BUCK-BOOST INVERTER USING SINGLE PHASE MATRIX CONVERTER TOPOLOGY

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ABSTRACT

The aim of this project is about a buck-boost inverter 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 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) 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). 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.

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CHAPTER 1

INTRODUCTION

1.0 BACKGROUND OF STUDY

The main task of power electronics is to control and convert electrical power from one form to another. For the control of electric power or power conditioning, the conversion of electric power from one form to another is necessary and the switching characteristics of the power devices permit these conversions. A converter may be considered as a switching matrix. The matrix converter is an advanced circuit topology capable of converting all converters and could be realized in practice as a powerful solution of making an all silicon solution system. A matrix converter offers many advantages over traditional topologies, such as the ability to supply energy back to the utility. The switching algorithms for the matrix converter need to be designated carefully in order to ensure that the switches do not short circuit the voltages sources, and do not open the current sources, thus the continuous current must available at the input terminal are needed. The first study about Matrix Converter was realized by Zuckerberger [1]. It is a frequency step-up and fundamental voltage step-down converter. In application, where only voltage regulation is need, the family of Matrix Converter AC-AC converter has merit such as providing a larger range of output voltage with buck-boost mode, reducing in-rush and harmonic current.

The problem of commutation in SPMC occurs when inductive load is used. The use of PWM type of switching algorithm in SPMC will result with possible switching spikes