INVESTIGATION ON TRANSIENT RESPONSE OF SYNCHRONOUS MACHINE

Thesis is presented in partial fulfillment for the award of the
Bachelor of Engineering (Hons.) Electrical
UNIVERSITI TEKNOLOGI MARA (UiTM)

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MAY 2009

ACKNOWLEDGEMENTS

First and foremost, I would like to state my greatest gratitude to ALLAH S.W.T that gives me opportunity and strength to be able to complete my final year project and thesis.

I would like to express my sincere gratitude and thanks to my supervisor Assc. Prof. Dr. Noraliza Hamzah for her guidance, support and encouragement throughout the completion of this project. Her valuable suggestions have been greatly appreciated.

I wish to thank the panels of this thesis, Hj. Ishak Ismail for his suggestion and recommendation for using other method for my thesis's topic and Siti Zaliha Mohd. Noor for her courage to make my thesis completed with particular specifications.

I would also like to thank the excellent services provided by electrical machines and control systems lecturers for their patience guiding me throughout this thesis.

I would also like to thank my colleagues for their help in teaching me how to use MATLAB Simulink.

My deepest thanks go to my understanding parents and family.

ABSTRACT

This thesis presents the investigation on transient response and stability of higher orders model of synchronous machine in a typical power system by using the PID controller. The PID controller aims to improve the dynamic response as well as to reduce or eliminate the steady-state error in the machine. The other factors such as using different types of turbines and various component parts within the power system are briefly discussed. A transfer function simulation model is developed by using the MATLAB Simulink software. The fourth orders of synchronous machine model which connected to an infinite bus are implemented for better understanding of the machine response under sudden large disturbances during transient conditions. The model elements consist of Automatic Voltage Regulator (AVR), Automatic Generation Control (AGC), an excitation system and coupling coefficient. Several improvements on the simulation model are included. Simulation results are presented in order to get stable system of synchronous machine by using the designed controller.

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CHAPTER 1

INTRODUCTION

1.0 BACKGROUND STUDY

The problem of the maintenance of constant voltage covers an extremely large field, from the control of the busbar voltage of a power station to the supply of constant voltage to small electronic instruments [1]. In stability studies, the overall accuracy of a system is primarily decided by how correctly the synchronous machines within the system are modeled. The use of a second order synchronous generator model for simulation is inadequate for transient study. Hence, there is a need to analyze exclusively the model of synchronous machine in the power system.

Power system stability is the tendency of power system to react to disturbances by developing restoring forces equal to or greater than the disturbing forces to maintain the state of equilibrium (synchronism) [2]. There are three main categories of stability which namely steady state, transient and dynamics. Steady state stability is the capability of the power system to maintain synchronism after a gradual change in power caused by small disturbances. Transient state stability refers to the capability of a power system to maintain synchronism when subjected to a severe and sudden disturbance. The dynamic stability is an extension of steady state stability. It is concerned with the small disturbances lasting for a long period of time.

In real world systems, models are difficult to obtain. The used of Ziegler-Nichols method is one of the more common methods of controller setting that has come used to tune control loops [3]. The open loop method is useful for most process control loops. The closed loop method determines the gain at which a loop with proportional only control will oscillate, and then derives the controller gain, reset, and derivative values from the gain at which the oscillations are sustained and the period of oscillation at that gain. Therefore, this Z-N method will be used in this thesis to produce a better model.