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In this paper, a study of analyzed solar power generation system used nine level multilevel inverter using a capacitor selection circuit multilevel inverter with used current mode control and pulse width modulation use to generate the control signals for power electronic switches, used only seven power electronics switches it also produced sinusoidal output. It reduced the switching loss of the circuit and also increases the efficiency filter inductor also reduced. Nine level multilevel inverter implemented by MATLAB (R2014a) and the simulation results are presented.

Index Terms—Pulse width modulation (PWM); multi level inverter(MLI); Photovoltaic systems (PVS).

I. INTRODUCTION

A traditional multilevel inverters topologies are diode clamped multilevel inverter , flying capacitor multilevel inverter and flying capacitor multilevel inverters mainly this flying capacitor and diode clamped multilevel inverters are difficult to regulate the voltage levels. it also necessary to increase the voltage level of this system it also single phase inverter with twelve number of power electronics switches. Asymmetric voltage technology is used in cascade multilevel inverter System .

Photovoltaic system can be easily integrated with residential buildings hence they will be main responsible of making low voltage grid power flow bidirectional. control issues both the PV side and on the grid side have received much attention of from manufacturers ,competing for efficiency and low distortion and academia proposing new ideas soon become state-of-the-art. This paper aims at reviewing part of these topics (MPPT, current and voltage control) leaving to a future paper to complete the scenario. Implementation issues on Digital Signal Processor (DSP), the mandatory choice in this market segment, are discussed. In [2]

a single-phase grid-connected transformer less photovoltaic inverter for residential application is presented.[3] The inverter is derived from a boost cascaded with a buck converter along with a line frequency unfolding circuit. Due to its novel operating modes, high efficiency can be achieved because there is only one switch operating at high frequency at a time, and the converter allows the use of power MOSFET and ultrafast reverse recovery diode. It also features a robust structure because the phase leg does not have a shoot-through issue. This paper begins with theoretical analysis and modeling of this boost-buck converter-based inverter. And the model indicates that small boost inductance will lead to an increase in the resonant pole frequency and a decrease in the peak of Q, which results in easier control and greater stability. Thus, interleaved multiple phases structure is proposed to have small equivalent inductance; meanwhile, the ripple can be decreased, and the inductor size can be reduced as well.

This paper presents a multi objective control scheme based on the dynamic model of three-level, presented[4] neutral-point-clamped voltage source inverter for integration of distributed generation (DG) resources based on renewable energy resources to the distribution grid. The proposed model has been derived from the abc/αβ and αβ/dq transformation of the AC system variables. The proposed control technique generates the compensation current references and by setting appropriate references of

DG control loop, the DG link not only provides active and reactive currents in fundamental frequency, but also it can supply nonlinear load harmonic currents with a fast dynamic response. Simulation results and mathematical analysis have achieved a reduced total harmonic distortion, increased power factor, inject maximum power of renewable energy resources via a multilevel converter as an interface to the AC grid. It also compensated the active and reactive powers of linear and nonlinear loads. The analyses and simulation results show the high performance of proposed control scheme in the integration of renewable energy resources to the AC grid.

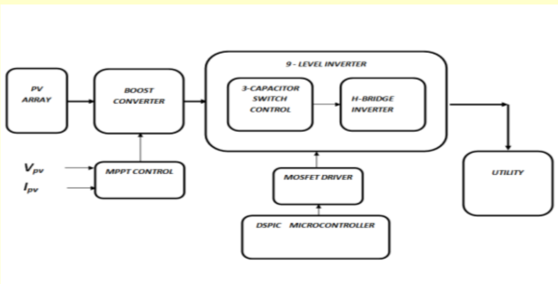

Fig .1.Block diagram of the system

Multilevel converters are very interesting alternatives for medium and high-power applications. The main reason is the increase in the number of output voltage levels and its apparent frequency. This paper presents a new configuration of flying capacitor multicell (FCM) converter. The main advantages of the proposed converter, in comparison with FCM and stacked multicell converters, are doubling the rms and the number of output voltage levels, improving the output voltage frequency spectrum, and canceling the midpoint of dc source.

Flying-capacitor converters (FCCs), like most multilevel converter topologies, require a balancing mechanism of the capacitor voltages. FCCs feature natural voltage balancing when a special modulation technique is used. The classic methods, such as phase-shifted pulse width modulation (PS-PWM), result in very slow balancing for some duty-ratio ranges. Previous work has shown that for a single-leg five-level FCC, one time constant is infinite for a zero desired output voltage. In this paper, a modified PS-PWM scheme for a single-leg five-level FCC is presented, which results in faster balancing over the total duty-ratio range. The modified PS-PWM scheme is studied, resulting in an averaged voltage-balancing model. This model is verified using simulations and experiments. The modified PS-PWM scheme solves the slow-balancing problems of the normal PS-PWM method for odd-level FCCs, while maintaining the passive control property and it provides a self-pre charge capability.

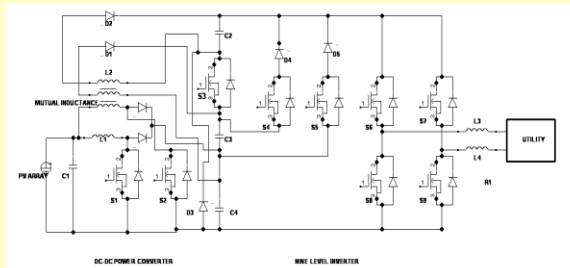

Fig.2. Nine level multilevel inverter

The solar fed nine level multilevel inverter as shown fig .2.consist of seven power electronic switches from S3-S9 for inverter circuit and from and from switches S1 and S2 dc-dc converter and switches S3-S5 are capacitor selection circuit multilevel inverter switches S6-S9 nine level inverter circuit. In C2-C3 capacitors are used in capacitor selection circuit are Used . Coupled inductance is used to increases power from to dc to dc power converter system. However, four dc capacitors are used to construct the four voltage levels. There, only power electronic switches of the level generation part switch in high frequency. The dc/dc power converter integrates a dc–dc boost converter and a transformer to convert the output voltage of the solar cell array into three independent voltage sources with multiple relationships. This new nine-level inverter is configured using a capacitor selection circuit and a full-bridge power converter, connected in cascade. The capacitor selection circuit converts the three output voltage sources of dc–dc power converter into a four-level dc voltage, and the full-bridge power converter further converts this four-level dc voltage into a nine-level ac voltage. The solar power generation system generates a sinusoidal output current that is in phase with utility voltage and fed in to the utility only one power electronics switch is switched at high frequency at any time. This circuit modes classified to positive and negative half cycles furthers divided into eight modes as shown in fig[3].

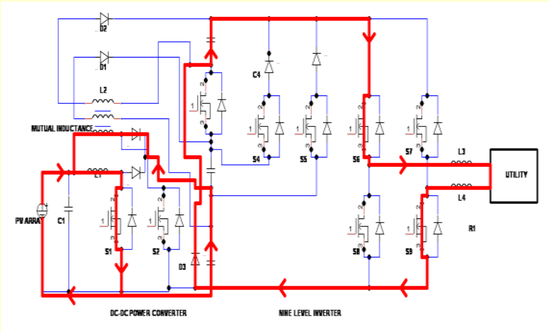

Fig.3. Mode 1 operation

This mode switch S1 in the dc to dc converter is turned ON inductor L1 and capacitor c4 also charging. Capacitor switches S3,S4 and S5 are turned off the capacitor c2 delivers its stored. The energy to load. This mode of operation output voltage is vdc/4

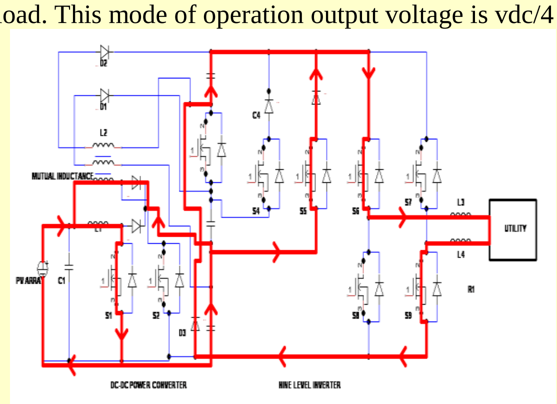

Fig4. Mode 2 operation

This modes of operation S5 is turned on inductor L1 and capacitor c4 is charging C2 delivers energy source to load output voltage is Vdc /2

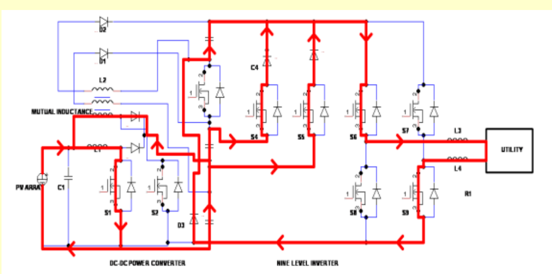

Fig.5. Mode 3 operation

This mode operation S4 is turned on, the capacitor C3 also deliver it stored energy to the load output voltage 3vdc/4 is produced.

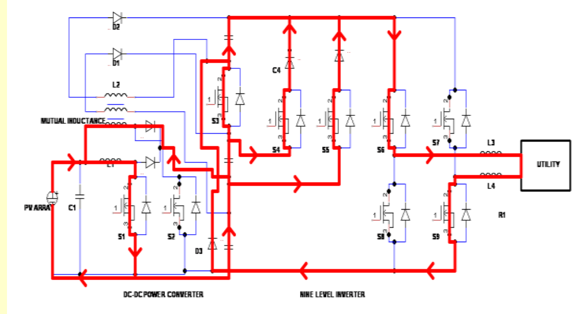

Fig.6. Mode 4 operation

This mode of operation S3 is also turned on. Capacitors C3 and C4 delivers to energy stored to load. And output voltage Vdc is produced.

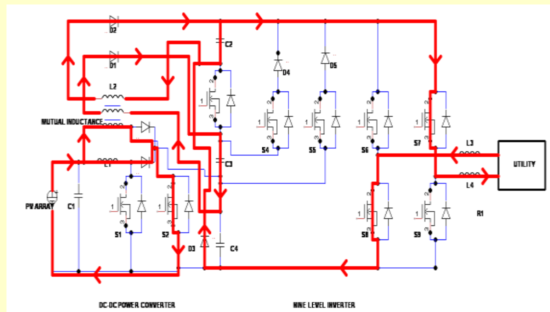

Fig.7. Mode 5 operation

This switch S1 in the dc to dc converter is turned off and switch S2 is turned on. Inductor l1and coupled inductor discharging energy to restore the capacitors C2 , C3 , C4 . Switches S7 and S8 are turned on to provide negative ac cycle for Ac load.

IV . SIMULATION RESULTS

A. Open loop simulation

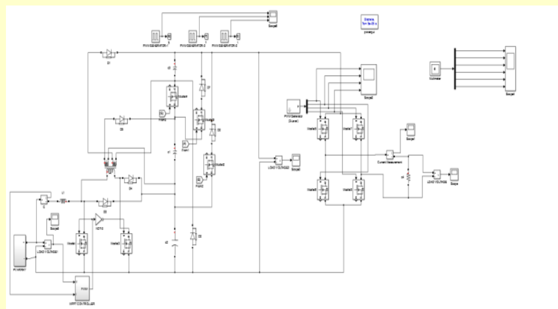

Fig .8. Simulation circuit diagram of nine level inverter

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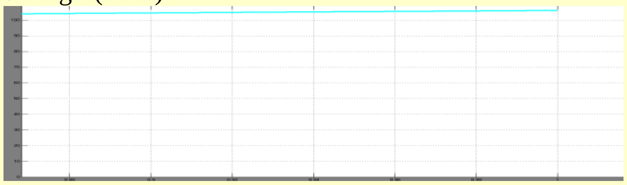
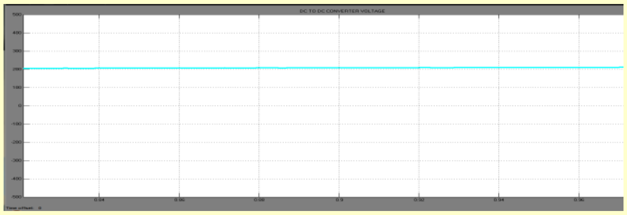
Voltages(volts)



Time(sec)

Fig. 9. Simulation of input voltage

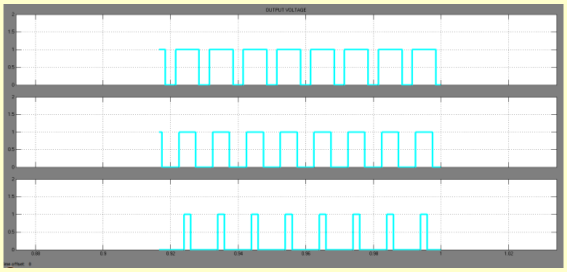
Voltage(volts)



Time(sec)

Fig. 10. Simulation result DC-DC voltage

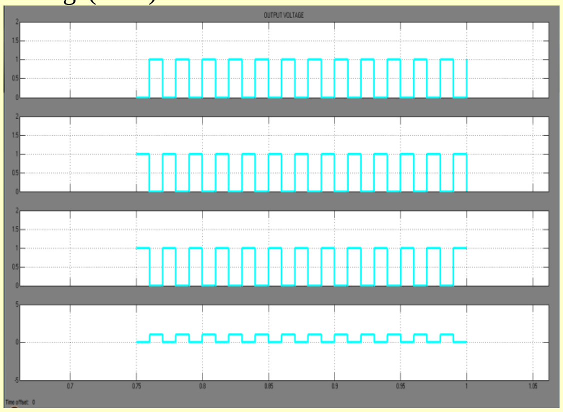
Voltage(volts)



Time(sec)

Fig.11 .Simulation result of capacitor selection circuit

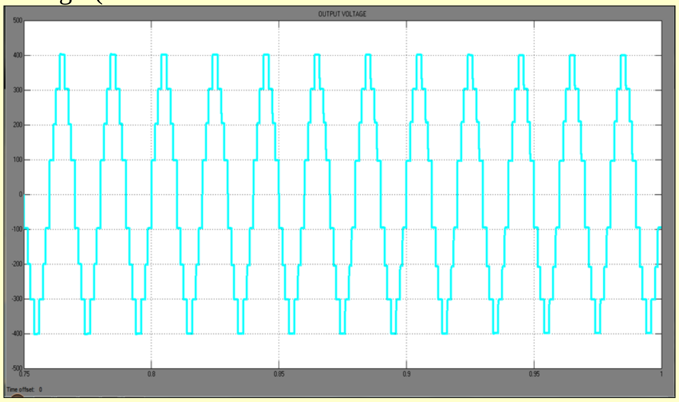
Voltage(volts)



Time(sec)

Fig. 12. Simulation circuit of voltage source inverter

Voltages(volts



Time(sec)

Fig.13. Output voltage of nine level inverter

B. *Parameters used in simulation*

Table I. Parameters used in simulation

Parameters	Symbols	Value
Input voltage	V_{in}	115volts
Duty ratio	D	0.5
Capacitance 2	C2	$1000\mu H$
Capacitance 3	C3	$4700\mu H$
Capacitance 4	C4	$10000\mu H$
Inductor	L1	10mH
Load resistance	RL	1000 Ohms
Output voltage	Vout	400V

In this output voltages of the nine level inverter circuit reduce the ripple voltage and also used capacitor selection circuit multilevel inverter produced a nine level output is generated. Further increases volatge source inverter produced nine level ouput.

VI. CONCLUSION

The proposed solar power generation system is composed of a dc–dc power converter and a seven level inverter. The seven-level inverter contains only six power electronic switches, which simplifies the circuit configuration. Furthermore, only one power electronic switch is switched at high frequency at any time to generate the seven-level output voltage. This reduces the switching power loss and improves the power efficiency. The voltages of the two dc capacitors in the proposed seven-level inverter are balanced automatically, so the control circuit is simplified. Experimental results show that the proposed solar power generation system generates a seven-level output voltage and outputs a sinusoidal current that is in phase with the utility voltage, yielding a power factor of unity. In addition, the proposed solar power generation system can effectively trace the maximum power of solar cell array.

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