the design of the estimator, QBasic was used. It is shown the pole-zero controller gives good response. Similarly, the recursive least squares estimator provides a reasonable estimates of the systems parameters.

ACKNOWLEDGEMENT

In the name of ALLAH s.w.t, The Most Beneficent, The Most Merciful, who gives me the strength and ability to complete this thesis as it is today.

I wish to extend my sincere thanks to my supervisor Prof.Ir.Dr.Syed Abdul Kader AlJunid for his constant guidance and support throughout the preparation of this project and for reading the different version of manuscript and thereby remove many of the errors and gives good suggestions for improvement. Without him, this will not be a reality.

I would like to thank once again to my supervisor for giving me his QBasic program thus ensuring that the simulation analysis be made possible.

Last but not least, special thank you to my beloved parents for giving me fully support from the beginning.

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CHAPTER 1

1.0 INTRODUCTION

Control systems are an integral part of modern society. A control system consists of subsystems and processes or plants assembled for the purpose of meeting a certain specific objectives. These objectives can be spelled out directly in time domain, indirectly in frequency domain, and sometimes based on some optimal objectives to minimise error or cost.

Almost all control systems that are in used today are closed loop. One of the advantages of such control system is the ability to reduce the error from disturbances. The closed loop system compensates for disturbance by measuring the input response, feeding that measurement back through a feedback path and comparing that response to the input at the summing junction. If there is any differences between the two responses, the system drives the plant, via the actuating signal, to make a correction. If there is no difference, the system does not drive the plant, since the plant is already the desired response. Hence, closed loop system have the obvious advantages of greater accuracy than open loop system. Transient response and steady state error can be controlled more conveniently and with greater flexibility in closed loop systems, often by a simple adjustment of gain amplification in the loop, and sometimes by designing the controller or compensator.

A linear time invariant system can be represented by a transfer function, where a controller can be designed to meet the specific tasks. If the specifications are in time domain, the root locus method can be used. If the specifications are in frequency domain then the Bode plot method can be applied. However, these methods are based on trial and error and assuming the plant parameters to be fixed. If there is any changes to the plant parameters, the objectives will not be met. The controllers can be retuned if the new plant parameters are known.