

Single Phase Matrix Converter for Boost Inverter Operation Controlled Using Xilinx FPGA

This thesis is presented in partial of fulfilment for the award of the
Bachelor of Electrical Engineering (Hons)
UNIVERSITI TEKNOLOGI MARA (UiTM)
SHAH ALAM, MALAYSIA
(2011)



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ACKNOWLEDGEMENT

All praises be to Allah, Most Gracious and Merciful with also bless and regard to Nabi Muhammad S.A.W, his companion and the people who follow his path. Thanks to Allah S.W.T who has given me strength and ability to complete this project.

I would like to express my gratitude to my project supervisor, Mdm. Siti Zaliha Binti Mohammad Noor who has encouraged with great ideas, opinion, valuable guidance and support in order to complete this project. My deepest gratitude and thank also to my beloved parents for their endless support and understanding; staff of Faculty of Electrical Engineering who which have help toward the completion of this project. May Almighty Allah bless and give reward to them for their generosity.

Lastly, I want to express my greatest gratitude to all my friends who have been giving me advice and opinion to complete this thesis whether it is directly or indirectly.

The kindness, corporation and support from all of the above mentioned people would always be remembered and only Allah S.W.T could repay their kindness.

ABSTRACT

This thesis is concerned on Field Programmable Gate Array (FPGA) design for control implementations of the Single Phase Matrix Converter (SPMC) operating as a Boost Inverter. The main attribute of the boost inverter topology is the fact that it generates an ac output voltage larger than the dc input voltage depending on the instantaneous duty cycle. The Single Phase Matrix Converter (SPMC) power circuit uses the Insulated Gate Bipolar Transistor (IGBTs) as power switching devices. The Sinusoidal Pulse Width Modulation (SPWM) technique is used to synthesize the output voltage. XILINX Field Programmable Gate Array (FPGA) was used as a digital controller of the converter. The selected simulation results are presented to verify the proposed operation of boost inverter.

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CHAPTER 1

INTRODUCTION

1.0 BACKGROUND OF STUDY

Power electronics refers to control and conversion of electrical power by power semiconductor devices where in these devices operate as switches. Power electronics systems are found in virtually every electronic device. 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 whenever 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 miliwatts (such in a mobile phone) to hundreds of megawatts (such in a High Voltage Direct Current 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 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 boost inverter operation based on single phase matrix converter (SPMC) where Insulated Gate Bipolar Transistor (IGBT) was chooses 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