

**UNIVERSITI TEKNOLOGI MARA
CAWANGAN PULAU PINANG**

**INVESTIGATION AND IMPROVE
OF CURRENT RIPPLE FROM
RECTIFIER USING 3-PHASE
CONTROLLED RECTIFIER WITH
CAPACITOR-INDUCTOR (LC)
FILTER CIRCUIT**

MOHD HAZWAN AIZAT BIN BADRIHISHAM

Faculty of Electrical Engineering

July 2017

ABSTRACT

This project is proposed to investigate the effect of current ripple in rectifier. In practical operation of Alternating Current (AC) to Direct Current (DC) converter it cannot avoid current ripple when converting to DC side. Definition of ripple is the small unwanted residue existed in DC voltage which has been converted from AC voltage signal. In this paper presents, the minimum current ripple less than 1% were chosen for DC motor operate smooth condition. The DC motor also known as an example of instrument that sensitive to ripple present and lead the DC motor to totally shut down. From this problem, the design circuit must fulfill its requirement to make the value of ripple factor smaller and desirable. To satisfy with suitable ripple factor, 3-phase controlled rectifier with filter circuit has been implemented. The controlled rectifier has abilities to control firing angle, α . The effect of increasing the firing angle, α can minimize the output current ripple produced in the rectifier. Furthermore, the capacitor-inductor (LC) filter circuit is used to limit the ripple by using smaller value of inductor and capacitor compared to the value of inductor filter and capacitor filter. Hence, the output waveform produce contain of AC signal can be reduced. The project were conducted using 3-phase controlled rectifier with capacitor-inductor filter (LC), inductor filter (L) and also capacitor filter (C) circuit. These circuits were simulate by using MATLAB/SIMULINK software.

ACKNOWLEDGEMENTS

First, I want to express my gratefulness to God Almighty Allah for giving me an effort, wisdom and perseverance in completing Final Year Project for EE200 path. Thanks to everybody that deliver their help and sharing their abilities alongside the interval of Final Year Project.

A deep gratitude from me to my Supervisor Miss Noor Azila Bin Haji Ismail for her guidance, enthusiastic, encouragement and helpful evaluations in bettering this Final Year Project. I might also wish to thanks for advising and aid in preserving my development on time.

I extend my gratitude to any nameless reviewers along with my friends for his or her remark which very useful in bettering the satisfactory and presentation of this paper. Final but now not least, I need to express my love and gratitude to my cherished mom and dad and family members for his or her ethical support and encouragement for the duration of my learning process.

TABLE OF CONTENTS

CHAPTER	TITLE	PAGE
	AUTHOR'S DECLARATION	i
	ABSTRACT	ii
	ACKNOWLEDGEMENTS	iii
	TABLE OF CONTENTS	iv
	LIST OF TABLES	vii
	LIST OF FIGURES	ix
	LIST OF SYMBOLS	xi
	LIST OF ABBREVIATIONS	xii
1	INTRODUCTION	1
	1.0 Research Background	1
	1.1 Problem Statement	2
	1.2 Objectives	2
	1.3 Research Scope	3
	1.4 Thesis Organisation	3
2	LITERATURE REVIEW	5
	2.0 Introduction	5
	2.1 Cause And Effect On Dc Motor	5
	2.1.1 I^2R Loss and Skin Effect	5
	2.1.2 Audible Noise	6
	2.1.3 Stray Heating	6
	2.2 3-Phase Controlled Rectifier	7
	2.2.1 Silicon Controlled Rectifier (SCR)	8
	2.2.2 Mechanism Used In Controlled Rectifier	8
	2.3 Types of Filters	9
	2.3.1 Inductor Filter	9

CHAPTER 1

INTRODUCTION

1.0 RESEARCH BACKGROUND

Alternating Current (AC) to Direct Current (DC) converter is an important unit for DC power supply system due to rapid growth of industrial industry [1]. The demand use of heavy machine are increasing rapidly day by day. The machine has its own limitation in producing smooth running operation. The limitation of the machine occurs when the AC power is convert to DC power by using a rectifier circuit. When a sinusoidal voltage were converted from AC to DC voltage, the ripple exist in a voltage waveform.

Ripple is an unwanted AC signal component in DC output[2]. Although a ripple current of 5% may seem relatively low, it is still quite high in terms of absolute value when dealing with dc currents in the order of 10–100 kA. Ripple currents in the range of 1 kA with frequencies of 360 Hz and higher also have the potential of coupling with surrounding steel structures, thereby overheating them and possibly causing them to weaken and fail [3]. The effect of ripple may result in many classification. The first effect is the losses in I^2R , it is because in producing or generating a perfectly smooth dc current. The current must be distributed uniformly across the cross section of the conductor. When the current is generate alternating or has an AC component, the current tends to concentrate closer to the conductor surface. It is known as skin effect. Higher surface temperature and conductor losses were the effect of skin effect which offer higher resistivity to ripple current. Second, effect in instrumentation and communication it is cause by a noise induced current in instrumentation cable. To reduce the induction effect the shielded cable is used. Lastly, audible noise, it is occurs in metal laminating when the current ripple changing frequently [4]. Although, there is more ripple effect causes in a system. As a consequence, the effect current ripple may