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Simulation and Analysis of Cascaded H-Bridge Multi Level Inverter Through Pulse Width Modulation

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Abstract: **Modern industrial mechanisms and traction system are mainly depending upon electric drives. The electric drives not only change the working environment of industry but makes system efficient, economical and fast, through multi-Level Inverter. Solid state control of drives changes the position of electric drives. Now Multi level invert like diode clamped , fly back and Cascaded H Bridge Inverter make these drives state of art for today's requirement with adjustable speed technology.**
Adjustable speed drives, cascaded H bridge multi-level inverter are the need of present era and efficient control for the technology is ever changing Pulse width modulation techniques change very efficiently
Common inverters are not sufficient for L-L and L-G peakvoltage so move us towards cascade H bridge multilevel inverter
Here, Pulse Width Modulation techniques are adopted to obtain a distortion less output L-L and L-G voltage with the help of MATLAB/Simulink.

Keywords: **Cascade H bridge Multilevel Inverters PWM, SPWM, SVPWM.**

I. INTRODUCTION

Multilevel inverter to improve the performace of motor drives and increases power quality to achieve better efficiency fo high power application[1]. Five level inverter topologies like FCMLI,NPCMLI and PWM H-Bridge controlled by pwm technique based on quality of output voltage[2].

In Present scenario where controlled electric power is the ultimate choice not only in industries but in commercial segments too. Electrical power system is one of the complex networks in the world with invention of new techniques of power control and equipment which have better energy efficiency and efficient control with fast and smart switching .

The Multilevel inverters have been showing its significance for the purpose of controlling and handling high power high voltage since it was introduced in decade of 1980s.

II. PROBLEM IDENTIFICATION AND PROPOSED METHODOLOGY

The Inverter technologies has a vital role in modern power system for efficient operations of adjustable speed drives, Power backup sources and HVDC transmission; these are the places where bulk power has to carry and single or common inverter is not capable to handle it. Multi Level Inverter is the solution of such problems at once. This Paper has presented an overview of multilevel power conversion. Multilevel voltage-source modulation was introduced and formulated in terms of a per-phase switching state which related to the converter line-to-ground voltage. Several topologies for performing multilevel power conversion were presented and the switching states were defined to match that of the modulation. In this way, the generalized multilevel modulation technique can be readily applied to any of the

specific topologies. Two types of cascaded multilevel topologies were discussed. The advantage of cascading multilevel converters is the large number of voltage levels available as the result of a compounding effect of cascading process.

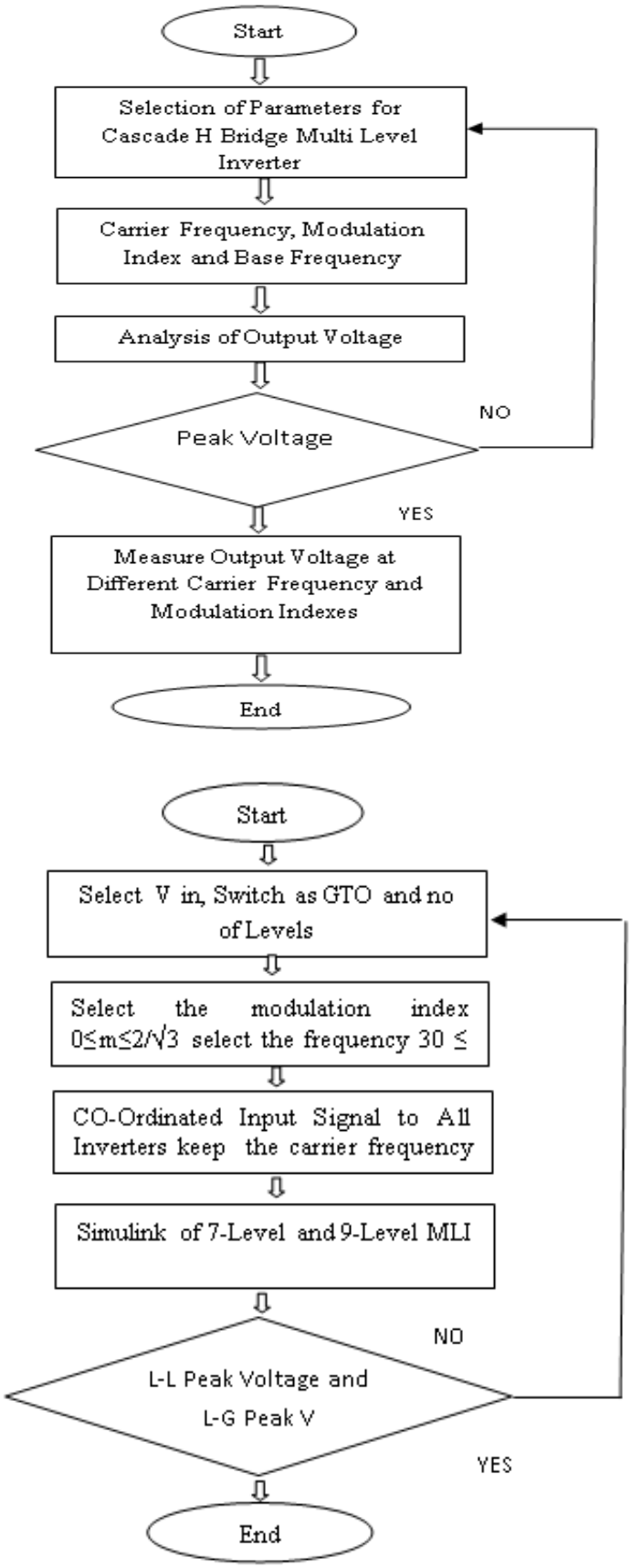

Figure:2 Solution of 7-Level and 9-Level Cascaded H-Bridge MLI

III. SIMULINK OF CASCADED MULTI LEVEL INVERTER

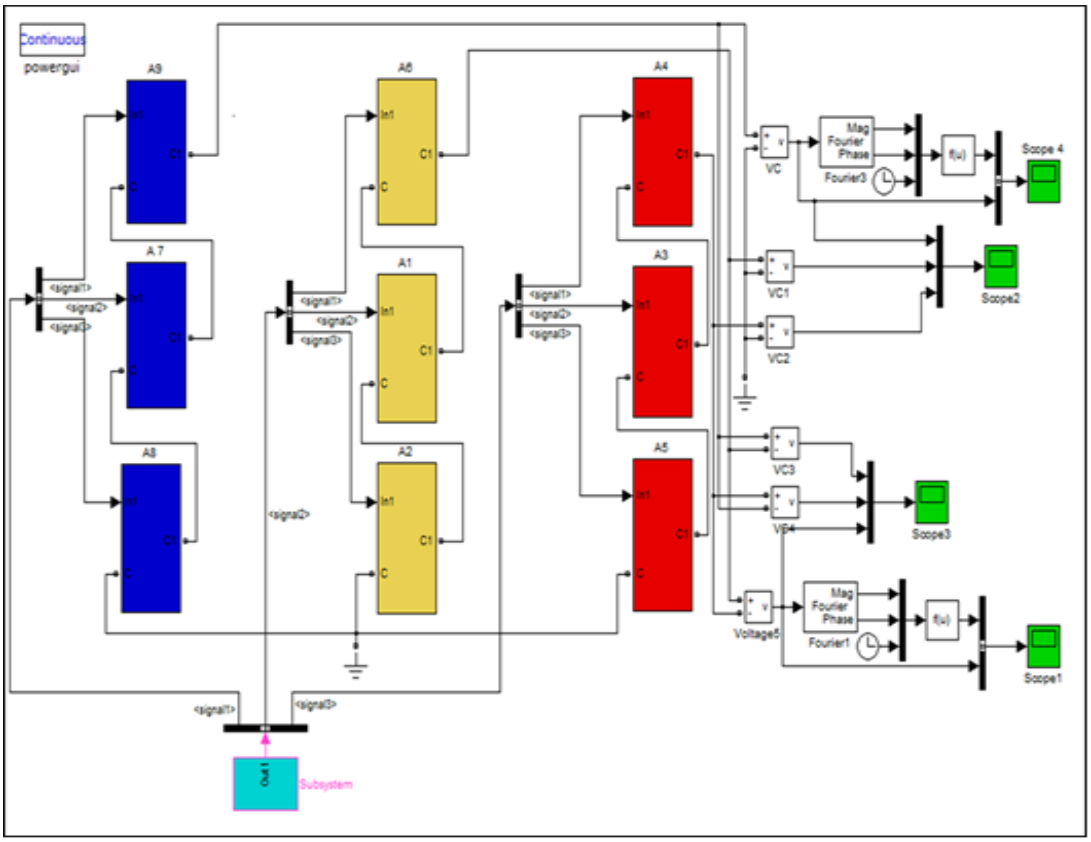

Figure:3 7-Level Cascaded H-Bridge MLI

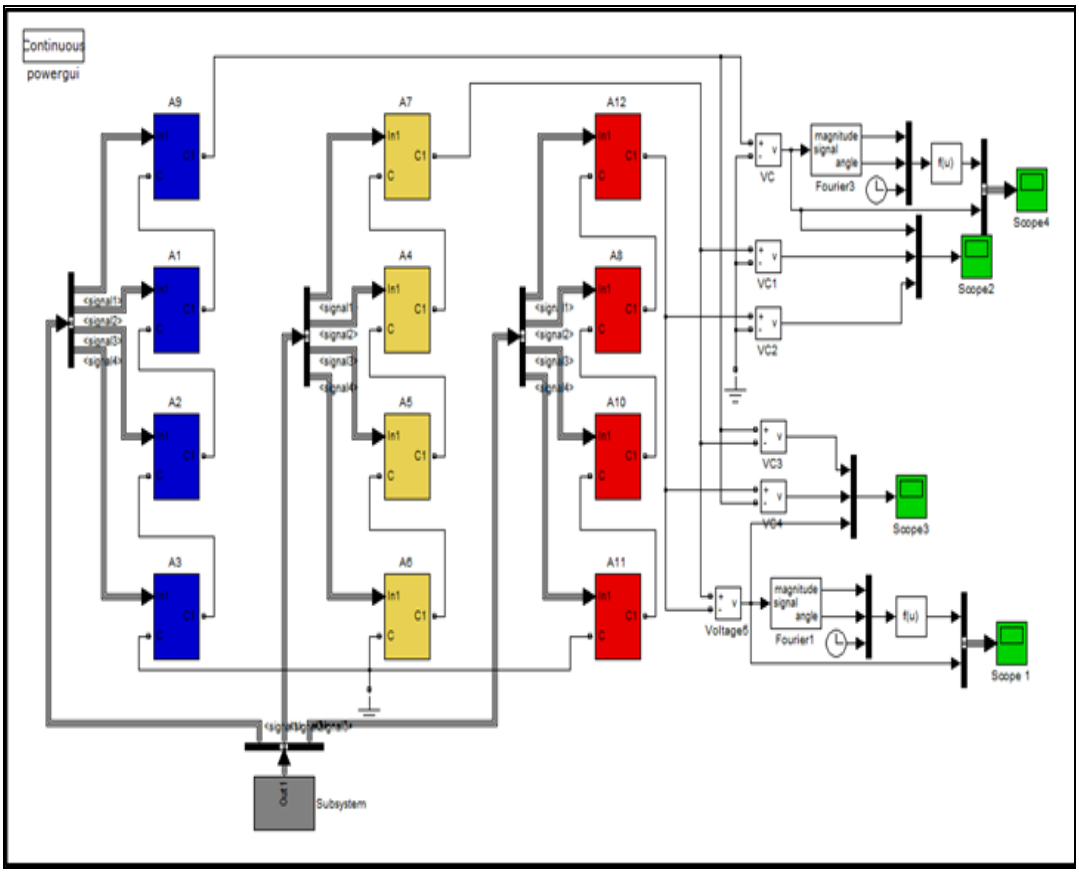

Figure:4 9-Level Cascaded H-Bridge MLI

In Figure 3 shows simulation model of 7-Level cascaded H-Bridge Multilevel inverter and figure 4 shows 9- Level cascaded H-Bridge Multilevel inverter to determine Line to line peak voltage and line to ground peak voltage.

IV. RESULTS AND ANALYSIS

As per results of 7-level and 9-level cascaded H-bridge multilevel inverter output voltage peak to peak are given in table 1.

Table: 1 Peak Voltage L-L and L-G for 7 level MLI

Sr. No	Modulation Index	Carrier Frequency	Fundamental Frequency	Peak Voltage L-L	Peak Voltage L-G
1	0.8	1500 Hz	50 Hz	548.62 V	318.38V
2	0.8	2500 Hz	50 Hz	564.16 V	325.42V
3	0.9	2500 Hz	50 Hz	631.42V	363.70V
4	1.0	2500 Hz	50 Hz	679.45V	392.91V

In Below figure given output voltage waveform of 7-Level cascaded H-bridgr multilevel inverter.

Table:2 Peak Voltage L-L and L-G for 9- level MLI

Sl No	Modulation Index	Carrier Frequency	Fundamental Frequency	Peak Voltage L-L	Peak Voltage L-G
1	0.8	2500 Hz	50 Hz	411.24 V	238.79V
2	0.8	2500 Hz	50 Hz	422.25V	242.50 V
3	0.9	2500 Hz	50 Hz	479.06V	276.05V
4	1.0	2500 Hz	50 Hz	508.58V	294.06V

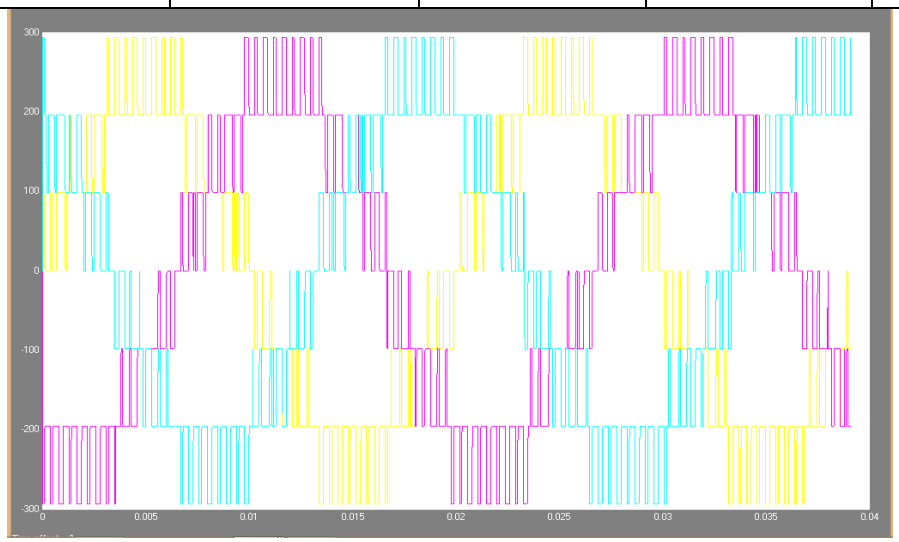

Figure :5 Output Voltage waveform of 7-Level MLI

In Figure 5 shows output voltage waveform of 9-Level cascaded H-bridge multilevel inverter for improving peak voltage of three phase system for application of any induction motor drives or synchronous motor drives.

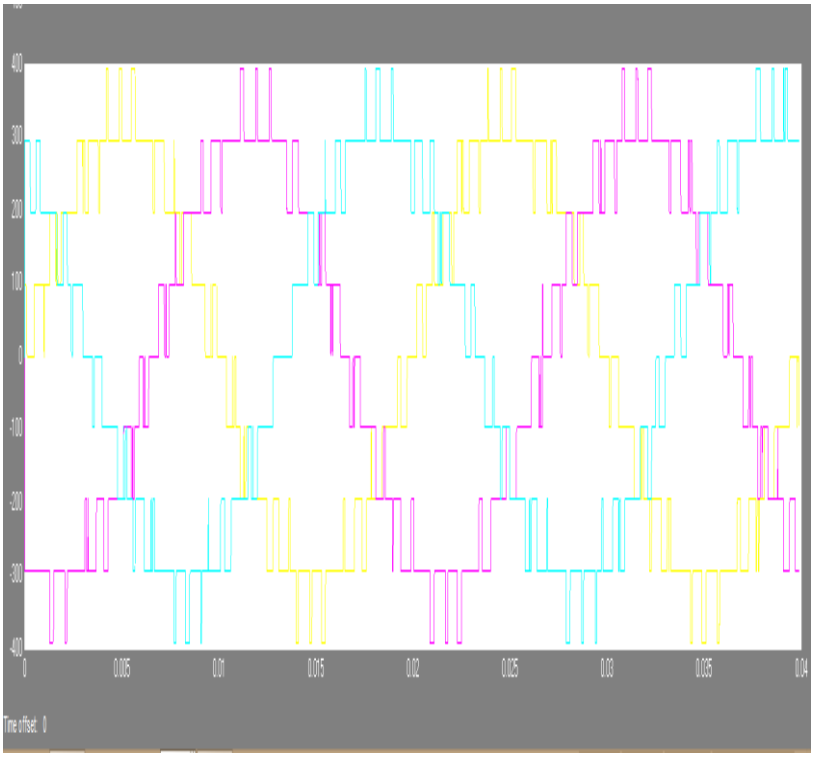

Figure :6 Output Voltage waveform of 9-Level MLI

V. CONCLUSION

As per the results shown in figure 5 & 6 output peak L-L and L-G voltage obtained through MATLAB/ simulink.

The developed simulink model capable to provide better result with changing the modulation index and carrier frequency. As per comparative table for both model 7 level & 9 Level multi level inverter results shows that on increase in modulation index results in increase in peak voltage also the increase in carrier frequency results in higher peak voltage.

Table:3 Comparasion analysis of different MLI

Topologies	**Diode Clamped**	**Fly Back**	**Cascade H-Bridge**
Advantages	Simple Control	Real Power Control	Least number of components
	High Efficiency	Reactive Power Control	No.of voltage levels same
Disadvantages	More number of clamping diodes according to levels	Complex Control according to levels	Separate DC Sources are required

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