SIMULATION OF A CURRENT SOURCE APF FOR A SINGLE PHASE SYSTEM FEEDING A NON-LINEAR LOAD

KHAIRUL NIZAM BIN NOH

FACULTY OF ELECTRICAL ENGINEERING
UNIVERSITY TEKNOLOGI MARA
MALAYSIA

ACKNOWLEDGEMENT

Alhamdulillah, all praises to Allah S.W.T., the Most Greatest and the Most Merciful for the guidance and blessing, because without it I cannot finished this final year project. I also wish to express my gratitude toward my final year project's supervisor, Miss Nor Farahaida binti Abdul Rahman for her guidance, invaluable help, encouragement and patience for all aspect from this final year project progress. Her numerous comments, advice and suggestion during the preparation of this final year project are gratefully praised. Mostly for her advice and patience on any problems that occurred during the project is invaluable and appreciated.

I would like to thank to all my friends that gives supports and helping me for finishing the thesis. Their support and help always give motivation and energy for me to finish the thesis. My appreciation also extended to all academic and non-academic member of Faculty of Electrical Engineering for their warm heart cooperation during my study period in Universiti Teknologi MARA Malaysia.

I also would like to thank to Yayasan Tenaga Nasional Berhad that gives financial support in form of educational loan during eight semesters of my study period. My appreciation also toward all technical staff and non-technical staff of Tenaga Nasional Berhad, Kuala Kangsar for their warm welcome and guidance during my internship period.

Heartfelt appreciation are expressed to my family members especially my parents. Without their guidance, support, encouragement and advices, I may never have overcome this long journey in my studies. When I felt down, their love will always give me strength to face all the problem happened.

Thanks you very much.

ABSTRACT

This thesis presents an implementation of a current source full bridge parallel active filter for minimizing the input current distortion in a single phase system feeding a nonlinear load. In this work, the switching frequencies for active power filter are varied to observe the input current waveform and the total harmonic distortion. In this method, a current source active power filter is used to inject an equal but opposite current to mitigate the distortion of the input current. The input current after the mitigation process will be nearly shaped as a sinusoidal and in phase with the supply voltage. Unipolar pulse width modulation technique is used to generate the switching signal to control the insulated gate bipolar transistor (IGBT) in the proposed active power filter. From the simulation result, the input current waveform after the mitigation was nearly shaped as a sinusoidal and the total harmonic distortion values become smaller (less than 5%) when the switching frequencies were increased. In order to study the operation and the effectiveness of the rectifier circuit with the proposed active power filter in reducing the harmonic was simulated using Matlab/Simulink.

TABLE OF CONTENTS

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF STUDY

Nowadays, people really concern about power quality supply by the utility company. This is because electronic equipment very sensitive to power changes. This problem happens because of the harmonic effect. A harmonic is a sinusoidal wave component having a frequency that is an integer multiple of the fundamental frequency. It can be represented by a Fourier series of pure sinusoidal waves which contain the fundamental frequency wave and its multiple called harmonics [2].

Harmonic distortion refers to the distortion factor of a voltage or current waveform with respect to a pure sine wave [3]. Most current distortion is generated by electronic loads, also called non-linear loads. Current distortion affects the power system and distribution equipment. It may directly or indirectly cause the loads destruction. Another indirect problem introduced by current distortion is called resonance. Certain current harmonics may excite resonant frequencies in the system. This resonance can cause extremely high harmonic voltages, possibly damaging equipment. Voltage distortion, on the other hand, directly affects loads. Distorted voltage can cause motors to overheat and vibrate excessively. It can also cause damage to the motor shaft. Even non-linear loads are prey to voltage distortion. Not only that, the large number of the power switches in a circuit can contribute a large power losses and switching stress [4].

Generally, there are two methods have been studied to solve harmonic current problem. Traditionally, a passive filter can be used to reduce the current from one or two specific harmonics. The passive filter elements are