MULTILEVEL INVERTER STRUCTURE WITH NEW MODULATION TECHNIQUE FOR REDUCTION IN TOTAL HARMONIC DISTORTION

[1]P.V.S.ADITYA, [2] Dr.G.Ezhilarasan [3]A.Upender
[1]Associate Professor, [2] Professor [3]PG Student,
[1]Electrical and Electronics Engineering,
[1]Holymary Institute of Technology and Science, Hyderabad,INDIA
[2]Saveetha University, Chennai,Tamilnadau

***Abstract:** The main objective of this paper is to be analysis and comparison of the Multi level inverter and it can be controlled by Pulse Width Modulation technique.PWM is designed based on the minimum power loss and minimum total harmonic distortion(THD).Multi level inverter is capable of producing increased number of levels in the output voltage.MLI topology which is able to increase the no of levels and also can pass the reverse current for inductive loads.*

IndexTerms – Multilevel inverter, total harmonic distortion,Inductive Load.

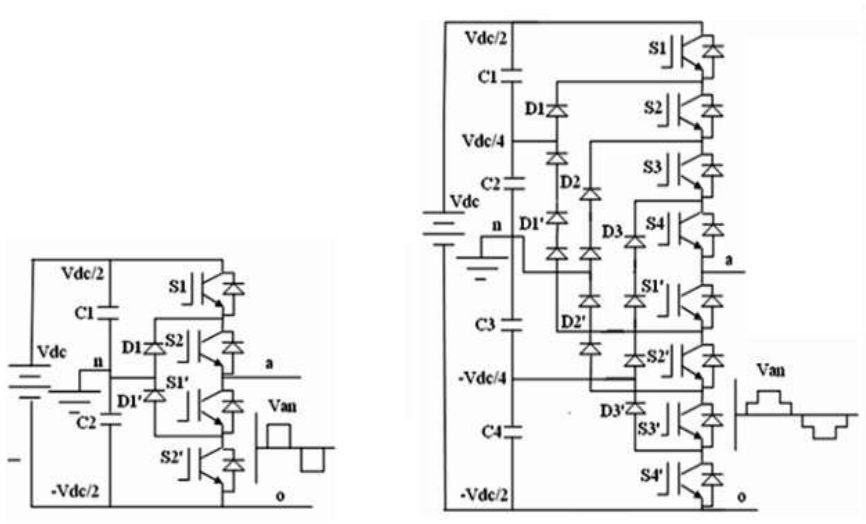
Introduction:

A multilevel inverter is a power electronic device which is capable of providing desired alternating voltage level at the output using multiple lower level DC voltages as an input. Mostly a two-level inverter is used in order to generate the AC voltage from DC voltage. Now the question arises what's the need of using multilevel inverter when we have two-level inverter. In order to answer this question, first we need to look at the concept of multilevel inverter.Three types of multilevel inverter have been explained,

Diode Clamped multilevel inverters

There are five switch combinations to synthesize five level voltages across a and n.

1) Voltage level Van= Vdc; turn on all upper switches S1, S2,S3 and S4.
2) Voltage level Van= Vdc/2, turn on the switches S2,S3,S4 and S1′.
3) Voltage level Van= 0, turn on the switches S3,S4, S1′ and S2′.
4) Voltage level Van= -Vdc/2 turn on the switches S4, S1′,S2′,S3′.
5) Voltage level Van= -Vdc; turn on all lower switches S1′, S2′,S3′ and S4′.



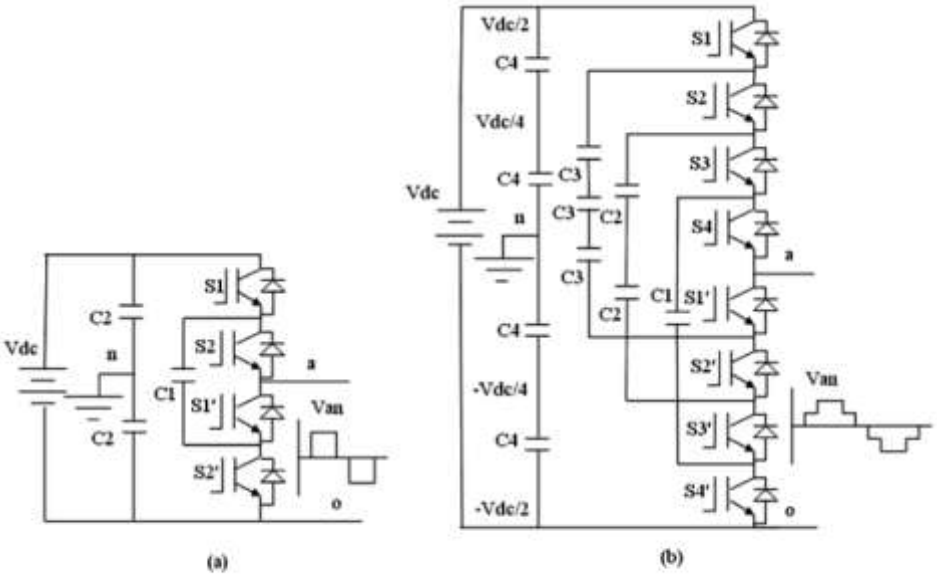
(a) (b)

Topology of the diode-clamped inverter (a) three-level inverter, (b) five -level inverter

1. Flying Capacitor multilevel inverters

In the operation of flying capacitor multi-level inverter, each phase node (a, b, or c) can be connected to any node in the capacitor bank (V3, V2, V1). Connection of the a-phase to positive node V3 occurs when S1and S2 are turned on and to the neutral point voltage when S2 and S1′ are turned on. The negative node V1 is connected when S1′ and S2′ are turned on. The clamped capacitor C1 is charged when S1 and S1′ are turned on and is discharged when S2 and S2′ are turned on. The charge of the capacitor can be balanced by proper selection of the zero states.. As with the three-level flying capacitor inverter, the highest and lowest switching states do not change the charge of the

capacitors. The two intermediate voltage levels contain enough redundant states so that both capacitors can be regulated to their ideal voltages.

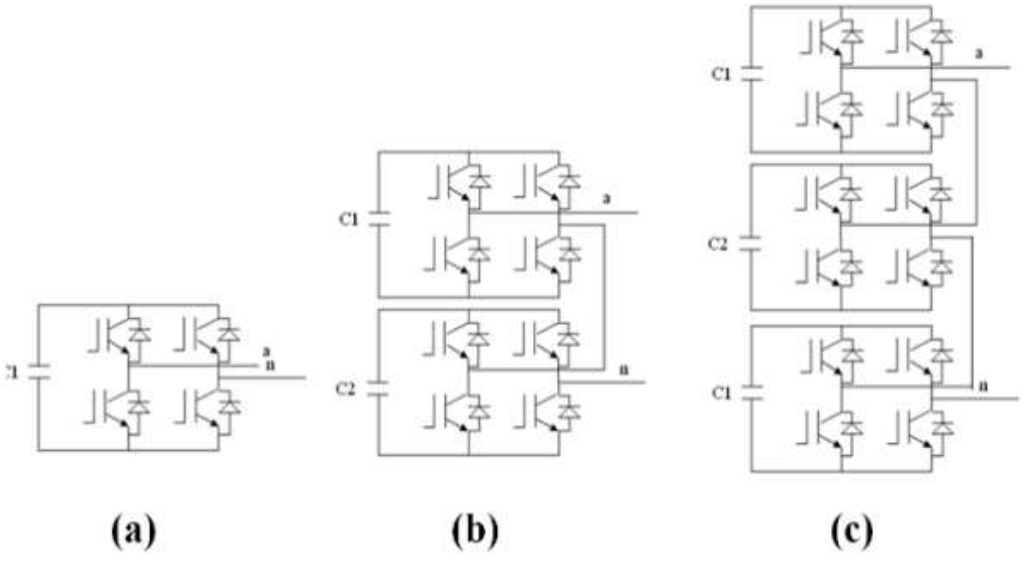


Capacitor-clamped multilevel inverter circuit topologies,
(a) 3-level inverter (b) 5- level inverter.

3.Cascaded H-bridge multilevel inverters:

A series of single-phase full bridges makes up a phase for the inverter. A three-phase CMI topology is essentially composed of three identical phase legs of the series-chain of H-bridge converters, which can possibly generate different output voltage waveforms and offers the potential for AC system phase-balancing.

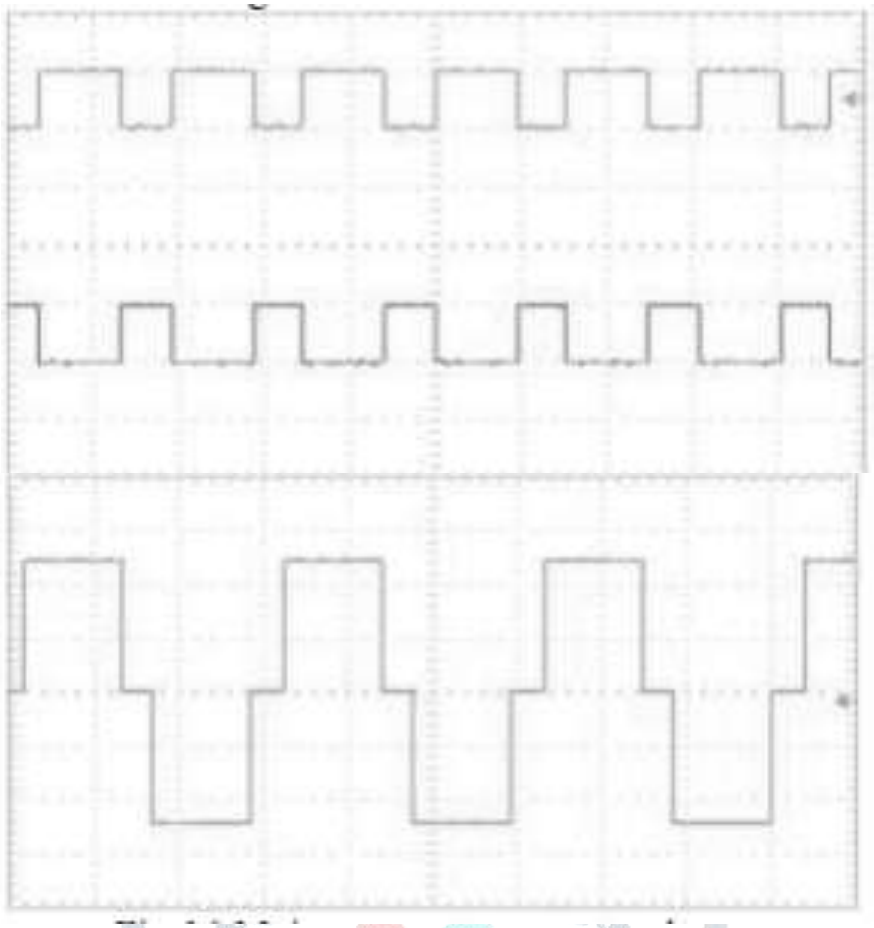
The converter topology is based on the series connection of single-phase inverters with separate dc sources. The power circuit for one phase leg of a three-level , five-level and seven-level cascaded inverter. The resulting phase voltage is synthesized by the addition of the voltages generated by the different cells. In a 3-level cascaded inverter each single-phase full-bridge inverter generates three voltages at the output: +Vdc, 0, -Vdc(zero, positive dc voltage, and negative dc voltage). This is made possible by connecting the capacitors sequentially to the ac side via the power switches. The resulting output ac voltage swings from –Vdc to +Vdc with three levels,-2Vdc to +2Vdc with five-level and -3Vdc to +3Vdc with seven-level inverter. The staircase waveform is nearly sinusoidal, even without filtering.



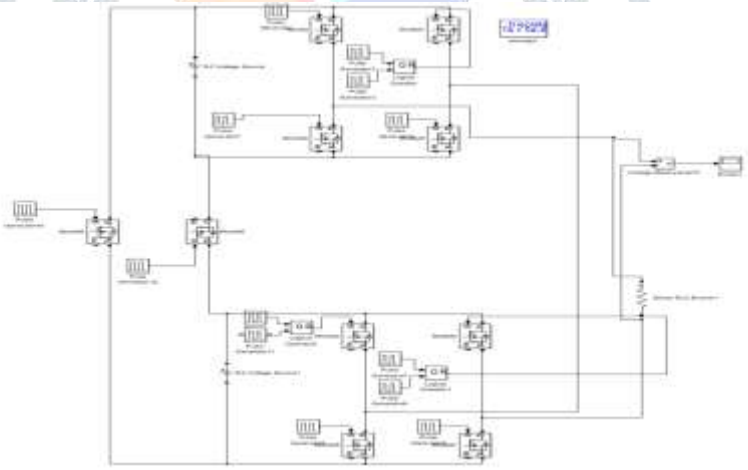
Single phase structures of Cascaded inverter (a) 3-level, (b)5-level, (c) 7-level

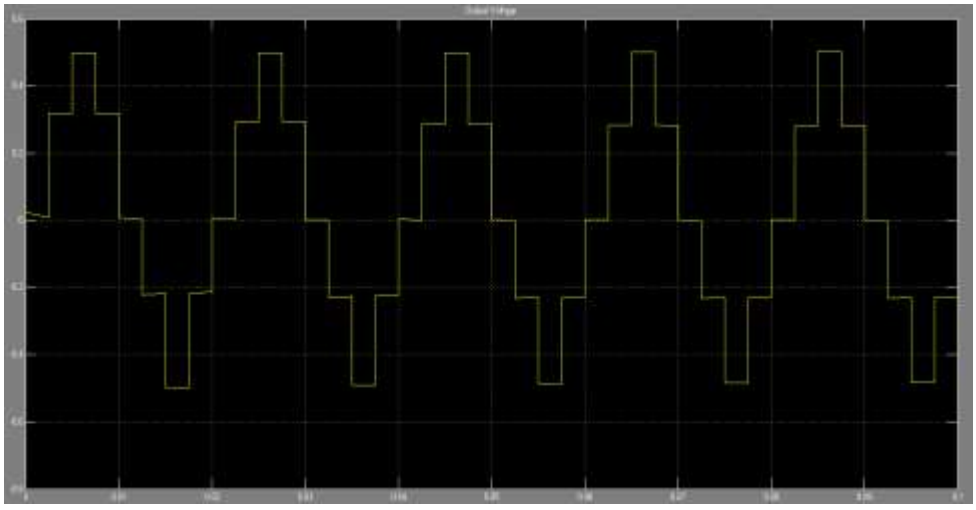
Simulation Results:

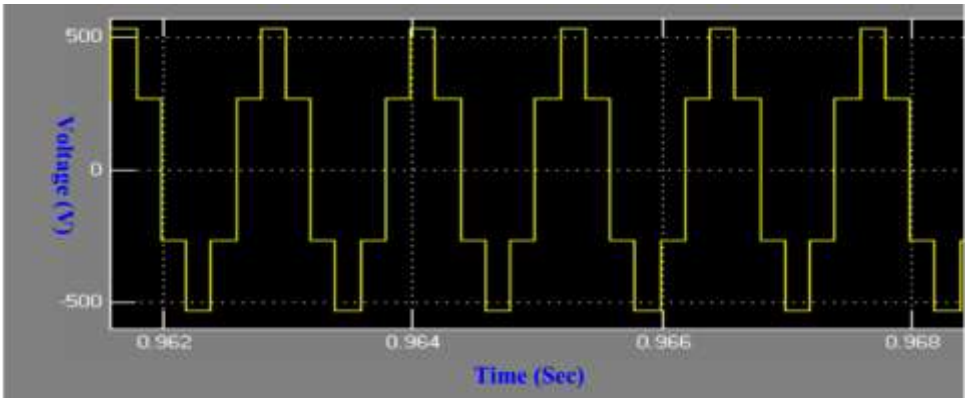
Two level h-bridge inverter is modeled with the help of MATLAB Simulink software with and without amplitude modulation technique. Simulink model for 2-level inverter is shown in Fig.1. Fig.2 shows the output voltage waveform. Cascade hbridge inverter (levels) % THD without using amplitude modulation % THD using amplitude modulation technique 2 level 48.34 % , 5 level 15.22 %

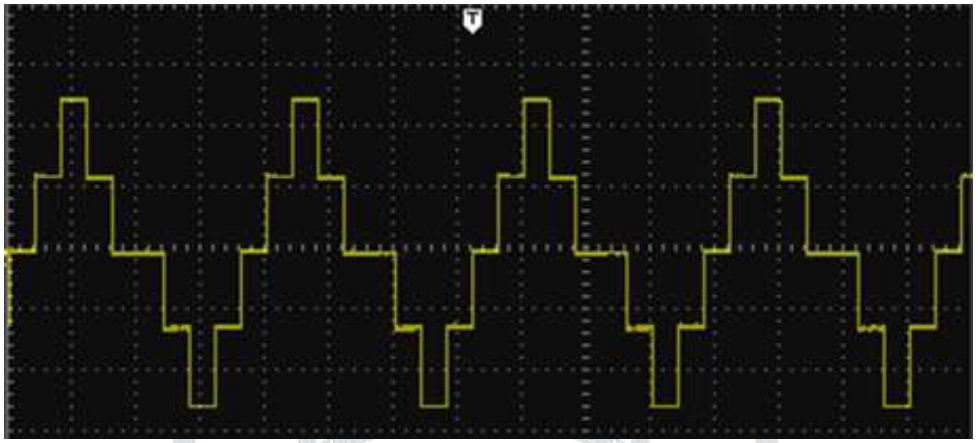


Five level h-bridge inverter with proposed AM technique Simulation results of five level inverter with amplitude modulation technique is shown in this section. Fig. shows the MATLAB model of five level inverter. While output voltage waveforms of five level









Conclusion:

- The MLI based topologies play a significant role for both high power and high/ medium voltage applications. Many reduced switch MLI topologies have been developed through research in academia and industry, but still new MLI topologies based on reduction of component count for different apps are emerging for different advantages.Compared to traditional five level inverter, reduced switch MLI topologies offers many advantages such as low modularity, high resolution output voltage , less component count, less space occupancy , cost effectiveness and easy of control.

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BIBILOGRAPHY:

Mr. P.V.S.Aditya received the B.Tech degree in EEE from V.R.S&Y.R.N College Engineering and Technology, CHIRALA,PRAKASAM(Dt), Andhra Pradesh, India, from JNTU University and **M.TECH** in **Power Electronics AND Electrical Drives** from RGMCET,NANDYAL year 2011. I have teaching experience of nearly 5 year & Currently working as Assistant Professor in Holy Mary Institute of Technology & Science ,Bogaram, R.R. Dist, Hyderabad,Telangana, India.

Dr.G.Ezhilarasan received his B.E degree in EEE from College of Engineering Guindy,Anna University, Chennai,Tamilnadu, India, **M.E** in **Power Electronics and Electrical Drives** from College of Engineering Guindy, Anna University and Ph.d from S.R.M.University,Chennai,Tamilnadu,. He have teaching experience of nearly 20 years and 2 years of Industrial Experience & Wrote 3 books, Currently working as Professor in Saveetha University.

Mr.A.Upender received the B.Tech degree in EEE from Aurora's Engineering College,Bhongir,Telanagan, India, from JNTU University and **Studying M.TECH** in Electrical **Power Systems at** Holymary Institute of Technology and Science.