Design of Multilevel Inverter for renewable energy applications with different PWM techniques

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Abstract: The Importance of renewable energy sources increasing day to day world. We need converters for interfacing renewable energy sources to grid. This paper proposes 21-level multilevel inverter for interfacing renewable energy sources to grid. This proposed topology used 16 switches and four voltage sources. The proposed MLI improve output voltage level and reduce device count. Different PWM techniques used for generating switching angels. The advantage of this proposed MLI to reduce the circuit complexity and total harmonic distraction. And installation area. The proposed multilevel inverter implemented Matlab/Simulink software.

Keywords: Multilevel Inverter, PWM Techniques, Total Harmonic Distraction.

I.INTRODUCTION

Now a days the importance renewable energy sources increasing in all sectors like government and private. We need particular converter for converting DC to DC and DC to AC .in this paper proposes multilevel inverter for renewable energy source applications.

ANPC nine-level inverter [1]for interconnected grid and renewable energy sources. The proposed inverter only ten switches and designed for single-phase applications. Compared conventional 5L inverter. The proposed inverter used less number of components. An isolated multi input multilevel inverter [2] for integration of renewable energy applications. The proposed inverter 5 switches for 5Level inverter. The converter reduces transformer saturated related issues. The Proposed inverter integration of different voltage sources to power for the local AC loads. This inverter simple structure, high gain. Multilevel inverter designed [3] for low, medium and high voltage applications. the proposed CCS-MLI for renewable energy applications. This inverter reduces device count and diodes, complexity of control circuit. Four switch based 3-phase inverter for [4] micro grid and renewable energy applications. The proposed inverter for generalized unbalanced grid connection and the advantage of inverter reduce device count controlling also simple.3-phase CSI designed for [5] grid interfacing distribution renewable energy system. This proposed inverter designed for continue power for distribution systems. This inverter used peak load hours. Three level inverter for [6] interfacing RES and Grid. The proposed inverter controlled by state variable in small-and large-signals operation.

Cascaded multilevel inverter [7] for PV systems .the proposed topology an improve five-level CMLI with low switch count and minimization of leakage current in transformer less PV system. Design of multi-level inverter DC-AC inverter for[8] AC applications. The proposed configuration is to reduce the number of power devices and compared traditional structures. MQZS cascaded hybrid five-level inverter [9].the proposed inverter can produce a nine-level output voltage. Requires nine high-frequency switching devices and four low-frequency switches.

This paper proposes 21-LEVEL inverter for renewable energy applications. The proposed inverter produce 21 level output voltage. This proposed inverter best suitable for single-phase supply applications. Like fan and washing machine or home uses This inverter used 16 switches and four voltage sources. Compare to other inverter simple structure, good gain.

II. PROPOSED TOPOLOGY

Fig.1 shows the proposed 21-LEVEL inverter, which consists of the full-bridge converter with arrangement of different magnitude voltage source and IGBT switches required. In fig.1. for 21 level inverter 12 IGBT switches required. In this topology strategy of different degree voltag sources nearby full platform converter gives the 21 level yield voltage. The progressions S5,S6 to S12 are used to gave the best approach to obatain assorted yield voltage levels.

The voltage sources V1,V2,V3 and V4 are of V,2V,3V and 4V independently

The 30kva laboratory prototype of STATCOM using 21-level delta-connected cascaded inverter. The control circuit is based on TMS320C32 DSP and FPGA. The switching angles of the multi-pulse optimal PWM are calculated off-line and stored in the look-up table in a FLASH ROM. The DSP look up the switching angles and transfer them to the FPGA, which generate the pulse-signals of the switch devices according the switching angles [10].A 21-level inverter designed and implemented for photovoltiaic and grid applications.[11]

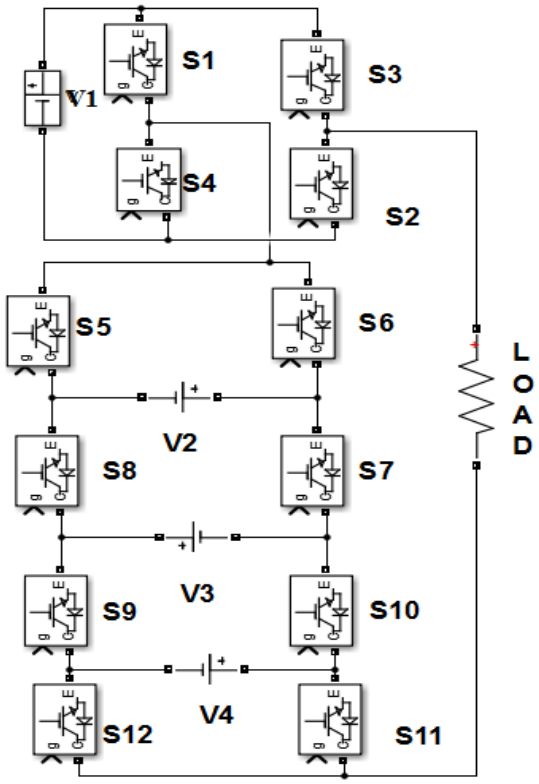


Fig.1.21-Level Inverter

This proposed inverter IGBT switches and anti parallel diodes used. IGBT switches used for high voltage and high current applications. MOSFET used for high frequency applications.mosfet switch used in chopper. In this section comparison of different MLIS and proposed inverter.

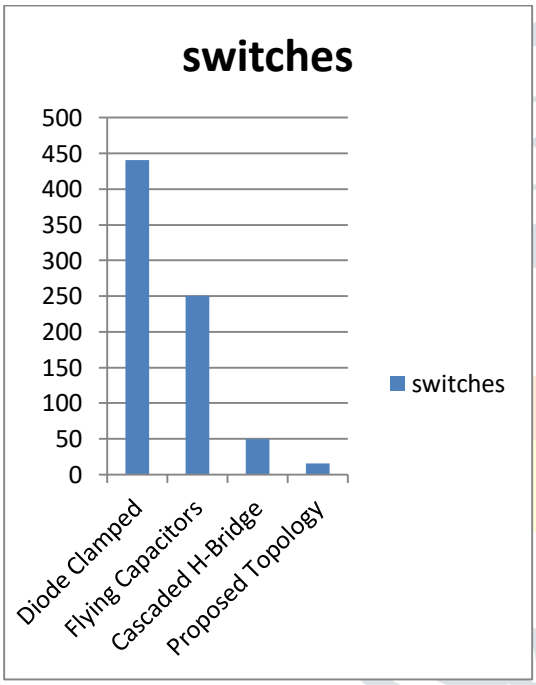
OUTPUT VOLTAGE levels	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12
+10V	0	0	1	1	0	1	0	1	0	1	0	1
+9V	0	1	0	1	0	1	0	1	0	1	0	1
+8V	0	0	1	1	1	0	0	1	0	1	0	1
+7V	0	1	0	1	1	0	0	1	0	1	0	1
+6V	0	0	1	1	0	1	0	1	0	1	1	0
+5V	0	0	1	1	0	1	1	0	0	1	0	1
+4V	0	1	0	1	0	1	1	0	0	1	0	1
+3V	0	0	1	1	1	0	0	1	1	0	0	1
+2V	0	1	0	1	0	1	0	1	1	0	0	1
+1V	0	0	1	1	0	1	1	0	0	1	1	0
0	0	1	0	1	0	1	1	0	0	1	1	0
-1V	1	1	0	0	0	1	1	0	0	1	1	0
-2V	0	1	0	1	1	0	1	0	0	1	1	0
-3V	1	1	0	0	1	0	1	0	0	1	1	0
-4V	1	1	0	0	0	1	1	0	1	0	0	1
-5V	1	1	0	0	1	0	0	1	1	0	1	0
-6V	1	1	0	0	1	0	1	0	1	0	0	1
-7V	0	1	0	1	0	1	1	0	1	0	1	0
-8V	1	1	0	0	0	1	1	0	1	0	1	0
-9V	0	1	0	1	1	0	1	0	1	0	1	0
-10V	1	1	0	0	1	0	1	0	1	0	1	0

Table.1. Switching pattern of Proposed 21-Level Inverter

III. DIFFERENCE BETWEEN PROPOSED AND CONVENTIONAL MLIS

Multilevel inverter Components	Diode Clamped	Flying Capacitors	Cascaded H-Bridge	21-level inverter
Main Switches	40	40	40	12

Clamping Diodes	380	…..	…..	….
DC Split Capacitors	20	20	…..	….
Clamping Capacitor	….	190	…..	….
Dc Sources	1	1	10	4
Total	441	251	50	16



IV. MODULACTION TECHNIQUES FOR MLI

The proportional and integral (Pi) control method real-time calculated for multilevel inverter (MLI) switching angle control. PI control method eliminated 3rd and 5th harmonic contents in H-Bridge seven level inverter [12]. SHEPWM to eliminate the 5th, 7th and 11th harmonics in nine level inverter with neutral point clamped (NPC) structure [13].

The FFA based optimization technique the overall THD of the output voltage of 11-Level cascaded multi inverter with equal and non equal dc sources. FFA algorithm is developed to compute the switching angles for minimization of overall voltage THD [14]. Multicarrier pulse width modulation (MCPWM) and optimized harmonic stepped waveform (OHSW) techniques applied solar fed cascaded 15-Level inverter both stand alone and grid connected system reduce 3rd ,5th and 7th harmonics[15].

Bee algorithm eliminates harmonics in cascaded 7-level inverter [16].SHE_OHSW and OHSW techniques calculated five-level and thirteen-level inverter switching angles and eliminates harmonics up to 17th order. SHE_OHSW modulation improves the performance of the five-level and thirteen-level inverter with reduce component, cost and complexity [17]. Firefly algorithm (FFA) solving nonlinear transcendental equations and generate optimized firing angles for multilevel inverter to generate desired outputs minimize harmonics and lower total harmonic distortion.

V.CONCLUSION

A-21 level inverter has been proposed in this paper with reduced number of switches and this inverter vest suitable for photovoltaic and grid applications. This topology needs less number of switches for high levels. The proposed inverter reduces the installation area, cost and simple control system. The proposed 21-level inverter compared with the conventional multilevel inverters where it needs almost twice the number of switches.

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