An Indirect Matrix Converter using Simple Commutation Method Based on AC/DC/AC Converter

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Abstract: *Most research work about matrix converters has so far regarded the modulation and control of the matrix converter. The practical experience is still very limited. In this paper presents an indirect matrix converter using simple commutation method base on AC/DC/AC converter. It combines the control method between the rectification stage and the inversion stage which can largely simplified modulation in rectification stage and all bidirectional switches at line side turn on and turn off at zero current. MATLAB/Simulink modeling and simulation of the matrix converter feeding an R load was carried out. The experimental results at variable frequency are presented.*

***Keywords*:** *Matrix converter, AC energy, switches*

1. CONTROL METHODS OF THE MATRIX CONVERTER

The architecture of matrix converter technology is presented in this chapter. The matrix converter concept is introduced with the mathematical model circuit operation and associated modulation techniques. The modulation techniques section of this chapter present the main modulation techniques used in matrix converters. The techniques are as follows.

- Venturini Methods
- Space Vector Modulation Techniques

1.1 VENTURINI METHOD

By the help of nine bidirectional switch we can calculate the duty cycle after getting the set of three input voltage with fixed frequency and amplitude.After input given it generates the three phase output waveforms as a result . By using the result we connect the load for obtained desirable reference waveforms, the input currents of magnitude I_i and angular frequency ω_i should be in-phase with the input voltages. To attain the above features, a mathematical approach is employed. The relationship between the input and output voltages and that of the output and input currents .

1.2 SPACE VECTOR MODULATION (SVM) METHOD

The concept of a “Space Phasor" is very important in the analysis of the space vector modulation method (SVM). This method is well known in conventional PWM inverters. The “Space Phasor" was originally a method used for representing and analyzing three-phase machines. This method of analysis is specially popular with researchers in the area of vector control. It has permission to the visualization of the spatial and time relationships between the resultant current and flux vectors in various reference frames.Matrix Converter operation can be explained in more general terms using a space vector approach. At the time of operation only one switch must be conduct during operation as a result it achieve twenty seven possible ON and OFF condition

2. TYPES OF MATRIX CONVERTER

There are so many different types of matrix converter oh basis of input and output these are follows:

1) 1 Phase to 1 phase Matrix Converter
2) 2 phase to 1 phase Matrix converter
3) 3 Phase to 1 Phase Matrix Converter
4) 3 phase to 3 Phase Matrix Converter

2.1 SINGLE PHASE MATRIX CONVERTER

The Single-Phase Matrix Converter consists of a matrix of input and output lines with four bidirectional switches connecting the single-phase input to the single-phase output at the cross conection. It compare the all four ideal switches S_1, S_2, S_3 and S_4 capable of conducting current in each directions, blocking forward and reverse voltages and switching between states without any delays.

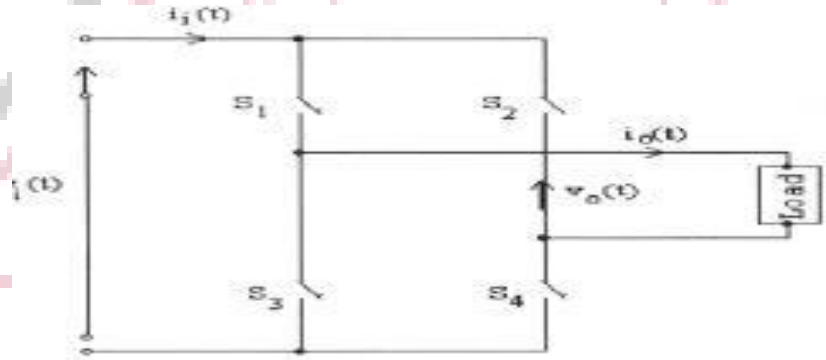

Figure 2.1 Representation of single phase matrix

2.2 TWO PHASE TO SINGLE PHASE MATRIX CONVERTER

The Fig.2.2 shows a schematic of a Two Phase to Single Phase Matrix Converter.The converter is combined of two bidirectional switches S_1 and S_2. Both switch connects to each other in single line the output line to an input phase. To neglect short-circuit in the supply-side and current blocking in the load side only one switch can and must be on at any time.

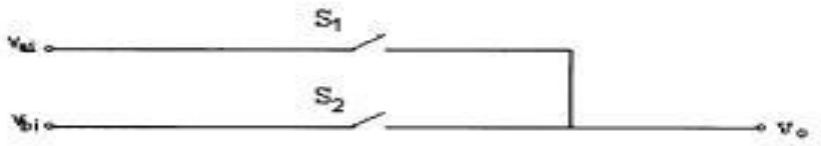

Figure 2.2 Representation of two phase to single phas

2.3 THREE PHASE TO SINGLE PHASE MATRIX CONVERTER

A Three Phase to Single- Phase Matrix Converter is shown in Fig.5.10. The converter is combined of three bidirectional switches S_1, S_2 and S_3. Each switch inter-connect the output line to an input phase. To neglect short-circuit in the supply-side andcurrent blocking in the load side only one switch can and must be on at any time. The switches are turned on and off in sequence one by one and cyclical way. For the jth switching period, if t^j_b t^j_2 and t^j_3 are the on-time intervals of S_1, S_2 and S_3, respectively.

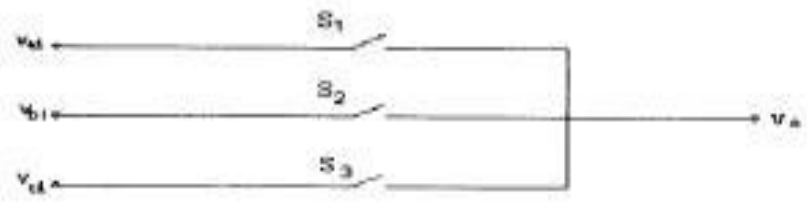

Figure 2.3 Representation of a Three Phase to Single Phase Matrix Converter

2.4 THREE PHASE TO THREE PHASE MATRIX CONVERTER

A Three-Phase to Three-Phase Matrix Converter structure similar in some part based on the Three-Phase to Single-Phase Matrix Converter. The structure of a three-phase to three-phase Matrix Converter is shown in Fig. 5.12 The converter consists of nine bidirectional switches (S_{aa}, S_{ba}, and S_{ee}) whose operations are according by a number of switching system.

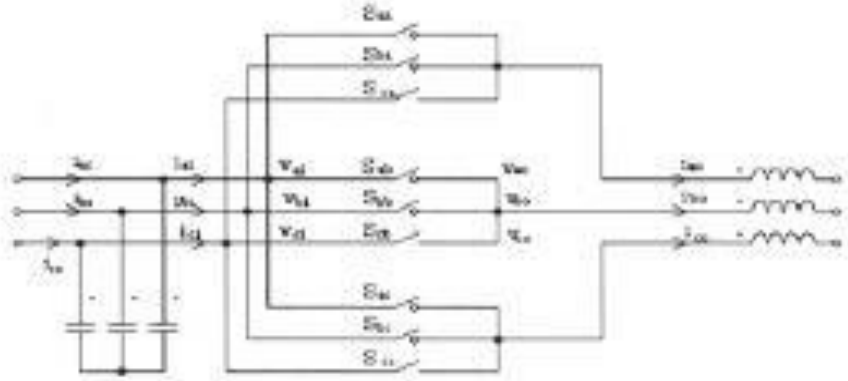

Figure 2.4 Representation of a Three Phase to Three Phase Matrix Converter

3. SIMULATION RESULTS

Simulation result for 25Hz

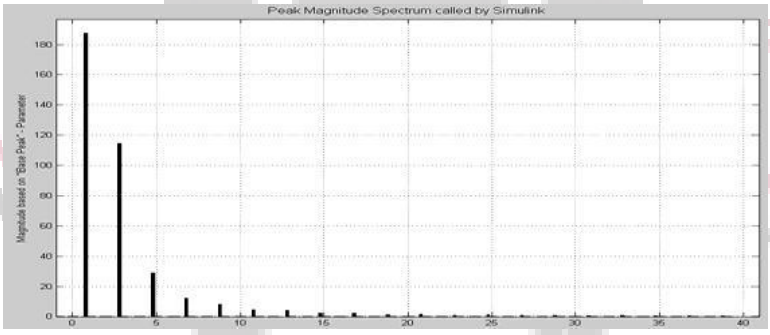

Fig 3.1 Harmonics without filter

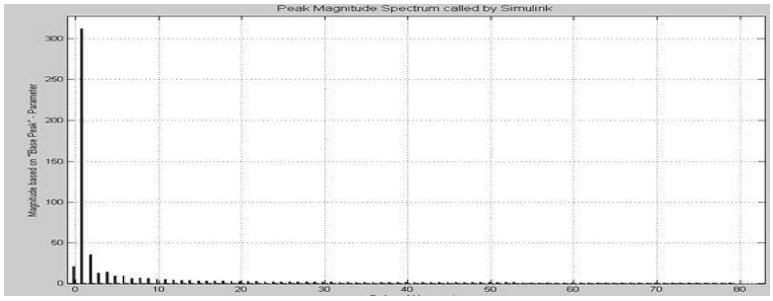

Fig 4.2 Harmonics after filtration

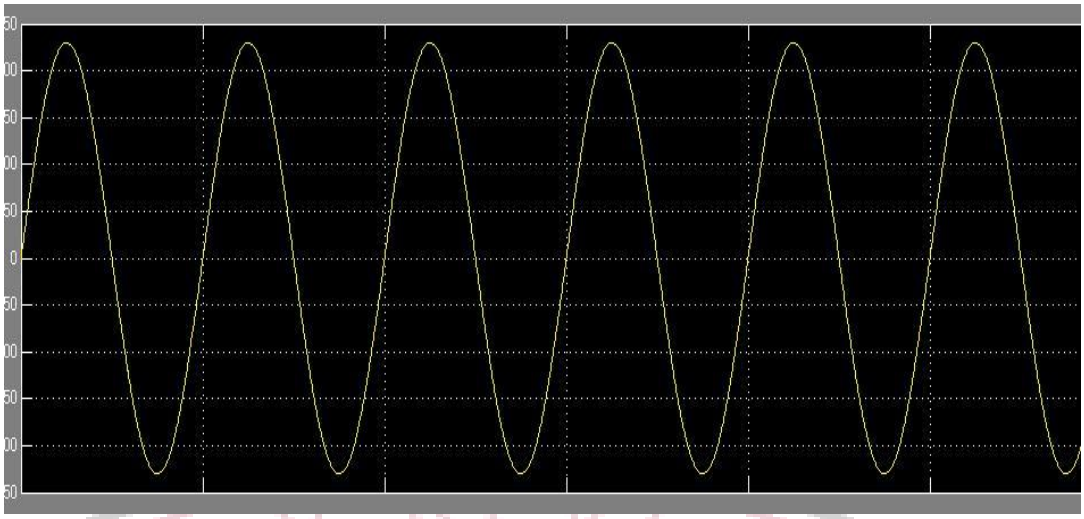

Fig 4.3 Input voltage of 50Hz

Fig 2.4 Output voltage of 25Hz without filter

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