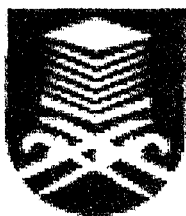


**SIMULATION OF A SINGLE-PHASE ACTIVE FILTER
TO CONTROL HARMONICS FOR MULTIPLE
NON-LINEAR LOADS**

Project report is presented in partial fulfillment for the award of the Bachelor of
Electrical Engineering (Hons.)

UNIVERSITI TEKNOLOGI MARA



NAZARUL ABIDIN BIN ISMAIL

Faculty of Electrical Engineering

UNIVERSITI TEKNOLOGI MARA

40450 SHAH ALAM

SELANGOR DARUL EHSAN.

ACKNOWLEDGEMENT

**In the Name of Allah
Most Beneficent and Most Merciful**

I would like to thank Allah for giving me the health and strength to conduct the project and study in my selected topic and thus enable me to prepare this thesis.

I would like to express my deepest gratitude to my project advisor, Pn. Bibi Norasiqin Bt. Sheikh Rahimullah who has guided me throughout this project from the beginning and for her continuous support in giving ideas until completion of this project.

I am also expressing my special thanks to my classmates, and all individuals who have given me their fullest and constant support during the preparation of this thesis.

Nazarul Abidin B. Ismail
UNIVERSITI TEKNOLOGI MARA
40450, SHAH ALAM,
SELANGOR DARUL EHSAN.

ABSTRACT

As the presence of harmonics can create problems, reducing and controlling the harmonics become a widespread concern for most of industries (companies). This thesis proposes an active power filter for single-phase system to control the harmonics for multiple non-linear loads.

The active power filter is based on a single-phase inverter with four controllable switches (that is IGBT ~ Insulated Gate Bipolar Transistor), a standard H-bridge inverter.

The simulation of the proposed circuit is also presented in this thesis together with the results.

TABLE OF CONTENTS

CHAPTER	PAGE
LIST OF FIGURES	viii
LIST OF TABLES	x
LIST OF ABBREVIATIONS	xi
1 INTRODUCTION	
1.1 Background	1
1.2 Sources of Harmonics	2
1.3 Interaction within a facility	6
1.4 Scope of work	6
1.5 Scope of the thesis	7
2 THEORITICAL BACKGROUND	
2.1 Introduction	8
2.2 Single-Phase Bridge Inverter	8
2.3 IGBT	13
2.3.1 IGBT I-V Characteristics	15
2.4 PSpice Simulation.	19

CHAPTER**PAGE**

3	THE SYSTEM OVERVIEW.	
3.1	The Inverter Model, Sliding Modes, and Equivalent Control	21
3.1.1	The Inverter Model	21
3.1.2	Sliding-Mode Control	23
3.1.3	Equivalent Control	24
4	CIRCUIT OPERATION	
4.1	Introduction	27
4.2	Design of the Active Power Filter Circuit	28
4.3	Design of the Controller	33
5	RESULTS AND DISCUSSION	
5.1	Circuit simulation and results	36
5.1.2	Effect of load waveform on filtering effectiveness	43