DESIGN AND ANALYZE DIFFERENT TOPOLOGIES OF SINGLE PHASE MULTILEVEL INVERTER

by

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Report submitted in partial fulfillment
of the requirements for the degree
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DECLARATION SHEET

I hereby declare that my Final Year Project Thesis is the result of my research work under supervision of EN. BAHARUDDIN BIN ISMAIL. All literature sources used for the writing of this thesis have been adequately referenced.

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APPROVAL AND DECLARATION SHEET

This project report titled Design And Analyze Different Topologies Of Multilevel Inverter was prepared and submitted by Mohd Saifuddin Bin Yusoff (Matrix Number: 081090507) and has been found satisfactory in terms of scope, quality and presentation as partial fulfillment of the requirement for the Bachelor of Engineering (Electrical System) in Universiti Malaysia Perlis (UniMAP).

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ABSTRACT

Conventional inverters have limitation in high voltage and high power applications. Lately, multilevel inverters are popular for high power applications due to its improved harmonic profile and increased power ratings. There is a lot of literature regarding the topology and control techniques of multilevel inverters. Thus the purpose of this project is to analyze and compare the performance between three multilevel inverter topologies of a 7, 9, 11 level multilevel inverter. Simulation studies on the operation of the multilevel inverter are done using the PSIM9 software. Analyses on the performance of the three topologies are based on the fundamental voltage, output voltage waveform, output current waveform and total harmonic distortion (THD). The general concept of a multilevel inverter is to synthesize a sinusoidal voltage from several levels of voltages. By having more than two levels to build the sinusoidal voltage, harmonic distortion of the waveform is significantly minimized.

ABSTRAK

Penyongsang konvensional mempunyai batasan yang tertentu terutamaya dalam aplikasi voltan dan kuasa tinggi. Sejak kebelakangan ini, penyongsang pelbagai aras semakin mendapat tumpuan dalam pelbagai aplikasi kuasa tinggi kerana jumlah harmoniknya adalah sedikit dan meningkatkan penjanaan keluaran kadaran kuasa. Sekarang terdapat banyak kajian latarbelakang terhadap topologi dan teknik kawalan penyongsang pelbagai aras. Tujuan utama projek ini dijalankan adalah untuk menganalisis dan membandingkan diantara tiga topologi penyongsang pelbagai aras. Dalam projek ini, simulasi keatas operasi penyongsang pelbagai aras telah dilakukan dengan menggunakan perisian PSIM9. Analisis terhadap kedua-dua penyongsang adalah berdasarkan isyarat voltan dan arus keluaran, serta jumlah herotan harmonik. Konsep asas penyongsang pelbagai aras ialah dengan menghasilkan bentuk sinusoidal daripada beberapa aras voltan. Dengan adanya dua atau lebih aras voltan untuk menghasilkan bentuk sinusoidal, harmonik di gelombang keluaran dapat dikurangkan. Konsep asas penyongsang pelbagai aras ialah dengan menghasilkan bentuk sinusoidal daripada beberapa aras voltan. Dengan adanya dua atau lebih aras voltan untuk menghasilkan bentuk sinusoidal, harmonik di gelombang keluaran dapat dikurangkan.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF SYMBOLS, ABBREVIATIONS AND NOMENCLATURES

Ac	-	Amplitude of the carrier signal
Am	-	Amplitude of the modulating signal
CCMI	-	Capacitor-clamp multilevel inverter
DC	-	Direct current
DCMI	-	Diode-clamped multilevel inverter
E	-	DC voltage input
fc	-	Frequency of the carrier signal
fm	-	Frequency of the modulating signal
IGBT	-	Insulated gate bipolar transistors
m	-	Number of levels
ma	-	Amplitude modulation index
mf	-	Frequency modulation index
NPC	-	Neutral-point Clamped
PWM	-	Pulse Width Modulation
SPWM	-	Sinusoidal Pulse Width Modulation
SVPWM	-	Space Vector Pulse Width Modulation
THD	-	Total Harmonic Distortion