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CASCADED MULTILEVEL INVERTER WITH MULTICARRIER PWM TECHNIQUE AND VOLTAGE BALANCING TECHNIQUE

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ABSTRACT

Multilevel inverters have been widely accepted for high-power high voltage applications. This performance is highly superior to that of conventional two-level inverters due to reduced harmonic distortion, lower electromagnetic interference and higher dc link voltages. A novel cascaded multilevel inverter topology with reduced number of power switches is proposed. It can also be applied for three-phase applications with the same principle. This topology uses isolated dc supplies. Therefore, it does not face voltage-balancing problems due to fixed dc voltage values. This new topology is based on a combination of conventional diode clamped and H-bridge topologies. The proposed idea has been validated through the simulation results. Here the proposed system has seven switches to achieve the fifteen levels and also to reducing the total harmonic distortion.

INTRODUCTION

Renewable energy resources are penetrating into the grid increasingly due to harvested green energy. As well, the energy demand is increasing significantly which necessitate more power generators and transmission lines. Photovoltaic panels are a distributed source of energy that can be installed on each customer site like on the rooftop of a house and deliver the power using a single phase inverter to convert the DC voltage of the panels to the useful and regulated AC voltage required by the loads. Power electronic converters are widely used to generate AC voltage from DC sources. They can be connected to the grid and supply the AC loads from DC sources like photovoltaic panels. Due to high THD (total harmonic distortion) and power losses of the conventional two-and three level inverters as well as reduced cost of the semiconductor power switches, new generation of inverters using combination of DC sources and switches called multilevel inverters has been introduced which has attracted the attention of industries and researchers because of their advantageous features. Multilevel inverters produce output voltage with more levels therefore it is smoother and closer to sinusoidal wave.

EXISTING SYSTEM

Existing Circuit Diagram

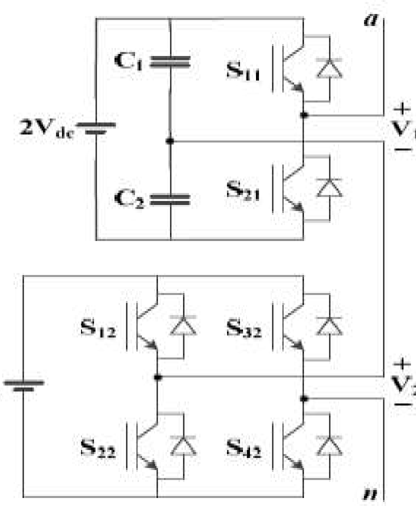

Fig 1 Existing circuit diagram

Herehybrid multilevelinverterexisted integrating half-bridge andfull-bridge cells. These cells can be used as cascaded structure instead ofCHB with equal and/or an unequalDC sources. A PWM strategy is designed to getthe highest possible output voltage levels while using thefewer switches. Here the existing system has eleven switches to achieve the fifteen levels and also to reducing the total harmonic distortion.

Moreover, the control strategy has the ability to balancethe neutral point voltage of the half-bridge cellevenduringthe load change conditions. The

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associated switching techniquewithmulticarrier PWM is designed to generatefifteen-level voltage at the output. As well,the designedswitchingtechnique allowsthe capacitors of the half bridge cell to have the balanced voltage despite load changes.

In this existingsystemwe proposed multilevel inverter with Reduced number of switches and the switching loss is alsoget reduced and Level is increased upto 9 or 15 level with reduced (THD).

This multilevel inverter has three DC sources and eight switches that cangenerate fifteen-level voltage at Van while using three equal sources as:

$$Vdc1=Vdc2==Vdc3=E$$

By considering the voltage sharing of the half-bridge cell it is clear that in each switching cycle, one of the DC sources are connected to the output and the other is remained unconnected. Therefore one DC source with two series capacitors can be used as DC source of the half-bridge cell. The middle point of the capacitors is connected to the next cell and the designed switching technique deals with balancing the voltage.The existing approach improves the maximum achievable fundamental voltage. This strategy can be easily extended and implemented for inverters with more voltage levels.

PROPOSED DIAGRAM

Proposed Circuit Diagram

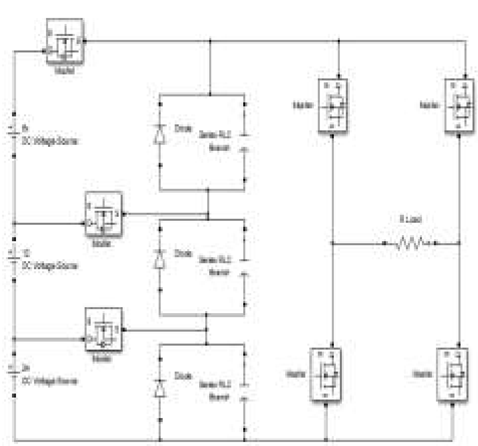

Fig 2 Proposed circuit diagram

In this paper a hybrid multilevel inverter is existed integrating half-bridge and full-bridge cells. These cells can be used as cascaded structure instead of CHB with equal and/or an unequal DC sources. A PWM strategy is designed to get the highest possible output voltage levels while using the fewer switches. Here the proposed system has seven switches to achieve the fifteen levels and also to reducing the total harmonic distortion.

The control strategy has the ability to balance the neutral point voltage of the half-bridge cell even during the load change conditions. The associated switching technique with multicarrier PWM is designed to generate fifteen-level voltage at the output. As well, the designed switching technique allows the capacitors of the half bridge cell to have the balanced voltage despite load changes.

In this existing system we proposed multilevel inverter with Reduced number of switches and the switching loss is also get reduced and Level is increased upto 9 or 15 level with reduced (THD). This multilevel inverter has three DC sources and seven switches that can generate fifteen-level voltage at Van while using three equal sources as:

$$Vdc1=Vdc2==Vdc3=E$$

The voltage sharing of the half-bridge cell it is clear that in each switching cycle, one of the DC sources are connected to the output and the other is remained unconnected. Therefore one DC source with two series capacitors can be used as DC source of the half-bridge cell. The middle point of the capacitors is connected to the next cell and the designed switching technique deals with balancing the voltage.

The proposed approach improves the maximum achievable fundamental voltage. This strategy can be easily extended and implemented for inverters with more voltage levels. When MOSFET Switches S1,S2,S3&S4 are turned ON, the maximum positive voltage Vdc is united to the (+ve) terminal (a) of the load. When the MOSFET Switch S5 is turned ON, the (-ve) terminal (b) of remaining all the switches are in OFF condition.

The current flows through the load from ‘a’ to ‘b’, so that the voltage brought to bear across the

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load is +Vdc. Then the negative output voltage starts when MOSFET S1 & S6 are turned ON and MOSFET Switch S2 & S3 is turned OFF. The current flows from 'b' to 'a'. Like these, the switching combination are generated and that generate the 15 level output voltage.

INVERTERS

The power in the battery is in DC mode and the motor that drives the wheels usually uses AC power, therefore there should be a conversion from DC to AC by a power converter. Inverters can do this conversion. The simplest topology that can be used for this conversionis the two - level inverterthat consists of four switches. Each switch needs an anti - parallel diode, so there should be also four anti parallel diodes. There are also other topologies for inverters. A multilevel inverter is a power electronic system that synthesizes a sinusoidal voltage output from several DC sources. These DC sources can be fuel cells, solar cells, ultra capacitors, etc.

The main idea of multilevelinverters is to have a better sinusoidal voltageand current in the output by using switches in series. Since many switches are put in series the switching angles are important in the multilevel inverters because all of the switches should be switched in such a way that the output voltage andthe current have low harmonic distortion. Multilevelinverters have three types. Diode clamped multilevel inverters, flying capacitor multilevelinvertersand the cascaded H-bridge multilevel inverter. The THD willbe decreased by increasing sthenumber of levels. It is obvious that an output voltage with low THD is desirable, but increasing the number of levels needs more hardware, also the control will be more complicated.

EXISTING SIMULATION

In this existing system, to use diodes and provides the multiple voltage levels through the different phases to the capacitor banks which are in series. A diode Transfers a limited amount of voltage, thereby reducing the stress on other electrical Devices.

The maximum output voltage is half of the input DC voltage. It is the main Drawback of the diode clamped multilevel inverter. This problem can be solved by increasing the switches, diodes, capacitors.

This type of inverters provides the high efficiency because the fundamental Frequency used for all the switching devices and it is a simple method of the back to Back power transfer systems.

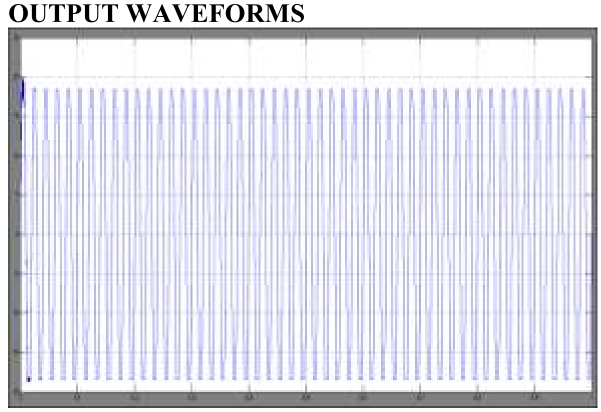
The 15-five level diode clamped multilevel inverter uses switches, diodes. Capacitors also used, so output voltage is half of the input.

In the 15-level hybrid multilevel inverters in the simulation mode are providing waveforms respectively. Here sinusoidal waveforms are used to mitigate The harmonic levels in unbalanced phase condition.

This inverter consists of two H-bridge inverters that are cascaded. Here we using 11-switches devices, to get the level of 15 to mitigate the harmonic In the event of unbalanced phase condition.

And its operates the pulses s1 and s1' switches given by one pulse generator but its no to turn at the same time so I need to use the not operator for operates at the complementary operation. Likewise all the pulse generator given the pulses is fed to the switches. Finally the scope block is used to display the simulation results.

OUTPUT WAVEFORMS



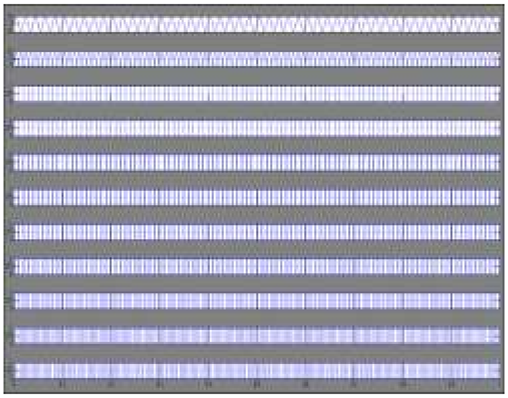


Fig 3 Output waveforms

The levels of output switching pulses are increased with using less number of switches are shown in above figure.

PROPOSED SIMULATION

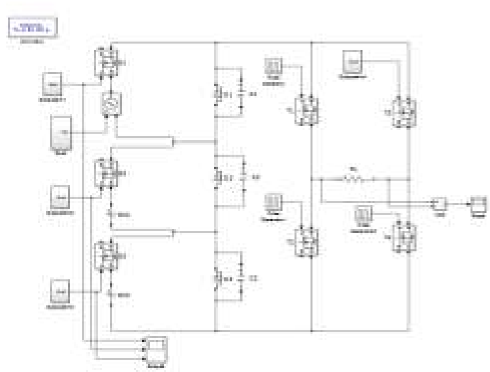
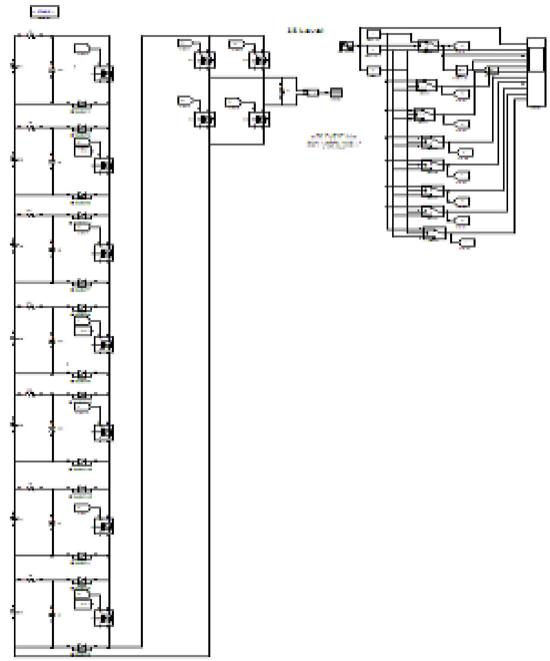


Fig 4 Proposed simulations

Fig 5Topology used

PROPOSED SIMULATION EXPLANATION

In this proposed system, to use diodes and provides the multiple voltage levels through the different phases to the capacitor banks which are in series. A diode Transfers a limited amount of voltage, thereby reducing the stress on other electricalDevices.



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In the 15-level hybridmultilevel inverters in the simulation mode areproviding waveforms respectively. Heresinusoidal waveforms areused to mitigate The harmonic levels in unbalanced phase condition.

This inverter consists of two H-bridge inverters that are cascaded. Here we using 7-switches devices, to get the level of 15 to mitigatethe harmonicIn the event of unbalanced phase condition. And its operates the pulses s1 and s1' switches given by one pulse generator but its no to turn at the same time so I need to use the not operator for operates at the complementary operation. Likewise all the pulse generator given the pulses is fed to the switches. Finally the scope block is used to display the simulation results.

OUTPUT WAVEFORM

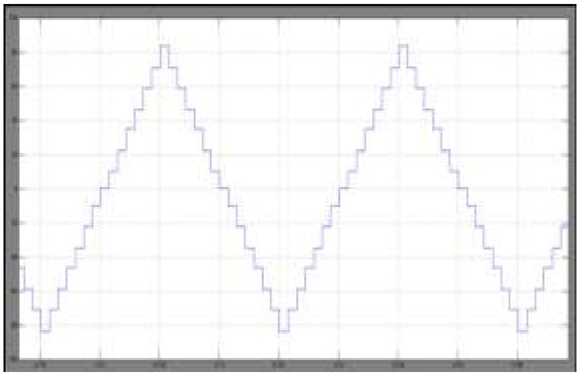

Fig 6 Output waveforms

The levels of output switching pulses are increased with using less number of switchesare shown in above figure.The 15 level output voltage (0Vdc, Vdc/7, 2Vdc/7, 3Vdc/7, 4Vdc/7, 5Vdc/7, 6Vdc/7,Vdc, -Vdc/7, -2Vdc/7, -3Vdc/7, -4Vdc/7, -5Vdc/7, -6Vdc/7, -Vdc).

CONCLUSIONS

In this paper a hybrid multilevel inverter has been studied and investigated To modify and get better performance. Therefore, a modified topology has beenproposedusing half bridge cell with two capacitors instead of two independent DCsources. In order to get the desired results, switching pattern has been design considering the output voltage value of half-bridge and full-bridge cells as well as applying the voltage balancing method combined with the switching technique. Moreover, the extended version of the proposed inverter has been depicted more half-bridge cells in order to reduce the number of switches and DC sources in comparison with other multilevel inverter topologies. The simulation results has including output voltage, current waveform and their THD% validate the main of the proposed multilevel inverter and the associated designed switching strategy. The simulation results during load variation proves the efficiency voltage balancedMethod in dealing with the capacitors voltages to keep them balanced and generateSymmetrical five-level voltage at the output.

Fig 7 Hardware assembly

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