DYNAMIC EVOLUTION BASED CONTROLLER FOR SINGLE PHASE INVERTER

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With the name of Al-Mighty Allah

To my beloved the late mother,
To my beloved father,
To my beloved husband and sons
For their continues love, motivation, support and encouragement

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ABSTRAK

Kajian ini dilakukan bertujuan mengkaji satu kaedah baru bagi mengawal sebuah penyongsang satu fasa. Pendekatan yang digunakan adalah berdasarkan kepada skala masa dinamik di mana ia menggunakan pendefinisian algoritma matematik sebagai algoritma kawalan bagi penyonsang satu fasa tersebut. Dengan menggunakan hukum kawalan yang ditakrifkan daripada persamaan tidak linear penyongsang satu fasa, model bagi litar penyongsang satu fasa dibina dengan menggunakan perisian MATLAB SIMULINK. Selepas itu, penilaian terhadap prestasi bagi penyongsang tersebut diuji menerusi pelbagai nilai gangguan beban. Penilaian prestasi penyongsang diuji dengan melalui proses simulasi di dalam perisian MATLAB SIMULINK. Hasil daripada proses simulasi menunjukkan bahawa teknik yang dikaji di dalam kajian ini adalah bersesuaian untuk mengawal penyongsang satu fasa.

ABSTRACT

This thesis proposes a new control method based on Dynamic Evolution Control for a single phase inverter. A new approach for synthesis of inverter controller theory presented as well as a control law algorithm for the inverter is derived. By using the control law derived from the non-linear equations, the model of single phase inverter with the proposed controller is constructed in MATLAB SIMULINK. Then, the performance of the proposed dynamic evolution control under various load disturbances is verified through the simulation. Simulation progress and result show that the proposed technique is suitable for controlling the power single phase inverter.

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LIST OF SYMBOLS

Ω	-	Ohm
m	-	mili
h	-	Henry
μ	-	micro
∞	-	infinity
α	-	duty cycle

LIST OF ABBREVIATIONS

PWM	-	Pulse Width Modulation
THD	-	Total Harmonic Distortion

CHAPTER 1

INTRODUCTION

The power inverter that functions as a converter is the heart of a DC-AC conversion system whereby it's well designed is based on its ability to provide clean and stable ac output voltage regardless of the load type connected to it. Besides, the power inverter should have the ability to recover from transients caused by external disturbances as quickly as possible. Nowadays, with the proliferations of power converters connected as loads, the inverter is required to deliver non-linear output. This highly distorted currents may cause deterioration in the quality of the output voltage.[1] Furthermore, the design of controllers for power inverter systems presents the interesting challenges as for the past several decades, many controller techniques have been proposed for power inverter applications. Since power inverters are non-linear time varying system, therefore the design of it controllers must have the capability to cover-up the none-linearity and time-varying properties of the inverter system.

1.1 Problem Statement

Inverter which is known as dc to ac converter has its own characteristics in order to provide the clean power output. The switches that constructed in the inverter circuit must be well controlled in order to ensure the switching transition operates in correct rules. As principle operation of inverter, the switching transition time must be accommodate in the control of the switches. If there any overlap of switch “ON” times will result the short circuit. Hence, the method of controlling these switches in single phase inverter is proposed in this research work as to enhance the existing control techniques.

1.2 Objective

The main objective of this research work is to propose and execute a new control technique for the single phase inverter. The control method is named as Dynamic Evolution Control (DEC) as some of dynamic characteristic of the control part is considered in order to operate this new technique. Besides, the objective is to perform the simulation process onto the proposed Dynamic Evolution Control by using the software of MATLAB SIMULINK. The importance of the simulation process is to observe and analyze the performance of

the proposed controller, Dynamic Evolution Control under resistance load disturbances.

1.3 Scope of work

Single phase inverters that exist in the power electronics world need the enhancement in their controller. The focus in this work research is emphasized on the observation of the single phase inverter controller based on Dynamic Evolution Control (DEC) where the parameters of DEC is designed referred to the mathematical modeling of single phase inverter switching scheme. The characteristic of control part which is begin with the steady state representation is evaluated and followed by the error state of the controller is determined. Furthermore, the duty cycle that used to control the switching scheme of the inverter is obtained. The synthesize of the inverter controller and the analysis on the non-linear equations models is done by using MATLAB SIMULINK software. Hence, the observation on the inverter and the performance of controller under resistance load disturbances is obtained.

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