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MODELING OF THREE PHASE FOUR SWITCH RECTIFIER BY ZERO VOLTAGE SWITCHING

Sumitranandan Agnihotri[1], Mrs Manju Khare[2]

[1]M.Tech (Control System) Scholar, Department of EE 'LNCT Bhopal (India)

[2]Associate Professor, Department of EE LNCT Bhopal (India)

ABSTRACT

A Three-phase four switch boost rectifier is introduce here. A 340 V input is given to the diode rectifier which boost it up to 900V voltage. This is advance technique which is used to get three level of DC voltages for different applications. Here we give 340V input voltage and boost it upto900V output voltage. By using switching we cut voltage into three different level i.e. 450V, 450V and 900V (Overall voltage).

Keywords: Zero Voltage Switching, Boost rectifier , AC and DC Rectifier, Zero Current Switching

I. INTRODUCTION

Previously designed rectifier gives the ideas to design the Simulink model for achieving the high voltage performances but rectification is not easy to do. Here we analyze the model that give the high performances for the same given input.

By using soft switching, we can achieve less than 5% input current total harmonic distortion. These models also automatically balance the output voltage by using the series capacitors and other low cost & high performances components.

II. 3-PHASE, 3-LEVEL ZVS RECTIFIER

The 3 Phase I/P lines given to the circuit of rectifier were used by the diodes of the rectifier switches. The Rectifier circuit is controlled by the four MOSFET Switches by controlling pulse width Modulation technique. The Electromagnetic (EMI) filters are also used here that helps to eliminate noise signals which have been superimposed with input current during high voltage transitions and clamping in the circuit. The over all output getcollected in output capacitors and it is clamped with clamped capacitor.The clamped capacitors are connected in series. Here the output voltages with different values are obtained.

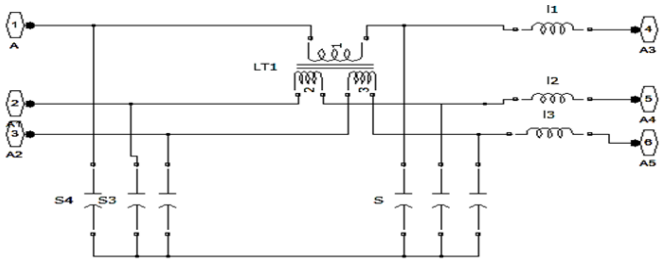

Fig.1 EMI Filter

III. MODEL AND ITS SIMULATION

The three phase rectifier simulink model is shown in figure-2.In this model C1,C2,C3 are the input capacitor connected with star connection which create the neutral point.This connection is also connected with middle of pairs of switches and middle of output capacitors, which help in the balancing the output.

In the figure-3, when the switch S1 and S2 are open the current will flow from the initial Conductors L1 and current Will flow with output voltage of V01 and switches capacitor Vcc will charged. After sometimeswitch S2 is disconnected. Vcc will be hence discharged and current flows from S2 and S3.

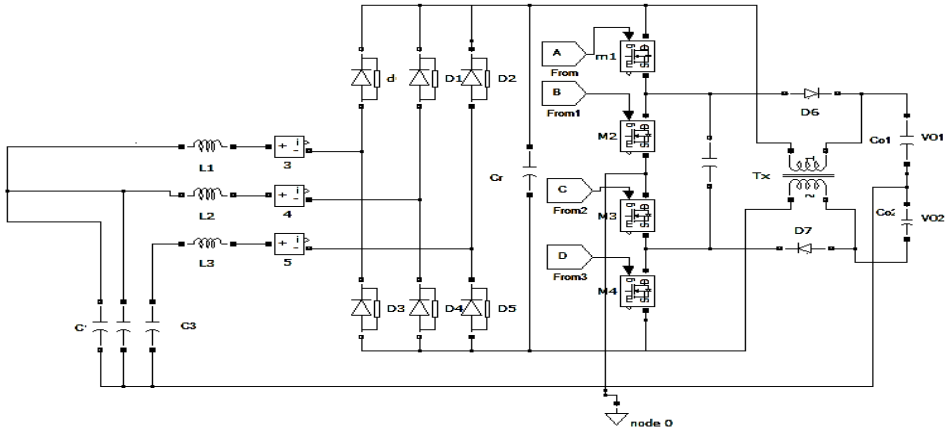

Fig.2 Three phase rectifier model

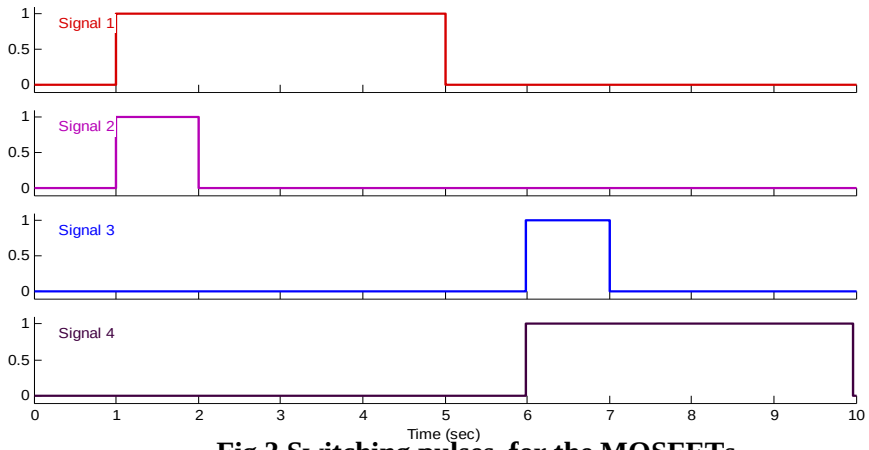

Fig.3 Switching pulses for the MOSFETs

Thus we assume current I1 is equal to VA/L1.After sometime the switch S1 is also turned off and at this time some delay are occurred at this time zero voltage switching will perform and give the current for the circuit. That's why the circuit is called Zero Voltage Switching Operated Circuit.

After that S3 and S4 switches will beconnected and performances isshown in the figure-4. At this time the current I2 and I3 Flows through inductor L2 and L3 and also current go to V02 side.The inductor current is given by

$$i_{L1} = \frac{V_A - (1-2D)V_{01}}{2L_1} I_S$$

Here Va is maximum peak of voltage and i_{L1}indicates the zero voltage switching delay.

IV. RESULTS

The results of the matlabsimulink model was evaluated on $340V_{L-L}$ voltage where the C1,C2 and C3 are 2.2μF, L1 , L2 and L3 are 89μH.D1-D6 taking the simple ratings and the diodes D7 and D8 having high snubber value.Figure 4shows the input current I_1, I_2, and I_3 waveforms of simulink result in scope at full power at $340V_{L-L}$ voltage.

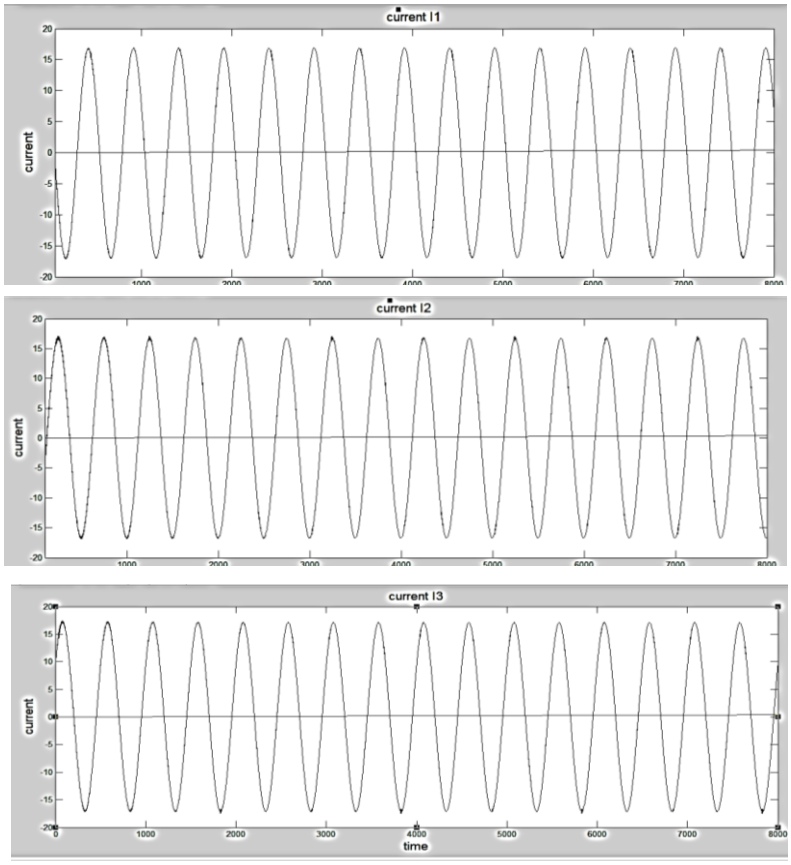

Fig –4 Input current waveforms

The figure 4 shows the Input current which is measured on the input side .Here we see inputs I1,I2 and I3. The relative THD of these inputs is less than 3% at this current and voltage boost is from 340V line to line to 900 V.

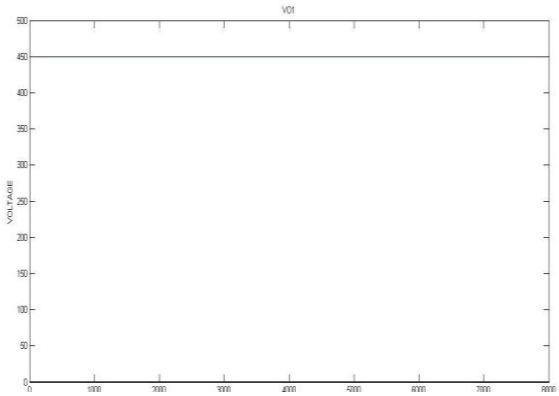

Fig-5(a)

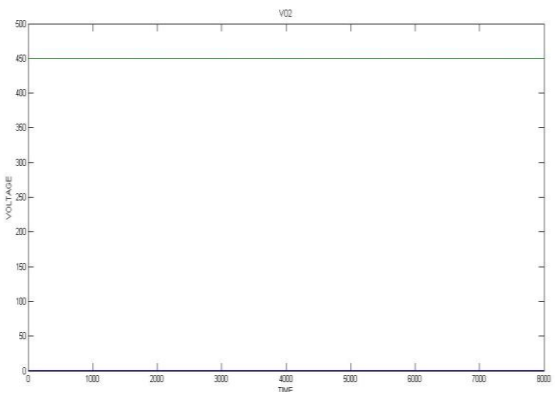

Fig-5(b)

Fig – 5(a) and 5(b) output voltages Vo1 and Vo2

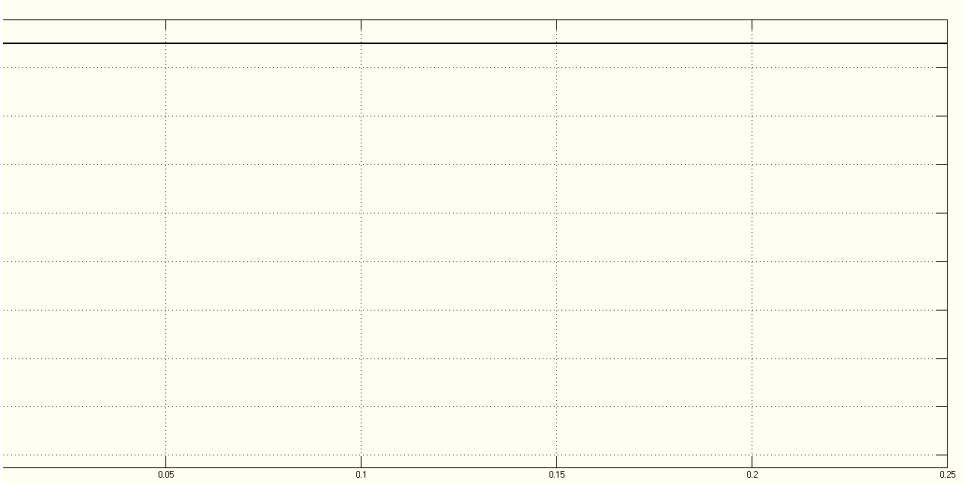

Fig –6 overall output voltage

Figure-5 shows two different outputs of 450V each operated by four switches and Figure-6 shows the overall output voltage of900 V.

V. CONCLUSION

The total work is done by MATLAB Simulink at 340V Line to Line Voltage. It achieves 94% efficiency at full load.

In this paper Three phase three level high voltage rectifier by zero voltage switching is introduced. The voltage across each switch was clamped by clamping circuit with output voltage, with one half of its measured value. By Simulink model the analyzed result is less than 5% input current THD over the input &above the 8% load.

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