SINGLE PHASE MATRIX CONVERTER (SPMC) AS RECTIFIER OPERATION CONTROLLED USING XILINX FPGA

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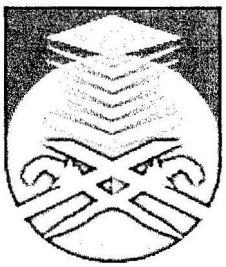

MD AZWAN BIN MD YASIN

Faculty of Electrical Engineering

UNIVERSITI TEKNOLOGI MARA

40450 SHAH ALAM

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ABSTRACT

This work presents a single phase matrix converter topology (SPMC) as a rectifier (AC-DC) controlled using Xilinx Field Programmable Gate Array (FPGA). Insulated Gate Bipolar Transistor (IGBT) was used for its power circuits, with Xilinx FPGA at heart of its digital control implementations. Pulse Width Modulation (PWM) technique was used to calculate the switch duty ratio to synthesize the DC output. Computer simulation model was developed using MATLAB/Simulink (MLS) to study the basic behavior of SPMC. Resistor and inductor were used as a load. Safe commutation strategies were developed through an arrangement of commutation switches that allows dead time to avoid voltage spikes due to inductive load then experimental Test-Rig was constructed to verify the operation. Simulation and experimental results for with commutation and without commutation strategy are presented to verify proposed operation.

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CHAPTER 1

INTRODUCTION

1.0 BACKGROUND OF STUDY

Power electronics is the applications of solid-state electronics for the control and conversion of electric power. The objective of power electronics is to improve the quality and utilization of electrical power based on the switching of power semiconductor devices such as diodes, thyristors and transistors. Power electronic converters can be found wherever there is needs to modify the form of electrical energy such as modify its voltage, current or frequency. The power range of these converters is from some milliwatts (such in a mobile phone) to hundreds of megawatts (such in a HVDC transmission system). With "classical" electronics, electrical currents and voltage are used to carry information, whereas with power electronics, they carry power. Thus, the main metric of power electronics becomes the efficiency. The power range of these converters is from some milliwatts (as in a mobile phone) to hundreds of megawatts (such as in a HVDC transmission system). With "classical" electronics, electrical currents and voltage are used to carry information, whereas with power electronics, they carry power. The power conversion systems can be classified according to the type of the input and output power such as AC to DC (rectifier), DC to AC (inverter), DC to DC (chopper) and AC to AC conversion.

This thesis is a research on rectifier operation based on single phase matrix converter (SPMC) where Insulated Gate Bipolar Transistor (IGBT) was choose as power switching device. The Matrix Converter (MC) is a modern and advanced power conversion topology which offers many advantages over traditional topologies such as fully controllable and has ability to regenerate energy back. Previous studies are focused on Three-Phase Matrix Converter (TPMC) topologies although SPMC offering very wide