

A Modified Hybrid Cascade 27 Level Multi Level Inverter with Asynchronous Machine Load

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Abstract: The Multi-Level Inverters (MLI) is an essential part of all electrical and electronics device. Most of the electrical equipment's in our country are run on 50Hz A.C. supply, in this proposed work present a modified hybrid cascade 27 level multi-level inverter for 3 phase A.C. supply. IN the last there are different researchers work on different level MLI inverter such as 7 level, 9 level, 11 level, up to 35 level and got good total harmonic reduction (THD). In this presented proposed Modified Hybrid Case Cade 27 Level Multi Level Inverter obtain good THD value at 27 level 1.82 that is better as compare to other methods. The proposed Modified Hybrid Case Cade 27 Level Multi Level Inverter shows better due to its logical switching pulse. There pulse are use relational operator for comparing waves. For the analysis and performance measurement of proposed MLI apply load that is three-phase asynchronous machine, also known as induction machine at receiver end and got good result in terms of machine's speed and second one is electromagnetic torque developed by the machine. The proposed method good result output of induction motor.

Keywords —Inverter, 27 level MLI, Power Electronics, PWM, AC, DC.

I. INTRODUCTION

There are completely different power converter topologies and management methods employed in inverter styles. Totally different design approaches address various issues which will be additional or less important looking on the method that the converter is meant to be used. The problem of waveform quality is one the necessary concern and it will be self-addressed in many ways. In observe capacitors and inductors can be wont to filter the waveform [1-2]. If the planning includes a electrical device, filtering can be applied to the primary or the secondary side of the transformer or to both sides. Low-pass filters are applied to allow the basic element of the waveform to pass to the output whereas limiting the passage of the harmonic elements. Therefore quality of wave shape are often adjusted. Note that, normal inverters continuously generate terribly inferiority output waveforms. to form the output waveform qualitative, low pass (LC filter) are often another within the circuit. Thus, at this time of your time readers might have a question that, why the quality of converter output is low? And why Low pass filter are often added within the circuit. Further, what forms of solutions are out there to extend quality of output waveform while not losing its efficiency? All this are open issues related to present day inverters. However, eventually all this will be self-addressed in this thesis. But at first we try to find out the converter applications from low power to high power so we summarize the wants to fulfill the high power demand. Finally we try and present the issues and solutions out there to fulfill the high power demand. [6] [7] [8]

II. PROPOSED METHOD

During this chapter implement the nine-level uneven cascaded multilevel inverter with IM for numerous types of level-shifted PWM techniques in Matlab Simulink. Because the number of levels can increase, the synthesized output wave shape has additional steps that produces a stairway wave that approaches the specified wave shape. Also, as additional steps are else to the wave shape, the harmonic distortion of the output wave decreases, approaching zero because the range of levels can increase. As the variety of levels can increase, the voltage that may be spanned by connecting devices serial conjointly will increase. [9]

The output voltage of the MLI has many levels synthesized from several dc voltage sources, the standard of the output voltage is improved because the no of voltage levels increase, thus total harmonic distortions and so the amount of output filter is reduces.

Block Diagram of Proposed Work

In case of twenty seven level uneven Cascaded MLI three DC sources are used having a pair of same and third completely different and 12 power switches are used. The uneven structure electrical converter will increase the amount of levels within the output and reduces the amount of input DC sources needed. IGBT is employed as semiconductor switch for planning the electrical converter circuit.

It has the high power rating, less conductivity loss and fewer change loss. These topology uses level-shifted multi carrier based mostly new PWM technique, accustomed manufacture a 27-level output voltage.

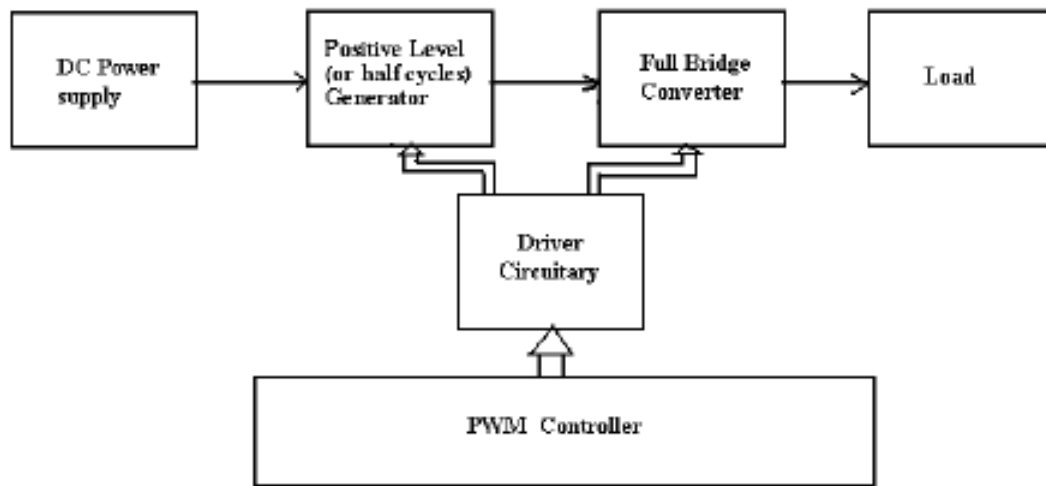


Figure 1: Proposed block diagram of 27-levels HCMLI

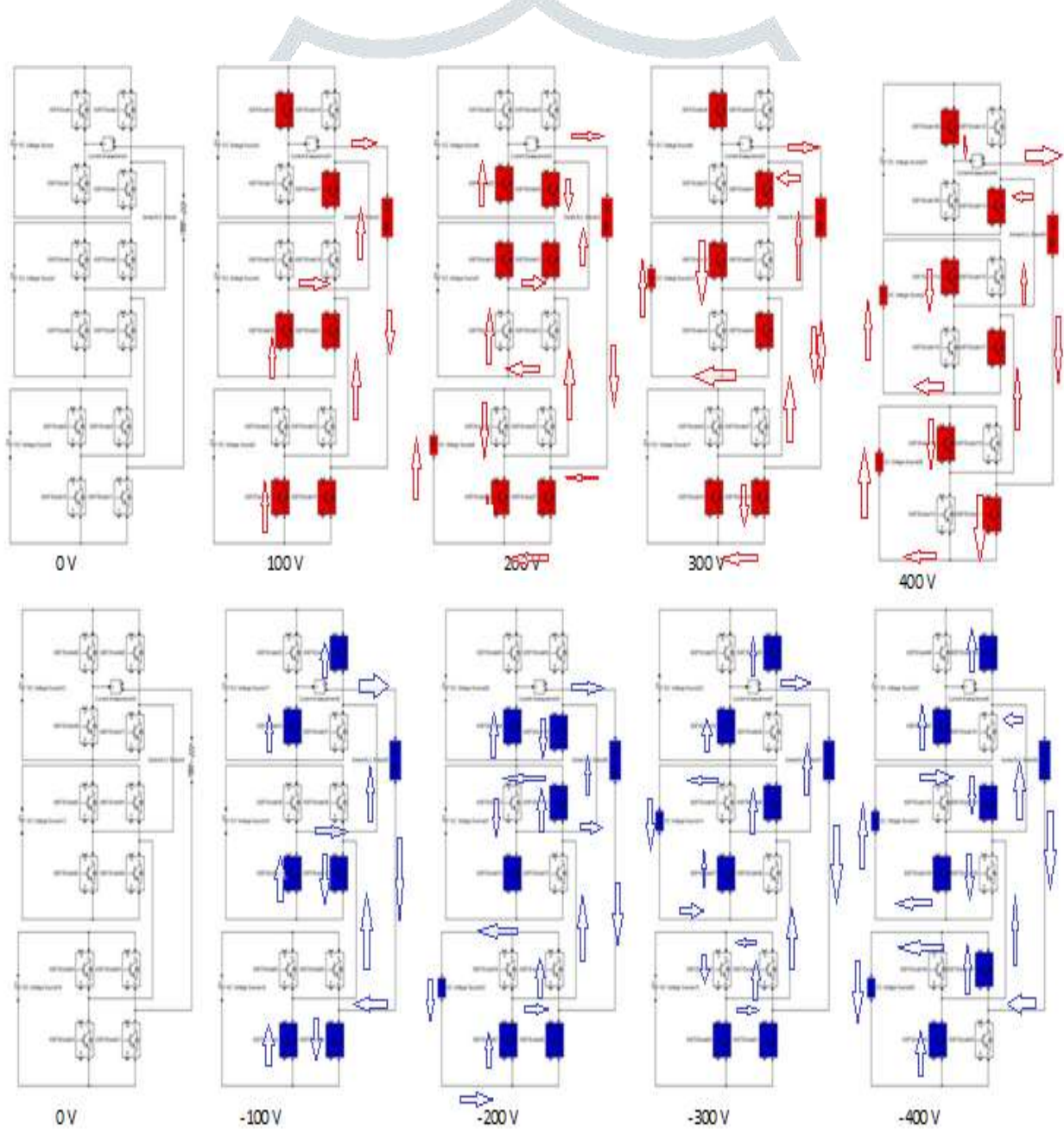


Figure 2: Different stages of output voltage level

Table 1: System parameters for 27-level Inverter

System Parameters	Value
Reference frequency	50 Hz
Carrier frequency	1.2K Hz
Load resistance	1Ω
Load inductance	1 mH
DC Sources	100V, 300V, 900V

III. SIMULATION AND RESULT

This chapter shows the comparative study of output voltage of 27-level asymmetrical cascaded multilevel inverters cascaded is compared for the APOD techniques, and it also shows the THD profile and performance of the circuit with IM for PWM techniques, and also the compare all result with different MLI.

Cascaded multi-level inverter shows the lowest THD profile without any type of filter and also any type of dependency of inductor and capacitor used for smooth the current wave form and due to less number of switching devices gate firing circuit also reduced that's why total cost and performance has been increased .

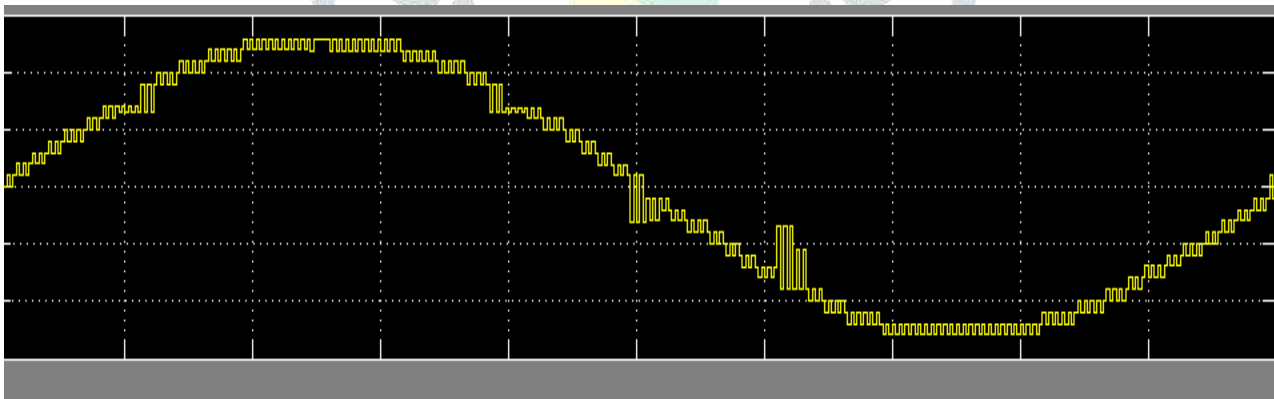
Performance Parameter

The main performance criterion is that the "purity" of the initial wave (in alternative words, the contribution of the initial frequency with regard to its harmonics), the menstruation is most typically outlined because the quantitative relation of the RMS amplitude of a group of upper harmonic frequencies to the RMS amplitude of the primary harmonic, or harmonic.[12] [13]

$$THD = \frac{\sqrt{V_2^2 + V_3^2 + V_4^2 + V_5^2 + \dots + V_N^2}}{V_1}$$

Where V_n is the RMS voltage of the n th harmonic and $n = 1$ is the fundamental frequency.

SIMULATION RESULT OF (27-LEVEL) ACMLI WITH IM USING APOD- CHB



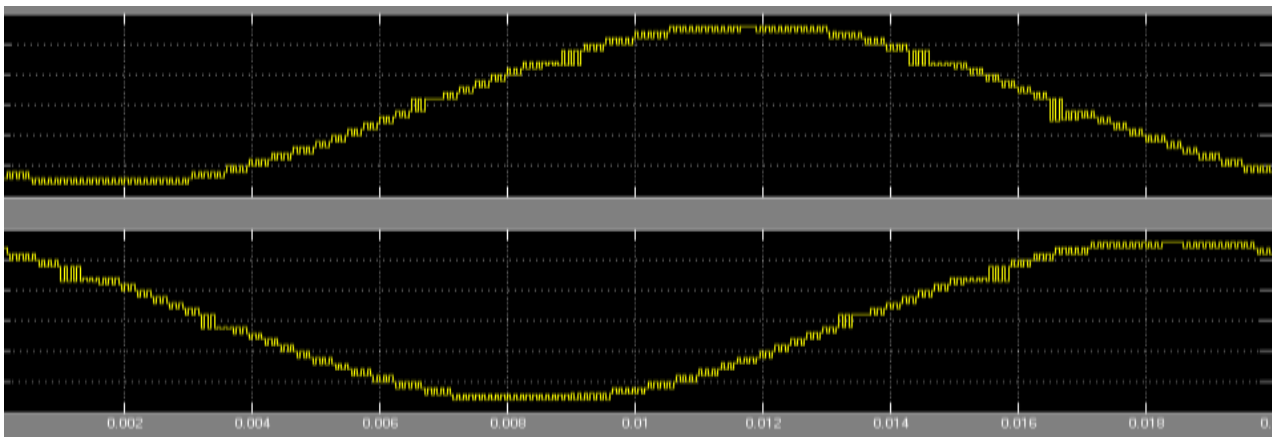


Figure 3: Output phase voltage waveform for asymmetric (27-level) MLI using APOD-CHB

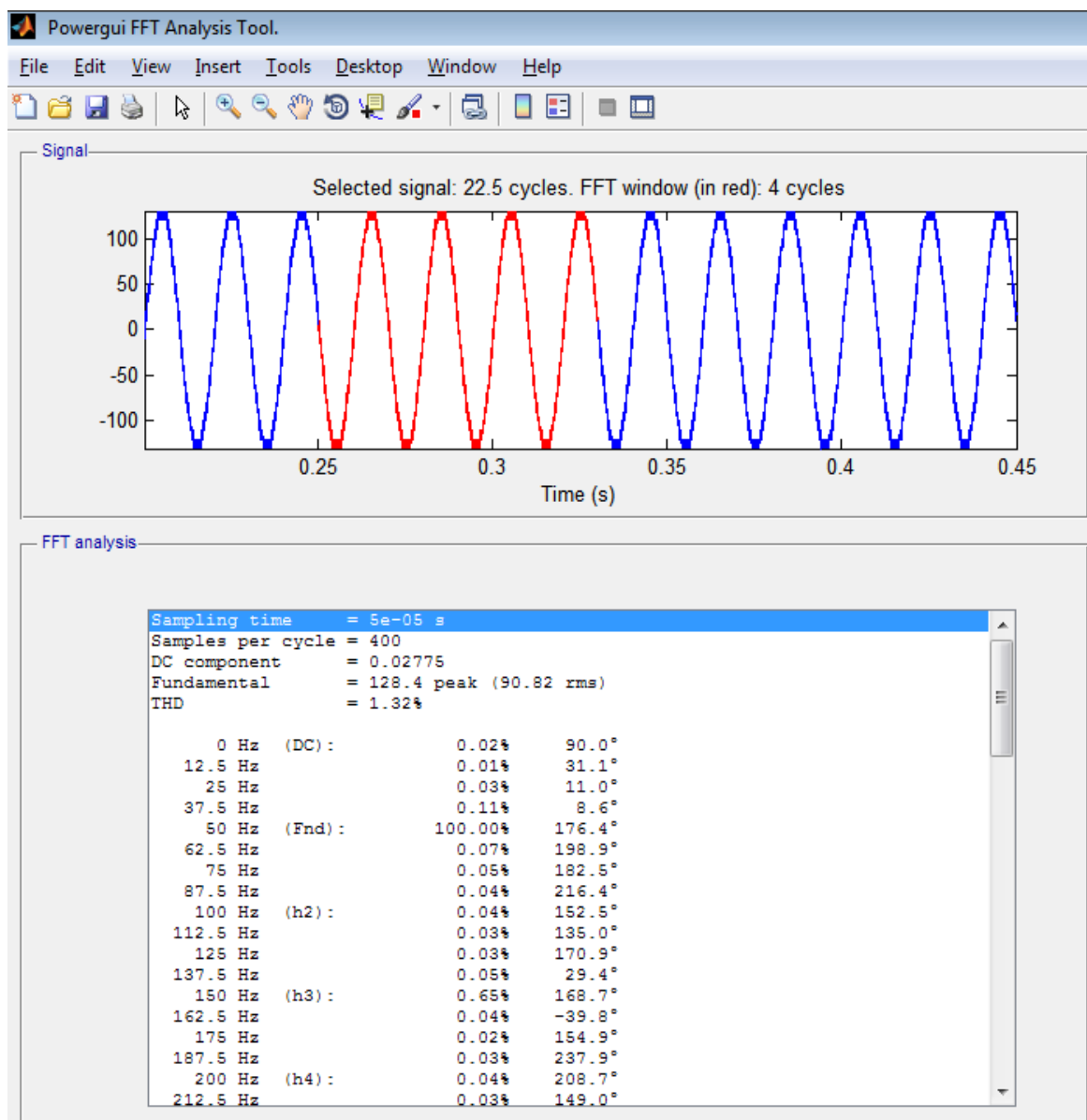


Figure 4: FFT analysis of voltage waveform of asymmetric (27-level) cascaded MLI using APOD-CHBMLI

In the above part discuss the performance of proposed MLI. Now compare proposed work with different previous method on the basis of number of level and total harmonic distortion. In the below table 2 shows –

TABLE 2: Comparison THD Result of the different Methods

S.No.	Ref.	YEAR	Method	LEVEL	Result-THD
1	[1]	2017	CHB	35	4.77%
2	[2]	2016	CHB	5	16.86%
3	[3]	2015	PWM	23	23.51%
4	[4]	2014	CHB	9	7.90%
5	[5]	2014	PWM	5	40.82%
6	Proposed	2018	Proposed	27	1.32%

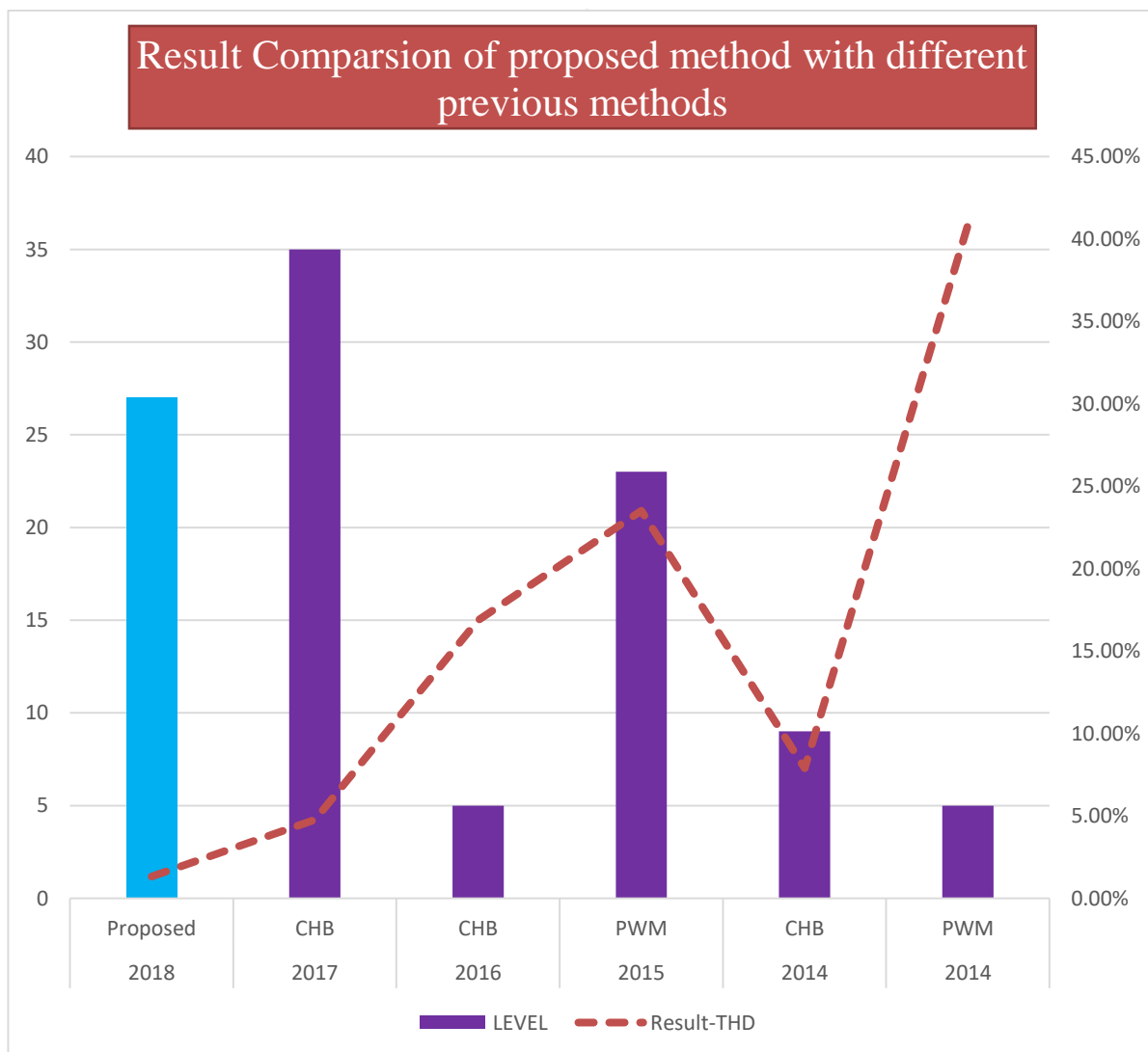


Figure 5: Graphical Comparison of proposed MLI with different previous methods

In the above figure 5 and table 2 shows the result comparison of proposed 27 level MLI with different previous method. In this table clearly see that the proposed MLI shows better THD at lower level. This same phenomena also describe with the help of graphical representation that is shown in above figure 5. That all of result of proposed work now discuss the conclusion and future work in the next chapter, that is conclusion and future work.

IV. CONCLUSION

In this work, the multicarrier pulse width modulation (PWM) techniques for 27 level have been presented. Performance factor like total harmonic distortion (THD) of the output voltage of asymmetric cascade H-Bridge multi-level inverter (CHB) have

been evaluated, presented and analyzed. The total harmonic distortion (THD) of the output voltage of cascade multi-level inverter (CMLI) is studied under different techniques such as APOD, compare for 27 level multi-level inverter (MLI) and less total harmonic distortion (THD) is observed for proposed 27 level with logical switches shows better result as compare to other previous methods. Therefore, it concluded that the 27-level cascade multi-level inverter (CHB MLI) provide a lower percentage total harmonic distortion (THD) as compared to other method shown in above table 5.1 and figure 5. The harmonic distortions present in the output voltage waveforms were experiential and calculate from side to side Fast Fourier Transform (FFT) analysis tool in Matlab and Simulink.

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