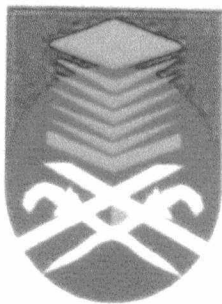


**CAPACITOR SWITCHING TRANSIENT  
IN SINGLE-PHASE AC REGULATOR CIRCUIT**

This thesis is presented in partial fulfillment for the award of the Bachelor of Electrical  
Engineering (Honour) by

**UNIVERSITI TEKNOLOGI MARA  
MALAYSIA**



NURASYKIN BINTI FAZIL  
Faculty of Electrical Engineering  
UNIVERSITI TEKNOLOGI MARA  
40450 SHAH ALAM,  
SELANGOR, MALAYSIA.

## ACKNOWLEDGEMENT

Syukur Alhamdulillah, thanks to Allah S.W.T. that gives me the time and strength also the opportunity to settle and complete this final year project as entitled “**Capacitor Switching Transient In Single-Phase AC Regulator Circuit**” although I have several problem, I manage to resolve it successfully.

I would like to express my sincere gratitude and appreciation to my project supervisor, Assoc. Prof. Dr. Mohd Fadzil b Saidon for providing me with valuable guidance, support, commitment, ideas and constructive comment during the course of this project.

My gratitude also to my beloved parents,

and also to my family for their love, inspirations and invaluable support throughout the years, for without them, I would never gone this far.

Lastly, very special thanks to our lecturers, classmate, housemate and all my friends who has help directly or indirectly in process of completing this final year project for their ever enduring support.

Thank you very much. Wassalam.

## ABSTRACT

This project presents the analysis of capacitor switching transient in single-phase AC regulator. Terminal capacitor switching is the process of improvement the power factor correction without altering the voltage or current to the original load. The main target of this project is to obtain the characteristic of the transient and resonant of the circuit in the presence of terminal capacitance with and without the supply inductance. The step-by-step design procedure, which involved many equations, have been implemented in this design. The project is designed using computer simulation via MATLAB.

The capacitor switching provokes transient current. This transient current can reach values ten times of the capacitor nominal current with duration of several millisecond<sup>[3]</sup>. The oscillation phenomenon of the capacitor switching transient result from the energy exchanged between the inductive and capacitive elements in the circuit. When existing of L and C in the circuit, it can create resonant. An increase in the value of L or C, or both L and C, will lower the resonant frequency of a given circuit. A decrease in the value of L or C, or both L and C, will raise the resonant frequency of a given circuit<sup>[2]</sup>. This disturbance can cause damage to electrical equipments. Possible solutions to the problems are also given in the last chapter.

# TABLE OF CONTENTS

<b>CONTENTS</b>	<b>PAGE</b>
Declaration	i
Acknowledgement	ii
Abstract	iii
Table of Contents	iv
List of Figures	vii
List of Tables	x
List of principal symbols and acronyms	xi
Abbreviations and acronyms	xii
<b>Chapter 1 INTRODUCTION</b>	
1.1 Introduction	1
1.2 Objectives	1
1.3 Methodology	1
1.4 Scope of work	2
<b>Chapter 2 LITERATURE REVIEW</b>	
2.1 Introduction	3
2.2 Paper review of recent works	3
2.3 Conclusion	7
<b>Chapter 3 CAPACITOR SWITCHING TRANSIENT</b>	
3.1 Introduction	8
3.2 Capacitor	8
3.2.1 Capacitor energized and de-energized	8
3.3 Transient	10
3.3.1 Switching capacitor transient	10
3.4 Resonance	11

3.4.1	Resonant frequency	11
3.4.2	Resonant circuits	14
3.4.2.1	Series resonant circuit	14
3.4.2.2	Parallel resonant circuit	15
3.5	Disadvantages of transient	17
3.6	Disadvantages of resonant	17

#### **Chapter 4 PROPOSEDWORK**

4.1	Introduction	18
4.2	Thyristor	18
4.2.1	The ideal thyristor	18
4.3	Circuits configuration and operations	20
4.3.1	Basic circuit arrangement of single-phase for analysis	20
4.3.2	Presence of terminal capacitance	22

#### **Chapter 5 DESIGN AND SIMULATION**

5.1	Introduction	25
5.2	Obtaining the terminal capacitance value	25
5.2.1	Conclusion	28
5.3	Simulation	29
5.3.1	Introduction	29
5.4	Parameters in MATLAB/SIMULINK	31
5.4.1	Thyristor	31
5.4.2	Pulse generator	32
5.4.3	Floating scope	33
5.4.4	AC voltage source	34
5.4.5	Simulation parameters	35
5.4.6	Series RLC load	36
5.5	The advantages of using MATLAB/SIMULINK	37

#### **Chapter 6 RESULTS AND DISCUSSIONS**