PASSIVE FILTER STUDIES ON SINGLE PHASE MATRIX CONVERTER (SPMC) OPERATING AS A RECTIFIER

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ABSTRACT

This paper presents the application of single phase matrix converter (SPMC) as an AC-DC controlled rectifier. For basic operation, the multiple PWM technique was used as a switching technique to synthesize the output. Besides, commutation strategy was developed to avoid overlapping during turn ON and turn OFF state of the IGBTs when inductive loads are used.

The use of LC filter at the DC side of the rectifier in order to get the purely DC where the capacitor holds the output voltage at the constant level and inductor smooth the current from the rectifier will create a non sinusoidal current supply hence generated current harmonic which are injected back to the AC system. Filtering requirements for current-source rectifiers are usually satisfied through the use of Passive Filter which is low-pass LC input filters.

Design of LC filters involves the positioning of the resonant frequency to meet the harmonic attenuation requirements. Besides, this application can also eliminate the supply current to be sinusoidal and in phase with the supply voltage. Simulated results are presented by using MATLAB/Simulink to validate the design approach.

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TABLE OF CONTENTS

CHAPTER	DESCRIPTION	PAGE
1	**INTRODUCTION**	
	1.1 Introduction	1
	1.2 Converter Classification	2
	1.3 Objective	3
	1.4 Organization of Thesis	3
2	**SINGLE PHASE MATRIX CONVERTER (SPMC)**	
	2.1 Introduction	4
	2.2 Single Phase Matrix Converter	4
	2.3 Bi-directional Switch	5
3	**SWITCHING STRATEGIES OF SPMC**	
	3.1 Introduction	7
	3.2 Insulated Gate Bipolar Transistor (IGBT)	7
	3.3 Switching State of SPMC	10
4	**CONTROLLED RECTIFIER**	
	4.1 Basic Concept of Rectifier	13
	4.2 Single Phase Diode Bridge Rectifier	14
	4.3 Effect of Capacitor Filter	14
	4.4 Rectifier Using SPMC	17

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

The Matrix Converter (MC) is an advanced circuit topology that offers many advantages such as the ability to regenerate energy back to the utility, sinusoidal input and output current and controllable input current displacement factor [1]. Besides, it has the potential of affording an "all silicon" solution for AC-AC conversion, removing the need for reactive energy storage components used in conventional rectifier-inverter based system. This circuit topology was first proposed by Gyugyi [2] in 1976. Obviously published studies mainly dealt with three-phase circuit topologies [3-5]. The Single-phase matrix converter (SPMC) was first realized by Zuckerberger [6].

There was four types of matrix converter, which relates to the type of power conversion; DC-AC, AC-DC, DC-DC and AC-AC. Since matrix converter was originally introduced, it has received considerable attention because it offers many advantages as described above. The size of the converter also is reduced since there are no large reactive components for energy storage [7].

The most important element of matrix converter is the switching strategy for the four quadrant switches. The switching strategy will result in the input source being converted to the desired output through matrix converter. PWM was used as the switching technique for the four-quadrant switches.
The switching technique will result in the selective four-quadrant switches on and off only at appropriate time. Applying the switching strategy and switching technique will produce the desired output that is synthesized from the input source of the matrix converter.