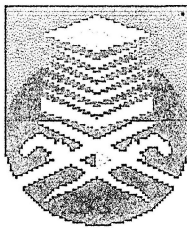


**SIMULATION OF A SINGLE PHASE INTER-TIE GRID
CONNECTED INVERTER**

**This project report is presented in partial fulfillment for award of the Bachelor of
Electrical Engineering (Hons)
UNIVERSITI TEKNOLOGI MARA**



IZELEIN HAJAR BINTI ZULKAFREE

Faculty of Electrical Engineering

UNIVERSITI TEKNOLOGI MARA

40450 SHAH ALAM SELANGOR

ACKNOWLEDGEMENT

In the most Name of Allah s.w.t Most Gracious Most Merciful

I would like to take this opportunity to express my gratitude to my supervisor, Assoc. Prof. Dr. Ahmad Maliki bin Omar for all the invaluable advises and supervision that have been provided to me throughout the year. His understanding and experiences with Power Engineering have guided me very well right from the starting to the end of path. Without his assistance, this project would not be possible.

I would like to extend my appreciation to my family who has provided me with not only financial support but have been constantly encouraging me through out this year of undergraduates learning. Not forgetting to Mohd. Aminnuddin bin Hajaruddin who have gave me moral support in completing this thesis. Without them, I would not have made it through.

Lastly, I would like to express my greatest appreciation for the support provided by all friends and to those who know and have contributed direct or indirect providing the morally support and encouragement towards the completion of this thesis.

ABSTRACT

This thesis presented a report on the performance of the grid connected inter-tie inverter. The information reported in this thesis includes the detailed analysis on the simulation progress based on the bridge topology using the PSIM simulation software. The system utilizes a single phase grid-connected inverter which can draw power from a solar energy input to be interfaced with 240V and 50Hz frequency as indicated in Malaysia.

The output voltage of the topologies required must be in sinusoidal waveform using the IGBT's as the power switching devices implemented through photovoltaic (PV) single-phase grid-connected inverter topologies, based on the bridge topology. In the same time, issues regarding to the output voltage and current with related to time at certain modulation index also being discussed.

The relationship and consequences of the inverter operating in both lead and lagging modes are demonstrated by using phase shift technique. The arguments are supported by the relationship between power and phase angle displacement.

Finally, this thesis also outlines the issues regarding with the operation of inverter using phase shift techniques, investigate on the Total Harmonics Distortion (THD), the incorporation of the filter and the feedback element which is Proportional Integrator (PI) and the limiter. The arguments are supported and verified using the PSIM simulation software.

TABLE OF CONTENTS

Chapter	List of Title	Page
	Declaration	i
	Acknowledgement	ii
	Abstract	iii
	Table of Contents	iv
	List of figures	vi
	List of tables	viii
	List of abbreviations	ix
1	INTRODUCTION	
	1.1 Introduction	1
	1.2 Background of project	4
	1.3 Objective of project	5
	1.4 Scope of work	6
2	LITERATURE REVIEW	
	2.1 Overview of the AC Inverter Topologies	7
	2.2 Filter Designing	7
	2.2.1 Low-Pass Filter	8
	2.2.2 High-Pass Filter	10
	2.3 Output Waveform Consideration	10
	2.3.1 Pulse Width Modulation (PWM)	11
	2.3.2 Sinusoidal Pulse Width Modulation (SPWM)	12
	2.4 Implementation of the SPWM by Sine Triangle Comparison	13
	2.5 Harmonics	14
	2.5.1 Total Harmonic Distortion (THD)	14
	2.6 Insulated Gate Bipolar Transistor (IGBT)	15
	2.6.1 Device Structure and Basic Characteristics	15
	2.7 The Power Switching Devices	16
	2.7.1 Devices Description	16
	2.7.2 Features and Application	17
	2.8 Inductor	17
	2.9 Comparator	18
	2.10 Capacitor	18
	2.11 Operational-Amplifier (Op-Amp)	19

3	CIRCUIT CONFIGURATION	
	3.1 Introduction	20
	3.2 Functions and Features of Inverters	20
	3.2.1 The AC frequency	20
	3.2.2 Magnitude of AC Voltage	21
	3.2.3 Waveform of the AC voltage	21
	3.3 Open Loop System Operation	21
	3.3.1 Modulation Index	23
	3.4 Closed Loop System Operation	24
	3.4.1 Feedback Control	26
	3.5 Control Section	27
	3.5.1 Proportional Integrator (PI) controller	27
	3.6 Power Factor	29
4	SIMULATION RESULTS	
	4.1 Simulation Results	31
	4.2 Open Loop System Operation	31
	4.3 Closed Loop System Operation	34
	4.3.1 Power generated	38
	4.3.2 Relationship of link inductance and power	43
5	DISCUSSIONS	
	5.1 Introduction	45
	5.2 Relationship between the Phase Angle Displacement and Power	46
	5.3 Total Harmonics Distortion (THD)	47
	5.4 Demonstration for a Utility Grid Connected Power System	47
6	CONCLUSIONS	
	6.1 Conclusions	49
	6.2 Future Development	50
	REFERENCES	52