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Design and Simulation of a Single Phase Four Level Neutral Point Clamped Inverter

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ABSTRACT--- In this paper, sinusoidal pulse width adjustment strategy for single stage four levels neutral point clamped inverter is proposed disposed of normal mode voltage. Sinusoidal pulse width modulation is much of the time utilized in modern applications. The gating sign are created by contrasting a sinusoidal reference signal and a triangular bearer sign of recurrence. The quantity of heartbeats per half-cycle relies upon the transporter recurrence.

Index terms:— SPWM, NPC, harmonics.

I. INTRODUCTION

DC/AC inverters are rapidly created with information of the power exchanging circuits down to earth in modern applications conversely with other power exchanging circuits. DC/AC inverters are generally utilized in AC engine drives. DC/AC inverters normally used variable voltage and variable frequency AC drives, uninterruptible power supplies, STATCOM, FACTS, voltage compensations.

In this section discuss some different multilevel inverter topologies. Voltage source inverter is mostly used in renewable energy and industrial applications. Current source inverters not used widely in industrial applications. Impedance source inverter has some smart features comparing to voltage inverter and current source inverter. Distributed generation and variable speed drives impedance source inverter used. Soft switching inverters, such as Zero voltage exchanging and zero current changing this systems to lessen the exchanging misfortunes and increase efficiency for different MLIs. Different multilevel inverters proposed previously based on applications. Three phase NPC inverter controlled [1] SVPWM reduced ripples in output current. Five-level ANPC inverter controlled SVPWM [2] and reduced common mode voltage in ANPC. Three level NPC inverter controlled SVPWM. NPC inverter controlled SVPWM improved overall performance [3] in NPC inverter. Many control techniques proposed previously for controlling NPC inverter. But sinusoidal pulse width modulation best method for controlling NPC inverter.

This paper we proposed sinusoidal pulse width modulation technique for single phase four level NPC. This Technique balancing neutral point if the load dynamic or any AC loads and reduce switching loss, reduces harmonics.

II. OPERATION PRINCIPLE OF FOUR LEVEL NEUTRAL POINT CLAMPED INVERTER

Eliminated common mode voltages in ANPC inverter used SVPWM technique [4]. Three-level NPC inverter controlled SVPWM improved overall [5] performance. SVPWM and Virtual SVPWM techniques controlled three levels NPC inverter.

Four level NPC inverter having six IGBT switches. When top three switches on remaining bottom three switches off. Diodes connected to midpoint to midpoint switches and supply voltage.

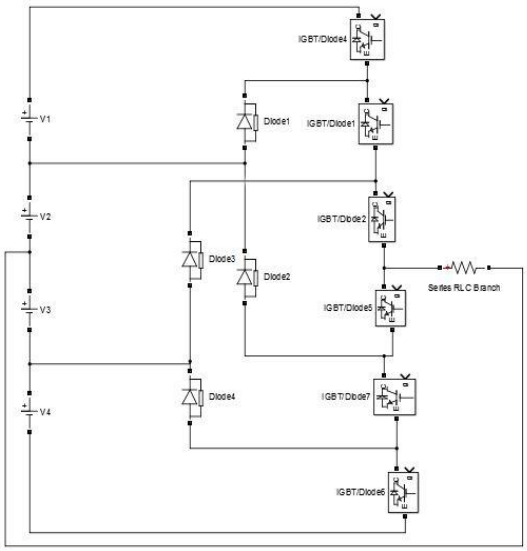

Fig 1. Main circuit of the single phase, four-level NPC inverter

TABLE 1: Switching states of 1-phase four level inverter

S_1	S_2	S_3	S_4	S_5	S_6	Output voltage
1	1	1	0	0	0	$+2V_0$
0	1	1	1	0	0	$+V_0$
0	0	1	1	1	0	$-V_0$
0	0	0	1	1	1	$+2V_0$

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III. PROPOSED SINUSOIDAL PULSE WIDTH MODULATION

Sinusoidal pulse width adjustment is as often as possible utilized in mechanical applications. The gating sign are produced by contrasting a sinusoidal reference signal and a triangular bearer sign of recurrence. The quantity of heartbeats per half-cycle relies upon the bearer recurrence.

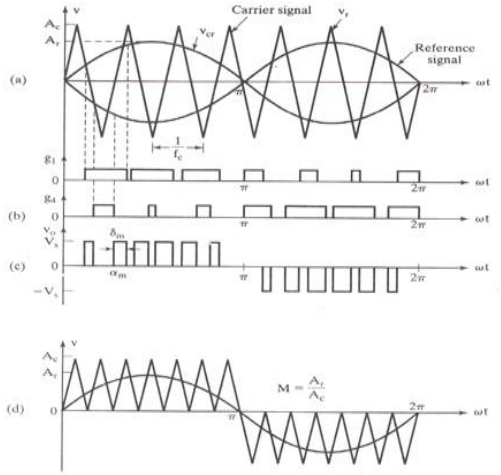

Fig.2a. sinusoidal PWM

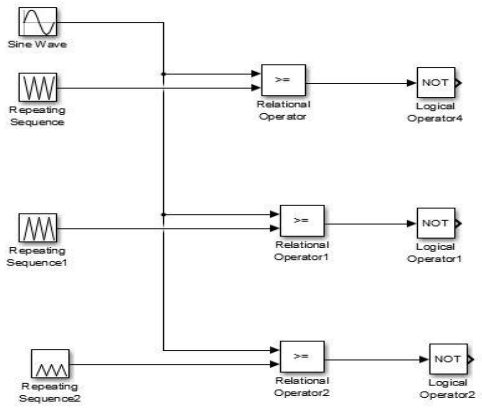

Fig.2b. sinusoidal pulse width modulation Matlab/ simulink

IV. SIMULATION RESULTS

Reproductions have been affirmed out to take a gander at the helpful of the proposed sinusoidal pulse width regulation strategy for a four level impartial point clasped inverter. The L-L voltage as shown in fig. output voltage 200V.

The proposed circuit used six IGBT switches, four diodes, four input voltage sources and resistive load. Supply voltages all equal 100V.

The parameters of the single phase neutral point clamped inverter used in the simulation are given below:

Supply DC voltage: 100v
IGBT switches: 6
Diodes: 4
Resistive load =10 ohm

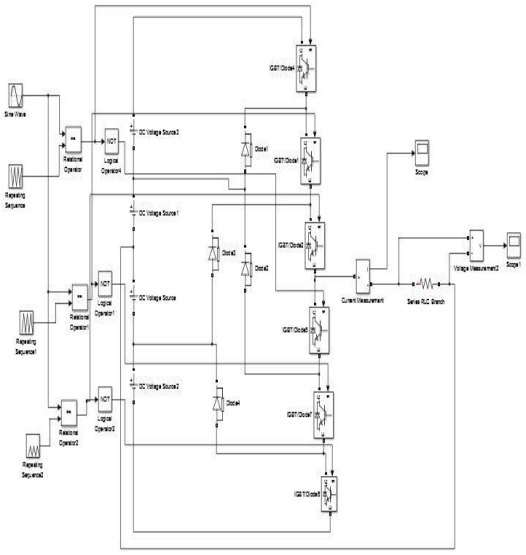

Fig.3. Single Phase Four Level Neutral Point Inverter

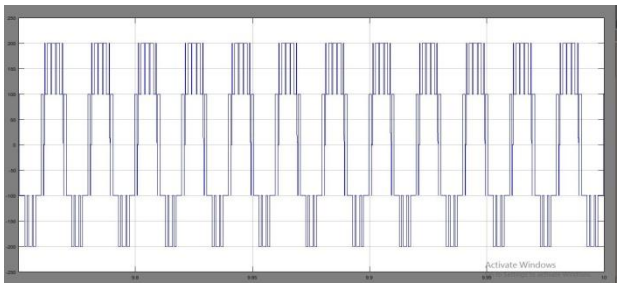

Fig.4 output voltage waveforms

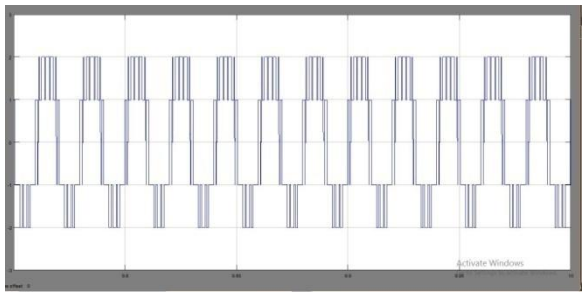

Fig. 5 output current waveforms with R-load

Fig 4 shows the output voltage of NPC inverter. Fig 5 shows the output current with R-load.

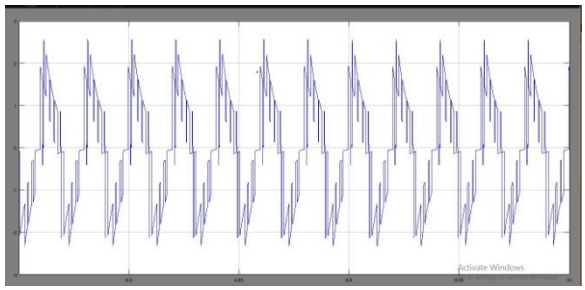

Fig.6 output voltage waveforms with L-load

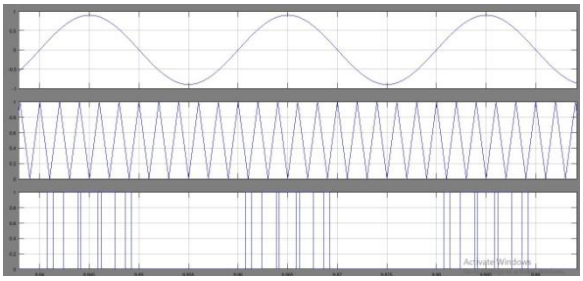

Fig.7 sinusoidal PWM

Fig.6 shows the output current with R-L Load and Fig. 7 shows sinusoidal pulse width modulation sine and triangular comparison

V. CONCLUSION

This paper has presented a single phase four-level NPC topology with reduced switching count compared to the other multilevel inverter topologies. Sinusoidal PWM technique controlled proposed MLI. Sinusoidal pulse width modulation easily implemented compared to SVPWM. Better output wave compared with single pulse width modulation.

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