PASSIVE FILTER STUDIES ON SINGLE PHASE MATRIX CONVERTER (SPMC) OPERATING AS AN INVERTER

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HADZIRATUL QUDSIAH BT ABDUL AZIZ
2004257342
B. ENG (Hons.) ELECTRICAL
Faculty of Electrical Engineering
UNIVERSITI TEKNOLOGI MARA (UiTM)
SHAH ALAM, SELANGOR DARUL EHSAN

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ABSTRACT

This report presents the analysis of passive filter studies for inverter applications on single phase matrix converter (SPMC). Basically, the input for inverter application is based on DC with the output in the form of AC which is using well-known Sinusoidal Pulse Width Modulation (SPWM) unipolar switching technique. Loads are represented in the form of resistance. Filter has been used due to its function to reduce harmonic content of the SPMC output waveform. This project will review the conventional passive filter design technique particularly to the LC low-pass filter design. By using this technique and basic formula, the value of inductor (L) and capacitor (C) components can be found through an iterative method. Voltage and current output harmonics are analyzed and corrected by LC low pass filter circuits. LC filter are designed at the DC (input) side as well as at the AC (output) side and simulated on MATLAB/Simulink (MLS). Studies on the effect of inductor (L) and capacitor (C) that acts as a filter for these circuits also have been covered. The comparisons between the simulation model with and without filter can be seen where it will affect the output waveform to become the desired sinusoidal output.

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CHAPTER 1

INTRODUCTION

1.1 Background Of The Project

Power electronics refers to control and conversion of electrical power by power semiconductor devices where these devices operate as switches. The four main forms of converters are:-

i) 'Rectifier' where it converts an AC input voltage to a DC output voltage

ii) 'Inverter' where it converts a DC input voltage to an AC output voltage

iii) 'Chopper' where it converts a DC input voltage to another DC output voltage.

iv) 'Cycloconverter' where it converts an AC input voltage to another AC output voltage.

The matrix converter (MC) is an advanced circuit topology which is capable of converting AC to AC, AC to DC, DC to DC and DC to AC. It is firstly proposed by Gyugyi [1] in a book in 1976 where it is mainly dealt with three-phase circuit topologies. The Single-phase matrix converter (SPMC) was first realised by Zuckerberger [2]. The SPMC offers many advantages over the conventional variable speed drives such as the ability to regenerate energy back to the utility, draws sinusoidal input and output current after filtering and also requires no large reactive components for energy storage [3].

In this paper, the DC-AC SPMC is used for the passive filter studies which focus on LC low-pass filter design. The main purpose of this project is to show that the LC low-pass filter can be apply for the DC-AC SPMC applications as well as to reduce harmonic content of the SPMC output waveform. An inverter converts a DC input to the sinusoidal AC output. However, practical inverters are nonsinusoidal and contain certain harmonics. So by using suitable filter, the harmonic can be removed to produce the beautiful sine wave and provide unity power factor operation.