A Comparative Study of PI Controller and Fuzzy Logic Controller for DC/DC Boost Converter in Photovoltaic System

This thesis is presented in partial fulfilment for the award of the

Bachelor of Electrical Engineering (Honours)

Mara University of Technology (UITM)

MOHD AKMAL BIN RAMLI

Faculty of Electrical Engineering

Mara University of Technology

40450 Shah Alam,

Selangor Darul Ehsan

ACKNOWLEDGEMENT

All praise to Almighty Allah, for giving me the strength, patience and guidance throughout the process of completing this research study.

I would like to express my sincere appreciation to my dedicated supervisor, Dr. Mohamad Nawawi Bin Seroji for his support, guidance, belief, patience and for his positive feedback. I would like to thank him for many opportunities and knowledge he has given me over the year.

To my beloved parents, I would like to special thank them for their contribution and support since the beginning.

My gratitude also goes to staffs, seniors and friends who have been so supportive in all type of work that I do. Once again thank you so much to everyone who has help me throughout the process of completing this research study. Thank you.

ABSTRACT

Nowadays, the switching power supply technologies are step forward into the next higher level in today's high-tech world. Almost all of the newer equipment in the dc/dc converter is to change the DC energy from one voltage level to another by performs the conversion with the high efficiency. As a solution, controller is added to the system to achieve the goal for regulating the output of the dc/dc boost converter.

This work introduces an approach to design the controller for the closed loop system for dc/dc boost converter. This system is controlled by using fuzzy logic controller and PI controller. The converter is design to step up the solar panel voltage to a stable 12V output. The output of the converter is measured and the values are sent to the controller to produce pulse width modulation (PWM) signal. The PWM signal is used to control the duty cycle of the converter.

Typical application of this boost converter is to provide DC power supply for standalone system without the storage element such as battery. The main reason of the absence of the storage elements is because of their size and high maintenance fees. Furthermore, the converter unit can be attached to the solar panel as a single product.

These simulations was developed using the Simulink tool box in Matlab software. Simulation and results of both controllers are compared to demonstrate the advantages and disadvantages between Fuzzy logic controller and PI controller in terms of rise time, settling time, percentage of voltage deviation and percentage of overshoot voltage [1].

TABLE OF CONTENTS

CHAPTER 1

INTRODUCTION

1.1 PROJECT OVERVIEW

This thesis concerns to design the controller for the closed loop system for dc/dc boost converter using fuzzy logic controller and PI controller. The simulation design is done by using the Simulink tool box in Matlab to analyze the dynamic performances between fuzzy logic controller and PI controller in terms of rise time, settling time, percentage of voltage deviation, and percentage of overshoot voltage.

1.1.1 BACKGROUND OF CONVERTER

Power electronics is the application of solid-state electronics for the control and conversion of electric power. Power electronic converters can be found wherever there is a need to modify a form of electrical energy (i.e. change its voltage, current or frequency) [18]. The power conversion systems can be classified according to the type of the input and output power.

- AC to DC (rectifier)
- DC to AC (inverter)
- DC to DC (DC to DC converter)
- AC to AC (AC to AC converter)