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Various Pulse Width Modulation Techniques for Asymmetrical 7-Level H-Bridge Inverter and Introduction to Variable Frequency Technique

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Abstract:- Inverter is a power electronic device used to convert dc voltage into ac voltage at a fixed desired frequency. Being a power electronic device, it is more efficient and reliable due to absence of any mechanical rotating part. Now a days an inverter is not only a device but also a part of power sector but a simple inverter has only two level so the out coming wave is much distorted form fundamental sine wave which introduces the harmonics into the circuit which makes the total system less efficient along with that the age of system decreases also there is a danger of faulty operation [1]. As the harmonics by its nature have heating effect along with distortion which is not good for load as well as whole power system. So the concept of multilevel inverter arises in which the levels of the inverter is increased so that the distortion of the out-coming wave could be minimized [2, 11]. As the level rises the sinusoidality of the output wave increases and thus harmonic content decreases [6]. But in case of multilevel inverter everyone is trying to improve the level of inverter by increasing the switches but in this paper we have introduced a asymmetrical circuit for 7-level inverter with a new topology so that the level of inverter can be obtained with reduced switches with a new topology and compared the modulation results with each other so that we could obtain the various pulse width modulation (PWM) technique results in this way a deep study is being taken place on various PWM modulation techniques on asymmetrical 7 leveled multilevel inverter.

Keywords:- *Multi Level Inverter (MLI), Pulse Width Modulation (PWM), Phase Deposition Pulse Width Modulation (PDPWM),Phase Opposition Deposition Pulse Width Modulation (PODPWM), Alternate Phase Opposition Deposition Pulse Width Modulation (APODPWM).*

I. INTRODUCTION

We have introduced a new topology in which we have taken a source of double magnitude in reverse direction in second bridge and source of first bridge in same direction[11] as shown in figure 1.

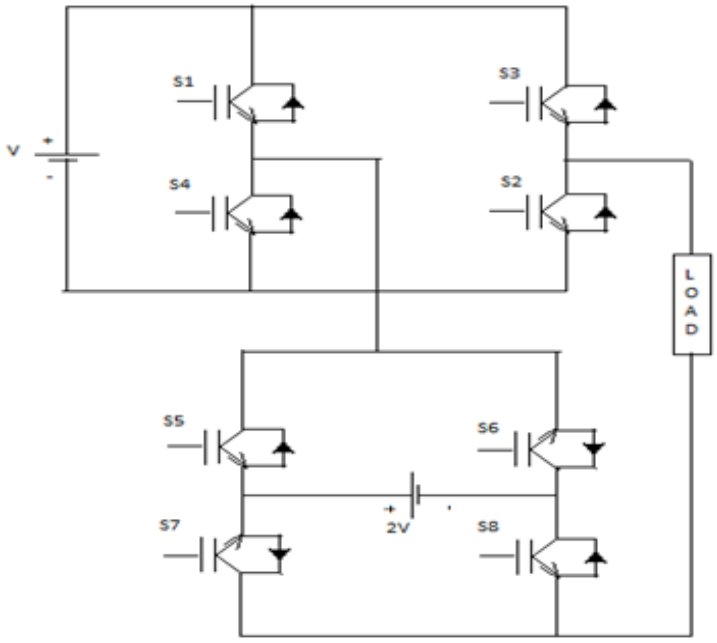

Fig 1

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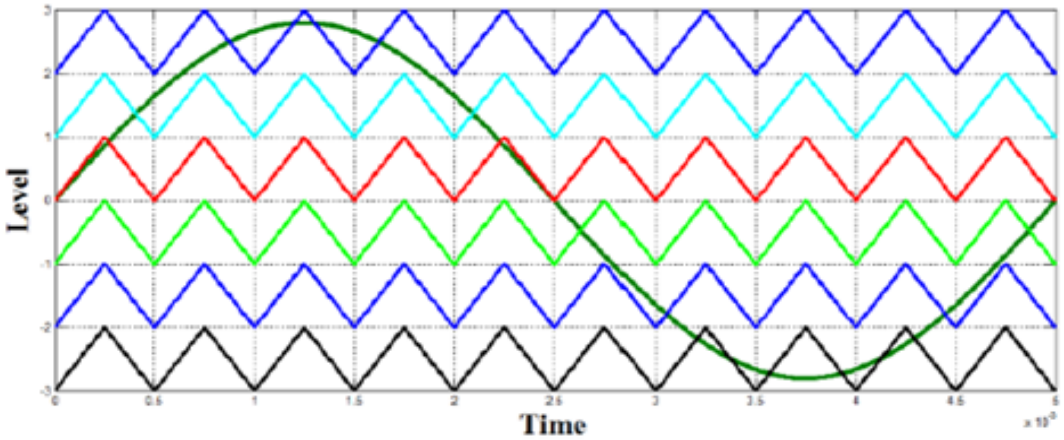
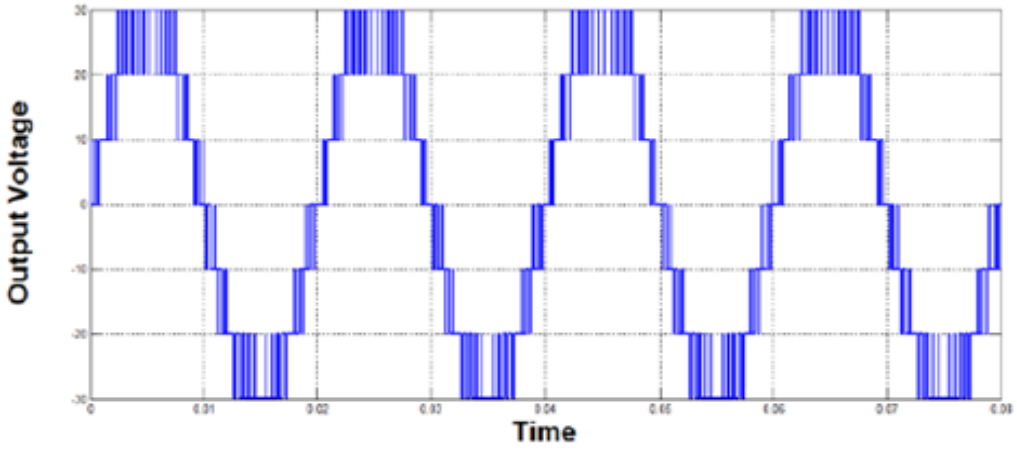
In this paper we are trying to study and also apply some innovative variable frequency method to reduce total harmonics distortion. Various PWM techniques are:-

PDPWM:- In Phase disposition pulse width modulation technique all carrier above and below the zero reference are in same phase[2,3,6,7].



(a)

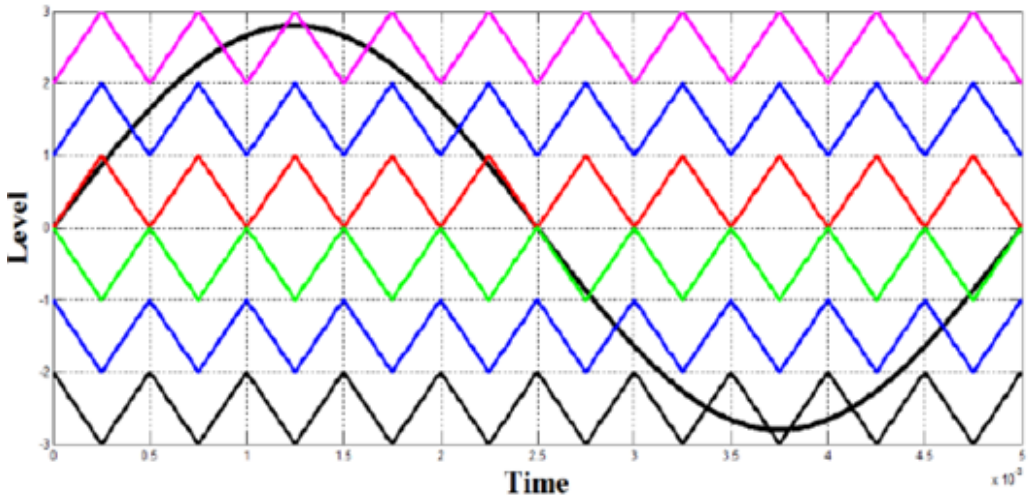


(b)

Fig 2:- (a) PDPWM Modulation Technique for 7 Level Inverter. (b) Output Voltage

(The waveform shown in figure is with lesser number of cycles instead of actually used ones just to make the changes visible otherwise graphics will become hazy.)

PODPWM:- In this modulation techniques all carrier above zero reference and below the zero reference also in same phase but 180° out of phase with above and below the zero reference[4,5,9].



(a)

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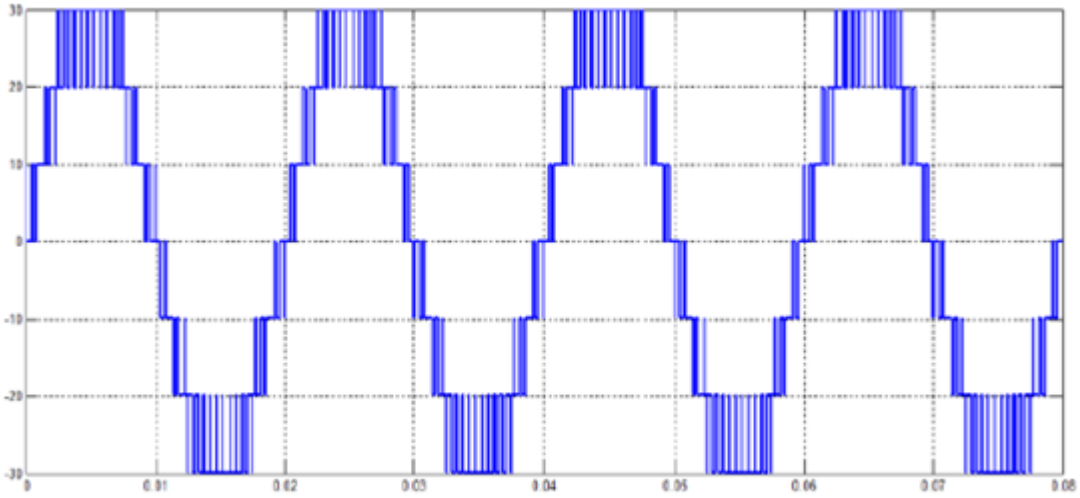

(b)

Fig 3:- (a) PODPWM Modulation Technique for 7 Level Inverter. (b) Output Voltage

(The waveform shown in figure is with lesser number of cycles instead of actually used ones just to make the changes visible otherwise graphics will become hazy)

APODPWM:- In alternate phase opposition Disposition pulse width modulation scheme every carrier is out of phase with its neighbor carrier by 180°[1,8,10].

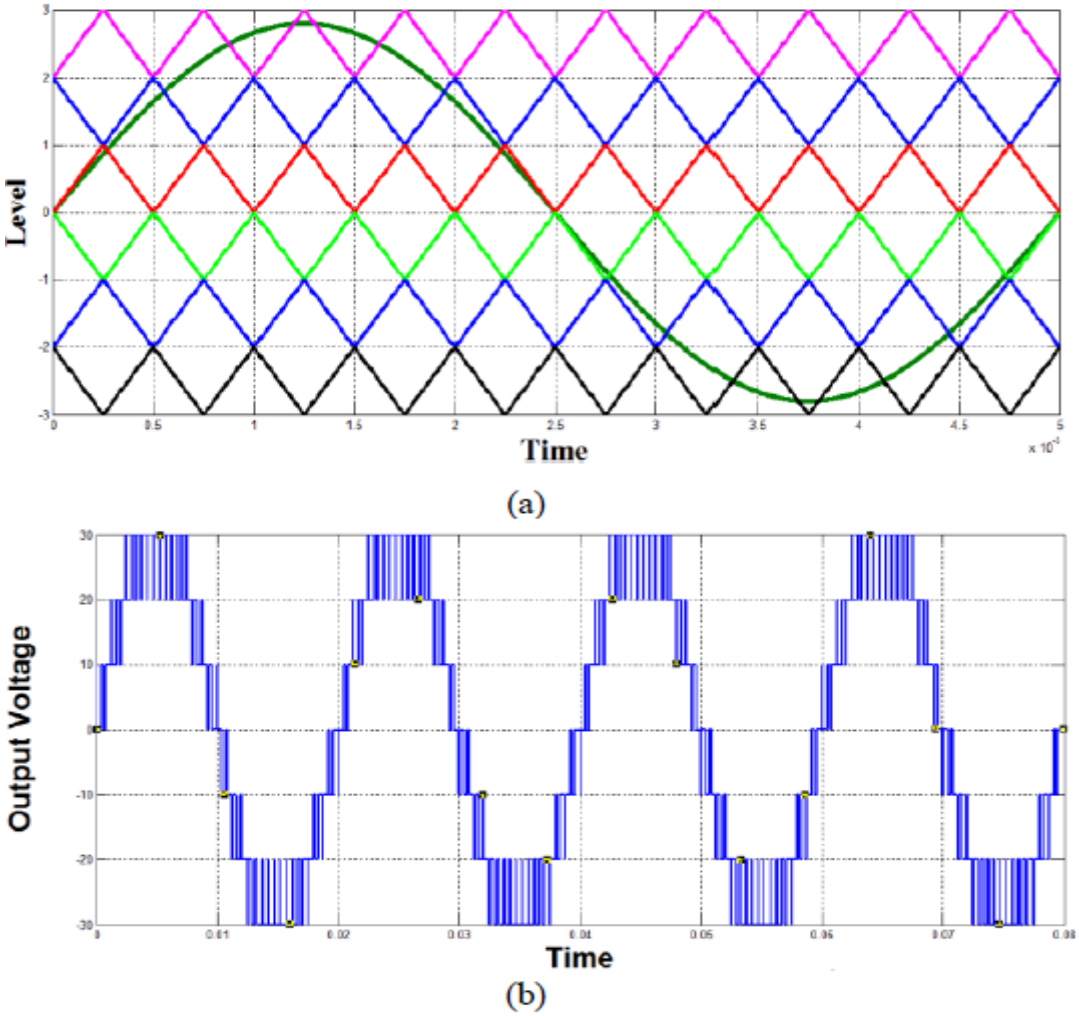

Fig 4:- (a) APODPWM Modulation Technique for 7 Level Inverter. (b) Output Voltage

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(The waveform shown in figure 4(a) is with lesser number of cycles instead of actually used ones just to make the changes visible otherwise graphics will become hazy.)

II. VARIABLE FREQUENCY PWM TECHNIQUE

In this new introduced technique we are applying the PODPWM technique but frequencies of the carrier wave signal is being modified or varied in such a way that the total harmonic distortion could be reduced.

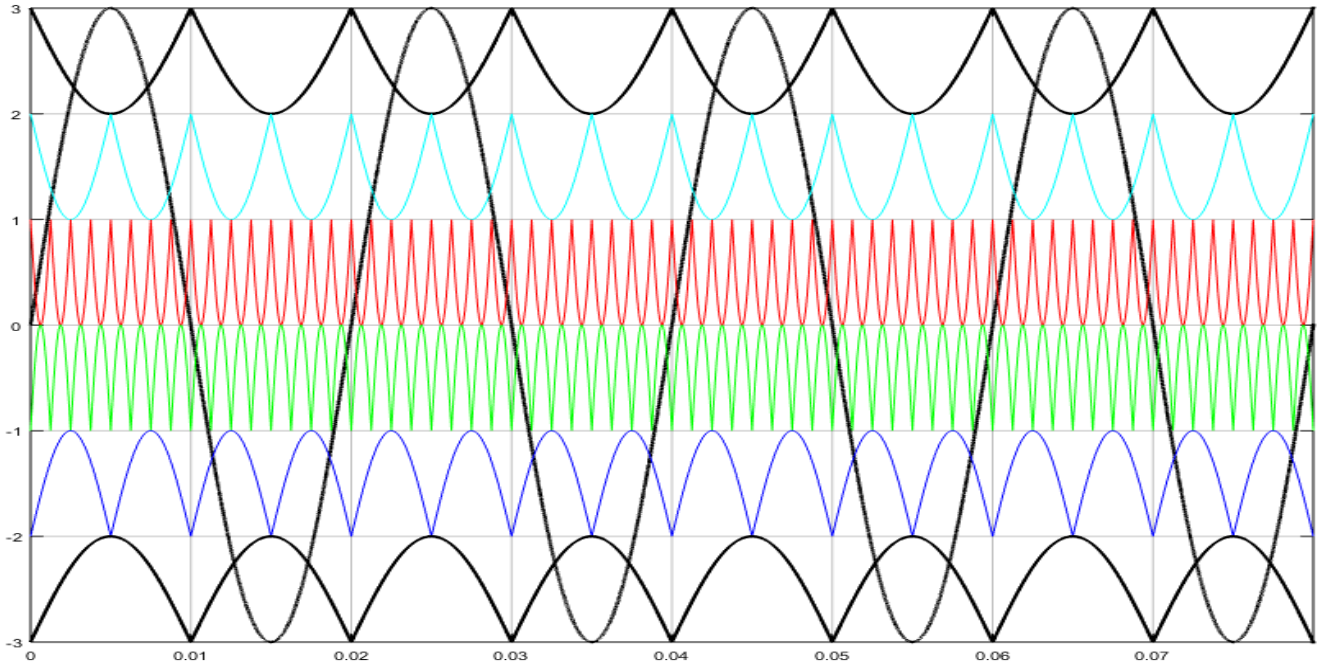

Fig 5:- Variable Frequency PWM Technique for 7 Level Inverter

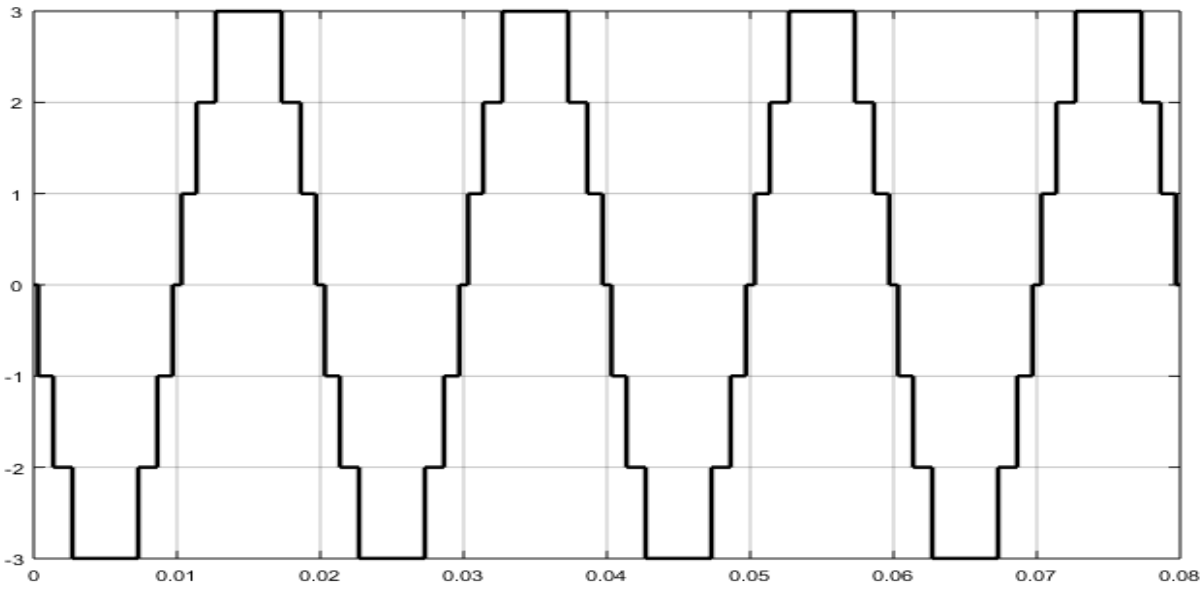

Fig 6:- Output Wave for 7 Level Multi Level Inverter

III. RESULT

Total harmonic distortion in different cases are:-

- PDPWM :-18.21
- PODPWM :-18.01
- APODPWM:-18.16
- VARIABLE FREQ. PWM:-12.38

IV. CONCLUSION

After getting the simulation results we may conclude that with variable frequency PWM technique we can reduce THD on same circuit of inverter to a comparable amount. In order to implement these results we are planning to work on 19 level MLI.

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