MULTILEVEL INVERTER CIRCUIT WITH IMPROVED OUTPUT AND REDUCED HARMONIC DISTORTION

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Abstract— The dependence according to the procurement, the A.C or the D.C power is used. The generation of A.C is cheaper and the transmission of the on electricity is greater than any other resource or any energy in this fast growing planet. The reason for this is that the generation and transmission is easier. However D.C component is cheaper. However, this may not be met to the standards until the emergence of power electronics, where the conversions of the Alternating to Direct and the vice versa is possible and the devices that are used in power conversions are called as the power converters. The power converter that can convert a D.C power to an A.C power is called as an inverter. In this paper a cascaded multilevel is presented so as to obtain an improved sine waveform from a straight line signal.This inverter 's switches have an automated gating pulses that are derived from the S-PWM and this multilevel inverter may operate by the usage of subsystems and hence there is not much need of the bulky circuit to be concentrated at one place but this inverter is flexible to operate by the usage of subsystems and a good waveform can be obtained.

Index Terms— switches, THD, sub-systems, multi-level inverter, PWM.

1 INTRODUCTION

The term multilevel inverter was rooted years ago. Multilevel inverter is a power electronic interface that synthesizes a desired output voltage from several DC voltages as inputs [1]. Now days the multilevel inverters have received much attention because of their considerable advantages such as high power quality, low harmonic components, better electro magnetic consistence, lower dv/dt and lower switching losses [2]. Recently, multilevel power conversion technology has been developing the area of power electronics very rapidly with good potential for further developments. The most attractive applications of this technology are in the medium to high voltage ranges. A multi level converter not only achieves high power ratings, but also enables the use of renewable energy sources [3]. Renewable energy sources such as photovoltaic, wind and fuel cells can be easily inter-faced to a multilevel converter system for high power applications.

There are three main types of multilevel inverters: Diode clamp multilevel inverter, flying capacitor multilevel inverter and cascaded multilevel inverter. The cascaded multilevel inverters have received special attention due to the modularity and simplicity of control. The cascaded multilevel inverters are mainly classified into two types: 1) Symmetric multilevel inverter, 2) Asymmetric multilevel inverter [4].In a symmetric multilevel inverter the D.C voltage sources have equal magnitudes where as an asymmetric inverter with different values of the D.C voltage sources. By increasing the magnitude of D.C voltage sources the higher number of output levels can be generated. This can operate at both fundamental switching frequency and high switching frequency usually means lower switching loss and high frequency [5] . The applications include use in laminators, pumps, conveyors, compressions, fans, blowers, and mills.The history of the multilevel inverter is as follows. The first topology introduced was the series H-bridge design, but sev-eral configurations have been obtained for this topology as well, since the topology consists of series power conversion cells, the voltage and power levels may be scaled easily [6]. The H-bridge topology was followed by the diode-clamped converter that utilizes a bank of series capacitors. The flying capacitor topology followed diode-clamped after few years, instead of series connected capacitors, this topology uses floating capacitors, to clamp the voltage levels. H-bridge inverters have isolation transformers to isolate the voltage source, but they don't need either clamping diode or flying capacitors.

There are many control and modulation strategies have developed for a multilevel converter like sinusoidal phase width modulation, space vector modulation and others. Many multilevel converter applications include industrial application for motor drives and using the FACTS (flexible alternating current transmission systems) [6].

Although the low voltage switches are used which

require related gate driver and protection circuits, they have a great drawback i.e. number of switches needed are in a great number and these switches are solid state devices and hence loss may take place. The other disadvantages of the power converter are small voltage steps are produced by isolated voltage sources or by the connection of series capacitor bank as they are connected for power improvement this may lead the overall system to the more expensive, complex and less reliable[5]. So in practice decrement of gate driver circuits and henceforth number of switches is very important [7]

2. CASCADED H-BRIDGE MULTILEVEL -- --INVERTER TOPOLOGY.

Conventional cascaded multilevel inverters is one of the most important topologies in the family of multilevel and multi-pulse inverters[4].The cascaded topology converts the several levels of D.C voltages to desired A.C voltage .The D.C levels are considered to be symmetrical since all of them are fuel cells or batteries etc, which requires less number of components when compared to diode clamped and flying capacitors type multilevel inverters and no specially designed transformer is needed, as compared to multi pulse inverter[8]. A cascaded inverter consists of number of H-bridge inverter units mainly known as the individual units in this paper. The H-bridge topology is shown in the below mentioned figure, is used to obtain A.C voltage from the three symmetrical D.C voltages namely(V1,V2,V3),the A.C output may be obtained from the different combinations of switches(S1,1;S2,1;S3,1;S4, The overall output voltage is given by:

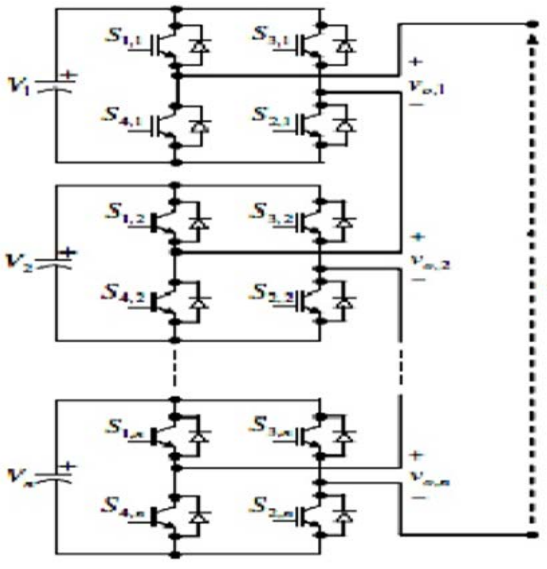

Fig. 1. Configuration of cascaded multilevel inverter

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3. PROPOSED MULTILEVEL INVERTER

The topology of the cascaded H-bridge,basic unit is shown in the figure.(i). This unit consists of four unidirectional power switches from the voltage point of view (s1, s2, s3, s4) and one D.C voltage source. The main disadvantage of the proposed model is that it requires high number of static power switches. However this basic unit is able to generate seven different levels at the output.The ones and zeroes indicate the on and off states of switches

STATE	S1	S2	S3	S4	Vo
1	0	0	0	0	0
2	1	1	0	0	Vdc
3	0	0	1	1	Vdc

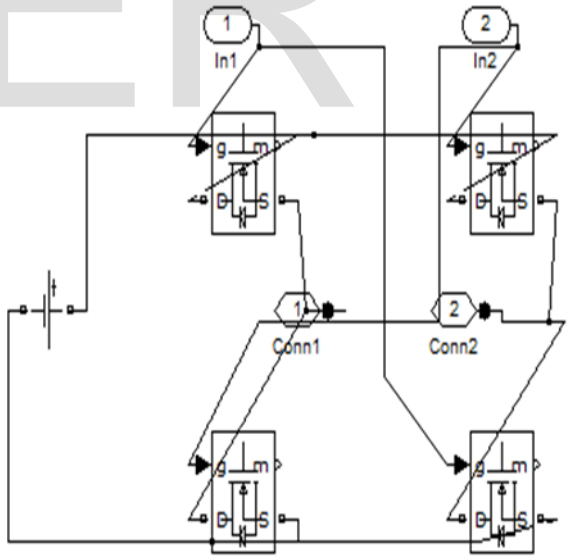


Fig. 2.Basic unit based on developed bridge

The working of this subsystem may be given as below the gating signal is fed to the mosfets (i) and (ii) a same gating pulse is fed to it and the working of mosfets (iii) and (iv) also follow the same criterion as of mentioned above.

The basic circuit is able to generate seven different levels of output,where as three outputs are only generated in the basic H-bridge. Only the H-bridge generates the different levels of

output. The topology shown here is a seven level inverter topology which is a asymmetrical inverter topology and if the this proposed cascaded inverter have the same voltage magnitudes in other words if it is symmetrical, this can produce the five level output. Therefore in order to generate more number of output levels, for this proposed topology an asymmetrical topology have to be selected which can only have different magnitudes of D.C voltage levels[9].

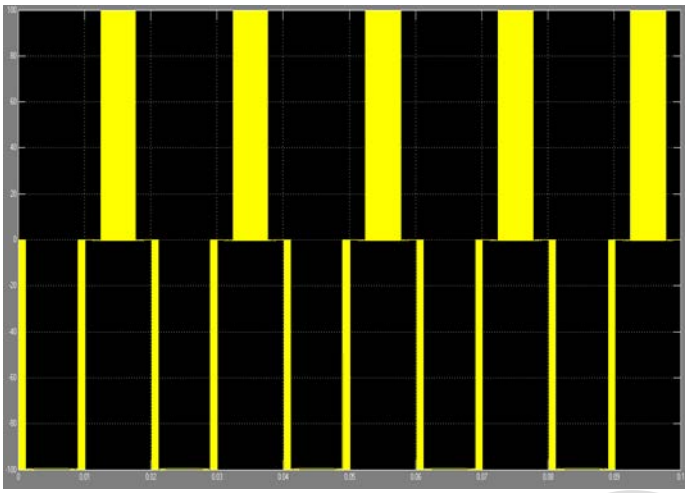


Fig. 3.Shows the output of basic individual unit.

A new cascaded multilevel inverter can be made by the series connection of n number of the H-bridge basic individual units.

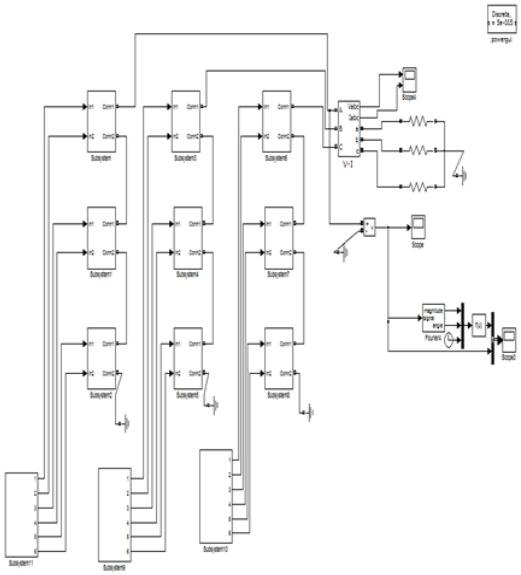


Fig. 4.Proposed multilevel inverter topology

4.THE MODULATION SCHEME.

The gating circuit consists of a S-PWM that is a sine wave pulse width modulation. Here the sine wave is compared to the triangular wave and hence the gating pulses may be obtained according to the requirement of firing angle and hence in this way the flexibility in the operation takes place. The gating pulses are as follows

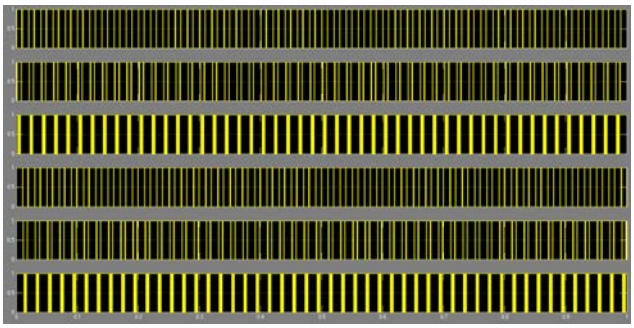


Fig. 5.Gating pulses.

The inverter topology mention shown here is a cascaded novel H-bridge inverter and the output that is going to obtained is Vo=3Vdc.The switching table of this inverter topology is as given below.

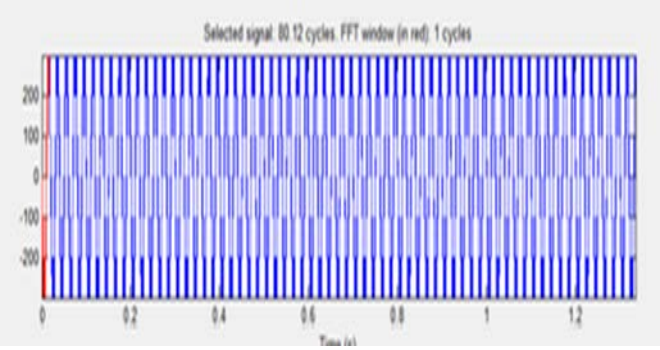
5.SIMULATION RESULTS.

Harmonic components in the load current may effect the performance of the inverter. So, in this paper harmonic components are tried to reduce load current is brought in a quality sinusoidal waveform. To analyze the harmonic components of the proposed technique, several harmonic measures

are possible. The total harmonic Distortion is one of the measure which evaluates the quantity of harmonic contents in the output waveform.

The matlab simulink power block set software has been used for simulation. The proposed multilevel inverter shown in fig.1. is subjected to produce a 50Hz, 7 level stair case waveform.

The output waveforms are as shown below



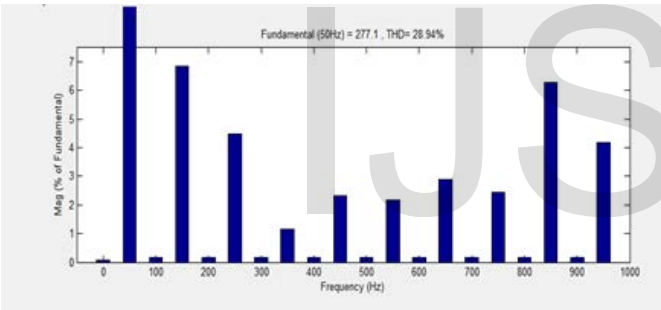


Fig. 6.Shows the output voltage and the corresponding waveform.

The output current and voltage waveforms are shown below

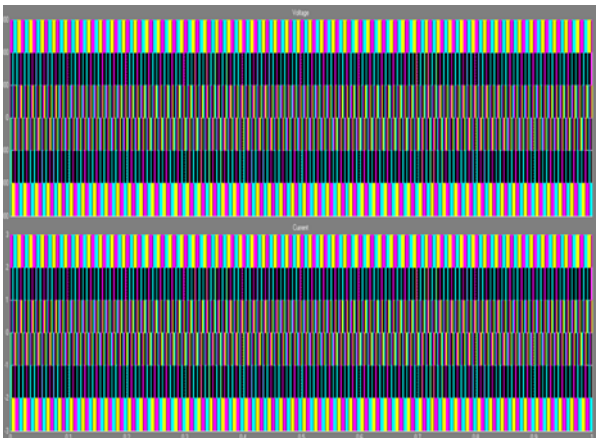


Fig. 7.Output Voltage and Current waveforms.

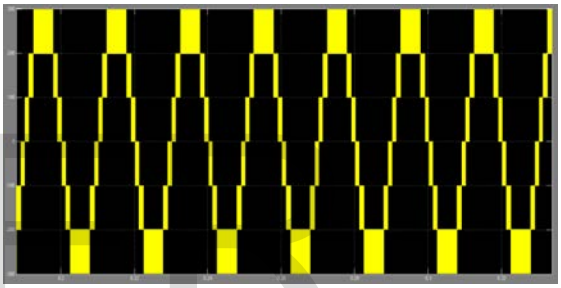


Fig. 8.Input wave form.

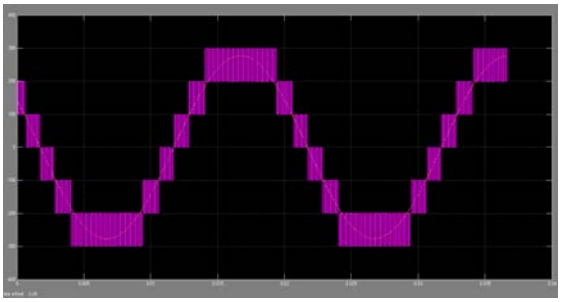


Fig. 9.shows the output waveforms.

6. CONCLUSION

A symmetrical multilevel inverter topology has been proposed in this paper. The most important aspect of this system is that the multi level inverter generates a near sinusoidal wave form.

This technique provides more flexibility to the designers and can generate more voltage levels without losing any voltage level which disturbs the THD characteristics. The simulation results also illustrates the performance and effectiveness of the proposed circuit to generate high quality output voltage wave from and reduce harmonic components.

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