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Design of Three Phase Matrix Converter AC-AC Utility Power Supply using SPWM Technique

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ABSTRACT

This paper describes the control analysis and design of an three phase matrix AC-AC utility power supply .The SPWM modulation techniques is used to control the desired output voltage and gives the control output voltage and reduced input harmonic distortions .In this Matrix converter Input is directly connected to output no DC link components is required. Simulation had been done using mat lab simulink and Simulated results are observed

Keywords – bidirectional switch, Matrix converter, Mat lab Simulink, spwm

I.   Introduction

Up till now most of the work has been done on matrix converter. Matrix converter has been recognized to propose an "all silicon" solution for AC-AC conversion that is used to eliminate the need for components of reactive energy storage used in till today's rectifier-inverter based system.One of the main contributions of [1] is to develop a accurate mathematical analysis to express the converter's low-frequency behavior. As per [1] [2],the output voltages are obtained by the multiplication of the modulation that is transfer matrix with the input voltages. The main essential characteristics of MCs are as follows , i) a easy and compressed power circuit; ii) production of load voltage with random frequency as well as amplitude; iii) sinusoidal input and output currents; iv) process with unity power factor; and v) restoration capability,. Although   the advances in power electronic tools and also not only the production of high-speed but also high-performance, DSPs are .some of the characteristics of a matrix converter.. One of the greatest difficulties in the process of this converter was the commutation of the bidirectional switches. After lots of serious research, the progress of this converter is reaching industrial application.   On the other side, every modulation strategies requires a definite modeling of a matrix converter that required for controller design. A new general restriction on the input of reactive power of the matrix converter like a function of the converter voltage gain and also output reactive power is getting deduced. Goal of this paper is to apply SPWM modulation approach to control circuit that controlled bidirectional switches like main power elements which create a changeable output voltage

system with clear frequency. It does not have any dc link circuit that allows high-Frequency operation

II.   Proposed System
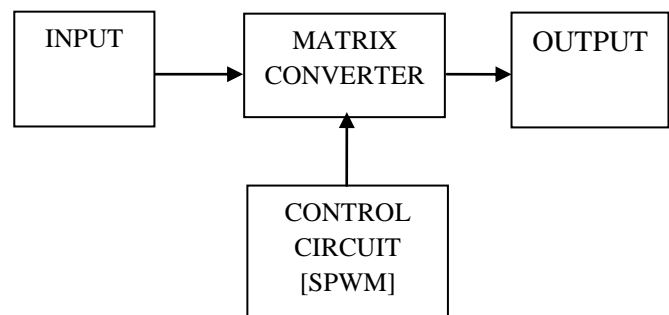**2.1Block Diagram**

Fig.1. Block Diagram of AC-AC Matrix Converters with control circuit

The Block Diagram is shown in figure above it consists of Matrix Converter and control circuit. AC input is given to matrix converter. This Matrix Converter is controlled by control circuit. The control circuit consists of SPWM Modulation Strategy. Control AC output is obtained with high frequency at output.It has brought significant attention in using static power transfer techniques to have very high performance ac power supplies.

2.2. Implementation of Three Phase Matrix Converter System

The Three Phase Matrix Converter system build up of a matrix of input and output lines with nine bidirectional switches that connecting from the three phase input to the three phase output at the point of intersection The Three Phase Matrix Converter

system is illustrated in Fig. 2. AC input is given and Controlled AC output voltage is obtained. It comprises nine bidirectional switches S1-S18 of each switch as shown in fig.2.The vital part of the full system is the meeting the performance of control loop mainly at the resonant output filter , in terms of which mostly problems for control output waveform occurs when load is shed .To over come this problem and to control the bidirectional switches for the

commutation problem. In system by using Control Circuit in which SPWN modulation technique is used at different switches sothat we get controlled AC output waveform with high frequency.(as low or high frequency).

2.3. Control Circuit using Sinusoidal Pulse Width Modulation

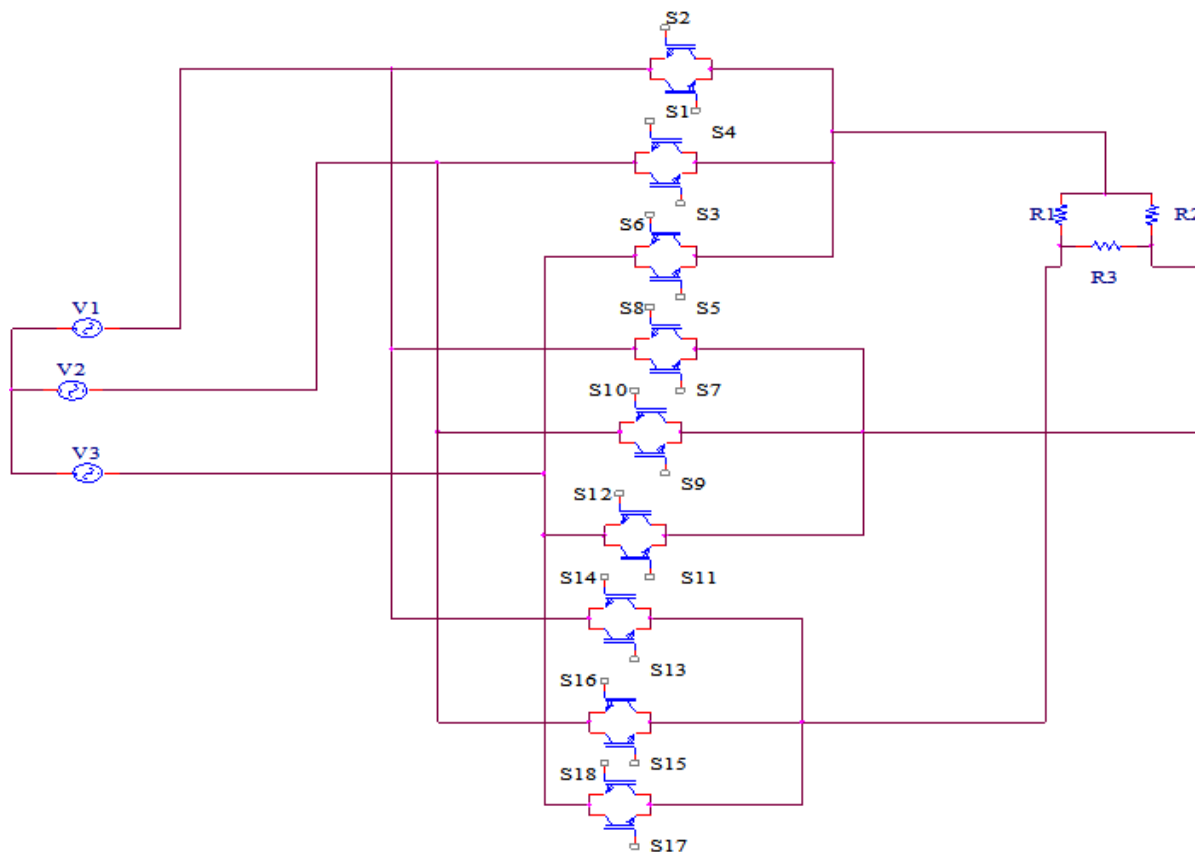Various and special aspects of this arrangement need to considered for a high-quality control design.

Fig.2.Three Phase Matrix Converter system

In which Output filter, load, modulation, and sampling delays are the important part need to be consider for the control so that it will not affect the output-voltage. However, matrix converter itself is a silicon solution to eliminate the dc link component and provide AC-AC conversion .In matrix converter bidirectional switches play important role which are capable of blocking voltage and conduction current in both direction But bidirectional switches are not directly available, discrete devices used to make the bidirectional switches. Mainly bidirectional switches used now a days are common emitter bidirectional switch cell arrangement consists of two diodes and two IGBTs connected in antiparallel .Commutation problem is main problem to be consider in implementing the matrix converter related to bidirectional switch .To over come this we are using

control circuit in which SPWM technique is used. The Sinusoidal Pulse Width Modulation (SPWM) is a famous wave determining method in power electronics as shown in Fig. 3. A high frequency carrier signal, v_c, of shape triangular is compared with a reference signal, v_r, of shape sinusoidal of the preferred frequency. The intersect points are used to establish the switching instants. The ratio of the reference signal (v_c) to triangular signal (v_r) of their magnitude is well-known as the modulation index (mi). The magnitude of fundamental component of output voltage is proportional to mi. The amplitude Vc of the triangular signal is generally kept constant. By varying the modulation index, the output voltage could be controlled.
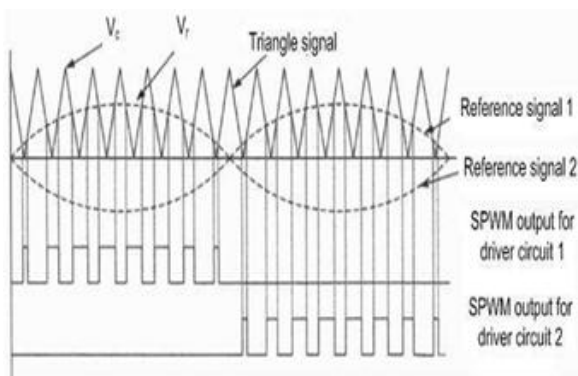
Fig.3.Formation of SPWM

III. Simulated Model

In order to verify the operation of the proposed system the prototype model in the matlab simulate model has been prepaid. The simulated model is as shown in the fig 4 . In the proposed system the three phase AC is given as a Input and we get control AC output. To get a control AC output voltage waveform we are using SPWM technique.
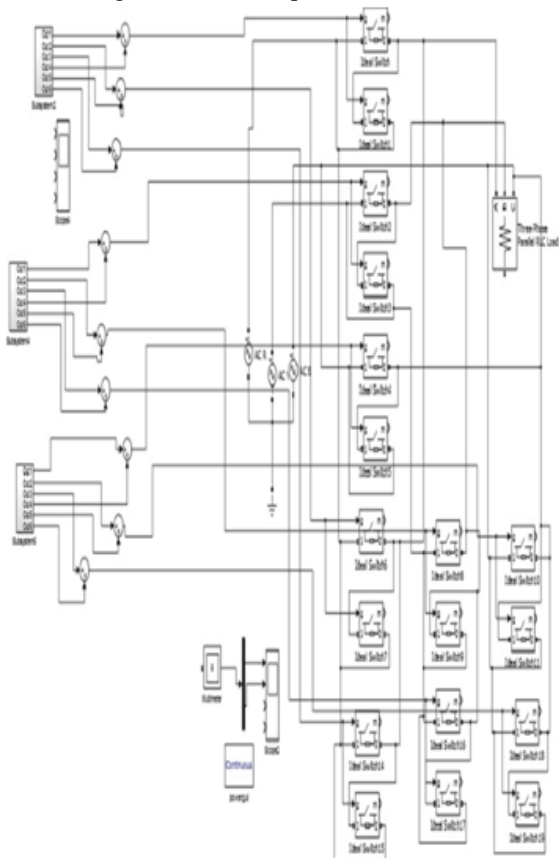

Fig.4.Simulated model of proposed system

3.1. Simulated Result

Simulated result as shown in the Fig.5. in Fig 5.a. Ac input is given to the system and desired Ac output is obtained as shown in Fig.5.b. In Fig.5.c. we can see separate ac input R Y and B given to system and we get desired output across load RLC of R Y and B.
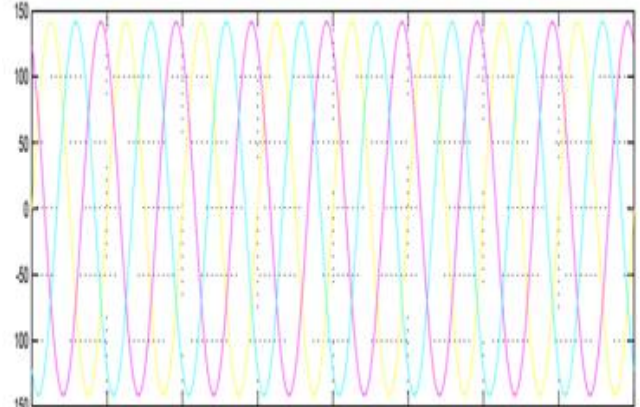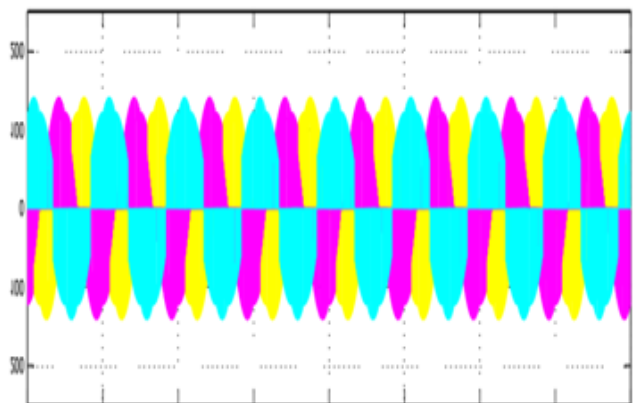

Fig.5.a.Input Waveform of the System
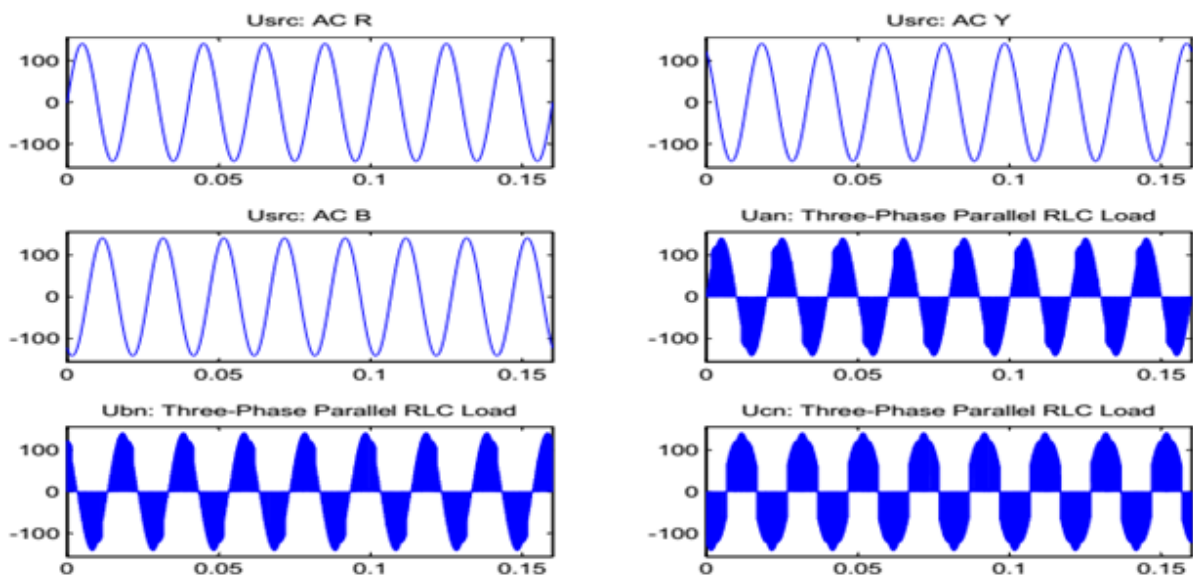

Fig.5.b.Desired Ac output Waveform of the Syste

Fig.5.c.Input and output waveform Simulated model of R Y and B across load RLC

IV. Conclusion

The proposed ac- ac power supply systems show the ability to generate a high-quality 50-, 60-, and 400-Hz sinusoidal waveform in the steady state and to cope with the most severe transient situations that can occur during normal operation. The proposed scheme uses a three-phase-to-three-phase matrix converter performing the static power conversion to provide a compact solution with no dc link and high quality input waveforms with reduced harmonic and less THD

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