SAFE COMMUTATION STUDIES FOR SINGLE PHASE MATRIX CONVERTER OPERATION AS INVERTER

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Ketua Projek
Fakulti Kejuruteraan Elektrik
UiTM SHAH ALAM

Puan

KELULUSAN PERMOHONAN PERLANJUTAN TEMPOH PENYELIDIKAN
TAJUK PROJEK : SAFE COMMUTATION STUDIES FOR SINGLE PHASE MATRIX CONVERTER OPERATION AS INVERTER

Dengan segala hormatnya perkara di atas adalah dirujuk.

Institut Pengurusan Penyelidikan (RMI) telah menerima dan **meluluskan** permohonan perlanjutan tempoh penyelidikan daripada pihak puan sehingga 15 November 2009. Walaubagaimanapun, pihak puan adalah dimaklumkan supaya tidak membuat sebarang permohonan perlanjutan tempoh penyelidikan selepas ini.

Sehubungan itu, RMI berharap dengan perlanjutan tempoh penyelidikan ini dapat membantu pihak puan menghasilkan projek penyelidikan yang lebih baik dan lancar mengikut garis panduan yang telah ditetapkan dalam surat kelulusan RMI sebelum ini.

Sekian, harap maklum.

Terima kasih.

"SELAMAT MENJALANKAN PENYELIDIKAN"

Yang benar

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5.2 Enhanced Executive Summary

The aim of this project is implementation of safe commutation starategies on inverter operation by using Single Phase Matrix Converter topology. The main attribute of the new inverter topology is the fact that it generates an AC output voltage larger or smaller than the DC input one, depending on the instantaneous duty cycle or modulation index (MI). It works in implementation of conventional and buck-boost inverter by using Single Phase Matrix Converter (SPMC). The inverter can handle a wide range of DC input voltages and produce a fixed AC output voltage. The Sinusoidal Pulse Width Modulation (SPWM) with switching frequency up to 10kHz is used to synthesis the output waveform. An improved SPWM control method employing DC bias sine modulation wave is presented to optimize the inverter performance. Prior to its practical realization a computer simulation model is developed to investigate the behavior of the SPMC using Matlab/Simulink (MLS) and PSpice. An experiment Test-Rig was constructed to verify the operation. The XILINX FPGA schematic design was used for digital control implementation. Selected simulations and experimental result are presented to verify proposed operation.

5.3 Introduction

Electric power is the muscle of the modern industry and power electronics make its utilization smarter. The objective of power electronics is to improve the quality and utilization of electric power. Power Electronics have revolutionized the concept of power control for power converters and for control of electric motor drives. They are based primarily on the switching of power semiconductor devices.

Converter systems comprised switches, reactive component such as inductance, capacitance and transformers. They may be classified into four basic form of power conversion that includes; a) AC to DC Conversion, b) AC to AC Conversion, c) DC to AC Conversion and d) DC to DC Conversion. There are cases where it is convenient to generally define these converters in terms of its four quadrant operation.

In this thesis, a review was carried out on basic single phase converter operation for energy conversion including advanced converter topology; offering many advantages over traditional topologies such as ability to regenerate energy back to the utility [1] and are fully controllable. Recently there has been considerable interest in the potential benefits of matrix converter technology, especially for applications where size, weight and long-term reliability are important factors [2]. Amongst the many matrix converter research; focused has been found mainly on the three phase matrix converter, whilst the single phase matrix converter received less attention. Various switching devices are outlined with IGBT as the preferred choice.

This thesis presents work in implementing Single Phase Matrix Converter (SPMC) as inverter operation. This is then extended to an buck-boost inverter operation with the output synthesized using Sinusoidal Pulse Width Modulation (SPWM) techniques. Safe commutation schemes were implemented to avoid damaging voltage and current spikes [3] that has limited the growth of matrix converter research for almost 25 years. Full bi-directional capabilities are investigated made possible due to its symmetrical