ANALYSIS OF 2-LEVEL 3 PHASE SPACE VECTOR MODULATION

A proposal submitted in fulfillment of the requirements for the award of the degree of Bachelor of Electrical Engineering (Power)

SHAFIZAD BIN IZHAR

2008748093

Faculty of Electrical Engineering

MARA University of Technology

40450 Shah Alam, Selangor, Malaysia

JANUARY 2012

ACKNOWLEDGEMENT

I would like to thank the following respective individuals for their big contribution and guide towards in accomplishing this project.

First and foremost, I would like to thank my supervisor, Pn Wan Noraishah Bt Wan Abdul Munim, for her patience and guidance throughout the whole year for the completion my Final Year Project (FYP).

I would also like to thank my family members for always being there to support me all the time and give me the courage and strength that are necessary for me to carry on with this project.

Last but not least, I would like to thank all the lecturers that have taught me throughout my education in MARA University of Technology, and also to my fellow friends in campus and hometown.

ABSTRACT

Space vector modulation (SVM) is one of the best choice techniques of modulation to drive 3 phase load such as 3 phase induction motor. The power circuit of a 3 phase inverter consists of six IGBT, mosfet or other switching electronic equipment is used for turn ON and OFF at fast repetition rates and this switching device are selected based on good performance and characteristic.

This thesis presents an analysis of the Space Vector Modulation (SVM) waveform to obtain its spectrum. The main objective of modulation technique is to reduce the harmonic for DC to AC output voltage and analysis total harmonic distortion in SVM when using modulation index is 1. Simulation results are obtained using MATLAB/SIMULINK. It also can be implemented in FPGA software. Finally, Space Vector Modulation will generate output voltage higher and less total harmonic distortion.

The SVM technique has been deeply studied due to its performance benefits when compared with other modulation techniques. Research starts with the study of the relationships between the switching states of the mosfet and the output voltage in the typical 2-level topologies.

There are few of applications for Space Vector Modulation (SVM) such as three phase Voltage Source Inverters to control of AC Induction, Brushless DC, Switched Reluctance and Permanent Magnet Synchronous Motors.

CHAPTER 1

INTRODUCTION

The field of high-power drives has been one of the most active areas in research and development of power electronics in the last decades. Several industrial processes have increased their power-level needs, driven mainly by economy of scale (production levels and efficiency), triggering the development of new power semiconductors, converter topologies, and control methods.

1.1 Background Study

What is Space Vector Modulation?

Space vector modulation (SVM) is an algorithm for the control of pulse width modulation (PWM). It is used for the creation of alternating current (AC) waveforms. Most commonly to drive 3 phase AC powered motors at varying speeds from DC using multiple class-D amplifiers or power devices are operated as binary switches. There are various variations of SVM that result in different quality and computational requirements. One active area of development is in the reduction of total harmonic distortion (THD) created by the rapid switching inherent to these algorithms.

Pulse Width Modulation (PWM) has been studied extensively during the past decades. Many different PWM methods have been developed to achieve the following aim, which is wide linear modulation range, less switching loss, less total harmonic distortion (THD) in the spectrum of switching waveform and easy implementation and less computation time [1]. PWM methods were widely used in most applications. The earliest modulation signals for carrier-based PWM are sinusoidal [2]. An alternative method to PWM, Space Vector Modulation (SVM), places the converter in a number of states (correspond to the so-called space-vectors), which are determined by the ON/OFF state of its controlled switches [3].