DIGITAL CONTROL DESIGN FOR SINGLE-PHASE MATRIX CONVERTER (SPMC) AS A CYCLOCONVERTER

Project Report is presented in partial of fulfillment for the award of the Bachelor of Electrical Engineering (Hons) of UNIVERSITI TEKNOLOGI MARA

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ABSTRACT

This report will focused on to design digital control for Single Phase Matrix Converter (SPMC) to operating as a cycloconverter. In this project, PIC and Xilinx FPGA were used to improve the digital control. The input for PIC will be come from Modulation Index circuit and Voltage Sensor circuit. This PIC will convert the voltage sensor output which is in sinusoidal signal into square wave signal. As long as the output from Modulation Index circuit is already in digital form so this PIC doesn't do any complicated function, it just moved the data from the input to output port. The output from PIC will interface with Xilinx Board to create SPWM. This modulation index data were used to adjust the amplitude of sinusoidal wave which is created inside Xilinx as needed before it will compared with triangular waveform also created inside Xilinx. After the comparison it will create Single Pulse Width Modulation (SPWM). This SPWM is useful to drive gating circuit. The output from voltage sensor will ensure that the output from Xilinx FPGA is synchronous with the frequency of the single phase output voltage. Then the state selector will determine and implement the operation of required switching state. The output will be check on the oscilloscope.

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF PROJECT

Power electronics refer to control and conversion of electrical power by power semiconductor devices wherein these devices operates as switches. Silicon-controlled rectifiers (SCR), led to the development of a new area of application called the power electronics. Once the SCRs were available, the application area spread too many fields such as drives, power supplies, high frequency inverter, and power electronic originated.

Power electronics has applications that span the whole field of electrical power systems, with the power range of these applications extending from a few VA/Watts to several MVA/Watts. The main task of power electronics is to control and convert electrical power from one form to another. Amongst techniques that could be explored includes; a) the use of Power System Block Set in MATLAB/Simulink relating to physical representation of models, b) use of Xilinx Foundation Series (Project Manager) simulation. To ascertain validity of other proposals prior to developing other applications, the SPMC as a direct frequency changer in [1] were used in this work as a comparison. The output is being synthesized using the well-known SPWM technique.

Power electronic converters may be classified into four categories on the basis of the type of the source and the type of desired output characteristics. The four main forms of conversion are:

i. AC-AC Conversion also known as 'Cycloconverter' and 'Cyclo-Inverter' converting an AC voltage to another AC voltage.

ii. AC-DC Conversion also known as 'Rectifier' where it converts an AC input voltage to a DC output voltage.

iii. DC-AC Conversion also known as 'Inverter' where it converts a DC input voltage to an AC output voltage