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COMPARISON OF DC-DC CONVERTER OUTPUT LEVEL WITH VARIOUS CONVERTERS USED TO IN SOLAR PV-GRID FOR RENEWABLE ENERGY SOURCES

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Abstract: solar PV cells are one of the upcoming sources for future generation almost 90% of the worlds PV technologies, today, are based on some variations of sillica.in general efficiency of solar PV technologies, varies, ranging between 6-18%. For purpose of improving efficiency Buck Boost Converter and switched capacitors with multi-level inverters are using in this paper.BuckBoost Converter Is A DC To DC Converter. The output voltage of the DC to DC converter greater than the input voltage. The output voltage of the magnitude depends on the duty cycle. A multilevel inverter is a power electronic device which is capable of providing desired alternating voltage level at the output using multiple lower level DC voltages as an input.to inverter outputs larger voltage than the input voltage by switching the capacitors in series and in parallel. The maximum output voltage isdetermined by the number of the capacitors.

I. ABOUT BUCK BOOST CONVERTER

There are two different types of working

principles in the buck boost converter

- Buckconverter.
- Boostconverter.

1. BUCK CONVERTEROPERATION

The following diagram shows the working operation of the buck converter. In the buck converter first transistor is turned ON and second transistor is **switched** OFF due to high square wave frequency. If the gate terminal of the first transistor is more than the current pass through the magnetic field, charging C, and it supplies the load. The D1 is the Schottkydiode and it is turned OFF due to the positive voltage to the cathode. The inductor L is the initial source of current. If the first transistor is OFF by using the control unitthen the current flow in the buck operation. The magnetic field of the inductor is collapsed and the back e.m.f is generated collapsing field turn around the polarity of the voltage across the inductor. The current flows in the diode D2, the load and the D1 diode will be turnedON.

The discharge of the inductor L decreases with the help of the current. During the first transistor is in one

state the charge of the accumulator in the capacitor. The current flows through the load and during the off period keeping Vout reasonably. Hence it keeps the minimum ripple amplitude and Vout closes to the value ofVs.

2. BOOST CONVERTERWORKING

In this converter the first transistor is switched ON continually and for the second transistor the square wave of high frequency is applied to the gate terminal. The second transistor is in conducting when the on state and the input current flow from the inductor L through the second transistor. The negative terminal charging up the magnetic field around the inductor. The D2 diode cannot conduct because the anode is on the potential ground by highly conducting the secondtransistor.

By charging the capacitor C the load is applied to the entire circuit in the ON State and it can construct earlier oscillator cycles. During the ON period the capacitor C can discharge regularly and the amount of high ripple frequency on the output voltage. The approximate potential difference is given by the equationbelow

VS + VL

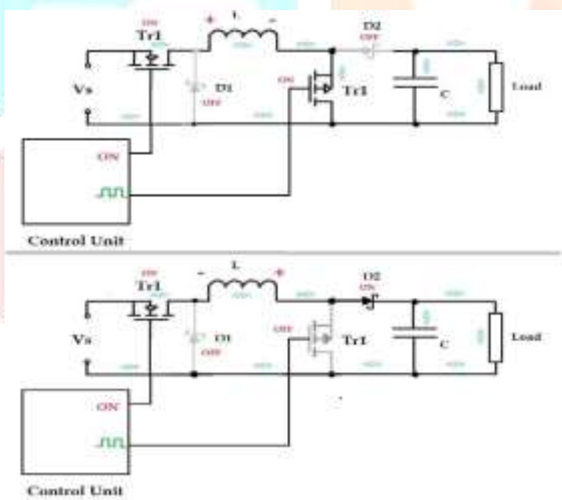


Fig 1.Buck boost converter

During the OFF period of second transistor the inductor L is charged and the capacitor C is discharged. The inductor L can produce theback e.m.f and the values are depending up on the rate of change of current of the second transistor switch. The amount of inductance the coil can occupy. Hence the back e.m.f can produce any different voltage through a wide range and determined by the design of the circuit. Hence the polarity of voltage across the inductor L has reversed now.

The input voltage gives the output voltage and at least equal to or higher than the input voltage. The diode D2 is in forward biased and the current applied to the load current.

3. Modes of Buck BoostConverters

There are two different types of modes in the buck boost converter. The following are the two different types of buck boost converters.

- Continuous conductionmode.
- Discontinuous conductionmode.

Continuous Conduction Mode

In the continuous conduction mode the current from end to end of inductor never goes to zero. Hence the inductor partially discharges earlier than the switching cycle.

Discontinuous Conduction Mode

It recharges the capacitors to VS + VL and it is ready for the second transistor. In this mode the current through the inductor goes to zero. Hence the inductor will totally discharge at the end of switching

II. MULTILEVEL INVERTER

The Inverter is an electrical device which converts direct current (DC) to alternate current (AC). The inverter is used foremergency backup power in a home. The inverter is used in some aircraft systems to convert a portion of the aircraft DC power to AC. The AC power is used mainly for electrical devices like lights, radar, radio, motor, and otherdevices.

1.MULTILEVELINVERTER:

Now a day's many industrial applications have begun to require high power.

Some appliances in the industries however require medium or low power for their operation. Using a high power source for all industrial loads may prove beneficial to some motors requiring high power, while it may damage the other loads. Some medium voltage motor drives and utility applications require medium voltage. The multi level inverter has been introduced since 19 A multilevel inverter is a power electronic device which is capable of providing desired alternating voltage level at the output using multiple lower level DC voltages as an input. Mostly a two-level inverter is used in order to generate the AC voltage from DC voltage.75 as alternative in high power and medium voltagesituations.

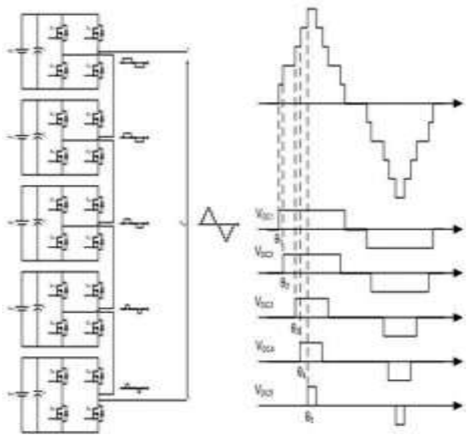


Fig2. Multilevel Inverter

2.GENERAL DC-ACINVERTER CIRCUIT

The need of multilevel converter is to give a high output power from medium voltage source. Sources like batteries, super capacitors, solar panel are medium voltage sources. The multi level inverter consists of several switches. In the multi level inverter the arrangement switches' angles are veryimportant.

Types of Multilevel Inverter:

Multilevel inverters are three types.

- Diode clamped multilevelinverter
- Flying capacitors multilevelinverter
- Cascaded H- bridge multilevelinverter

The main concept of this inverter is 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. Due to the capacitor balancing issues, these are limited to the three levels. 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 t The 5- level diode clamped multilevel inverter uses switches, diodes; a single capacitor is used, so output voltage is half of the input DC. The 9- level diode clamped multilevel inverter uses switches, diodes; capacitors are two times more than the 5-level diode clamped inverters. So the output is more than theinput.

Applications Of Diode Clamped Multilevel Inverter:

- Static varcompensation
- Variable speed motordrives
- High voltage systeminterconnections
- High voltage DC and AC transmission lines
- Static vargeneration
- Both AC-DC and DC-AC conversion applications
- Converters with Harmonic distortion capability
- Sinusoidal currentrectifiers

Cascaded H-Bridge Multilevel Inverter:

The cascaded H-bride multi-level inverter is to use capacitors and switches and requires a smaller number of components in each level. This topology consists of series of power conversion cells and power can be easily scaled. The combination of capacitors and switches pair is called an H-bridge and gives the separate input DC voltage for each H-bridge. It consists of H-bridge cells and each cell can provide the three different voltages like zero, positive DC and negative DC voltages. One of the advantages of this type of multi-level inverter is that it needs a smaller number of components compared with diode clamped and flying capacitor inverters. The price and weight of the inverter are less than those of the two inverters. Soft-switching is possible by the some of the new switchingmethods.

Multilevel cascade inverters are used to eliminate the bulky transformer required in case of conventional multi-phase inverters, clamping diodes required in case of diode clamped inverters and flying capacitors required in case of flying capacitor inverters. But these require large number of isolated voltages to supply each cell.

By the Capacitor We Can Eliminate Harmonics:

There are a number of methods to modify adverse system responses to harmonics:

1. Add A Shunt Filter: Not only does this shunt a troublesome harmonic current off the system, but it completely changes the system response, most often, but not always, for thebetter.
2. Add A Reactor To Detune The System.: Harmful resonances generally occur between the system inductance and shunt power factor correction capacitors.The reactor must be added between the capacitor and the supply system source. One method is to simply put a reactor in series with the capacitor to move the system resonance without actually tuning the capacitor to create a filter. Another is to add reactance in theline.
3. Change the Capacitor Size: This is often one of the least expensive options for both utilities and industrialcustomers.
4. Move a capacitor: to a point on the system with a different short-circuit impedance or higher losses. This is also an option for utilities when a new bank causes telephone interference—moving the bank to another branch of the feeder may very well resolve the problem. This is frequently not an option for industrial users because the capacitor cannot be moved far enough to make a difference.
5. Remove the Capacitor: and simply accept the higher losses, lower voltage, and power factor penalty. If technically feasible, this is occasionally the best economicchoice.

Next, by the switched capacitors, maximum output and harmonics reductions are proposed.

III. SWITCHED-CAPACITOR INVERTER USINGSERIES/PARALLEL CONVERSION WITH INDUCTIVE LOAD

A novel switched-capacitor inverter is proposed, inverter outputs larger voltage than the input voltage by switching the capacitors in series and in parallel. The maximum output voltage is determined by the number of the capacitors. The proposed inverter, which does not need any inductors, can be smaller than a conventional two-stage unitwhich consists of a boost converter and an inverter bridge. Its output harmonics are reduced compared to a conventional voltage source single phase full bridge inverter.

1. MAJORCOMPONENTS

Charge pump, multicarrier PWM, multilevel inverter, switched capacitor (SC).

A switched-capacitor multilevel inverter for high frequency AC power distribution systems. The proposed topology produces a staircase waveform with higher number of output levels employing fewer components compared to several existing switched capacitor multilevel inverters in the literature. This topology is beneficial where asymmetric DC voltage sources are available e.g. in case of renewable energy farms-based AC micro grids and modern electric vehicles. Utilizing the available DC sources as inputs for a single inverter solves the major problem of connecting several inverters in parallel. Additionally, the need to stack voltage sources, like batteries or super-capacitors, in series which demand charge equalization algorithms, are eliminated as the voltage sources employed share a common ground.

The inverter inherently solves the problem of capacitor voltage balancing as each capacitor is charged to the value equal to one of input voltage every cycle. State analysis, losses and the selection of capacitance are examined. The topology is applicable where unequal DC input sources are at disposal. Such scenarios are common in large renewable energy farms and electric vehicle networks. It is more convenient to employ multiple DC sources as input to a single inverter than to employ several inverters in parallel with their respective solitary DC input sources. This topology does not stack up the voltage sources inseries and therefore does not require voltage balancing circuits. Since the switched capacitors employed copy the input voltage every cycle, the problem of voltage balancing has also been eliminated. The harmonic content in the waveform is analyzed and is found to be minimum. The proposed topology obtains higher number of voltage levels compared to several existing topologies. This paper utilizes the proposed topology for high frequency AC distribution. However, the same topology can be employed for 50 Hz / 60 Hz distribution by employing a larger switched capacitor. It is shown that the number of output voltage levels exponentially increase with increase in the employed input voltage sources and SCs. In the hardware results, it is shown that the 5th and 7th harmonics are minimized to very low value of 1V each. Results at different distribution frequencies and power levels are presented. the bus voltage waveform. the magnitudes of lower order harmonics are small. The THD (total harmonic distribution) of the bus voltage waveform is 19.5%, which is inverter can operate with an inductive load. The structure of the inverter is simpler than the conventional switched-capacitor inverters. THD of the output waveform of the inverter is reduced compared to the conventional single-phase full bridge inverter as the conventional multilevel inverter accorded withresults.

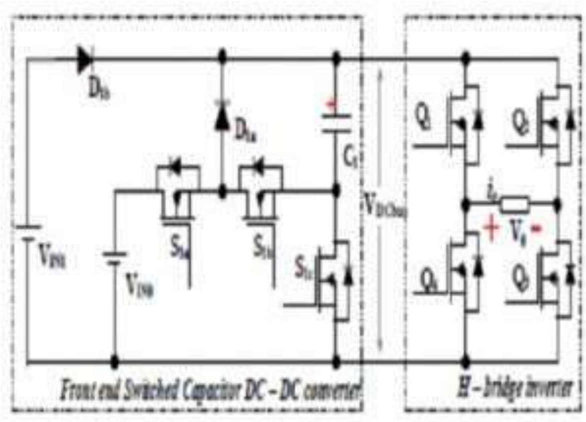


Fig3. switched capacitor with multi-level inverter

DC–DC converters with coupled inductors can provide high voltage gain, but their efficiency is degraded by the losses associated with leakage inductors. Without extreme duty ratios and the numerous turns-ratios of a coupled inductor, this converter achieves a high step-up voltage-conversionratio; a novel high step-up dc–dc converter for grid connected systems is proposed. The concept is to utilize two capacitors and one coupled inductor. The two capacitors are charged in parallel during the switch-off period and are discharged in series during the switch-on period by the energy stored in the coupled inductor to achieve a high step-up voltagegain.

IV SOLAR PV SYSTEM WITH MAXIMUM OUTPUT

Nowadays solar power is the quintessential energy source and receiving considerable attention from the researchers. The rapid evolution of semiconductor devices manufacturing technologies and the designer's orientation has enabled the development of new structures of converters (inverters) with a great performance compared to conventional structures. So, these new technologies of semiconductor are more suited to high power applications and they enable the design of high step up converters fed inverter structures to interface the system with grid combination.

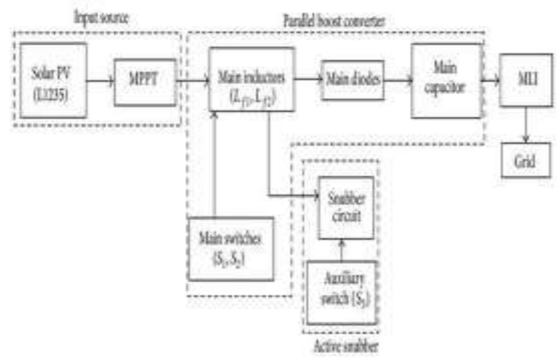


Fig4. PV Array With SC&MLI

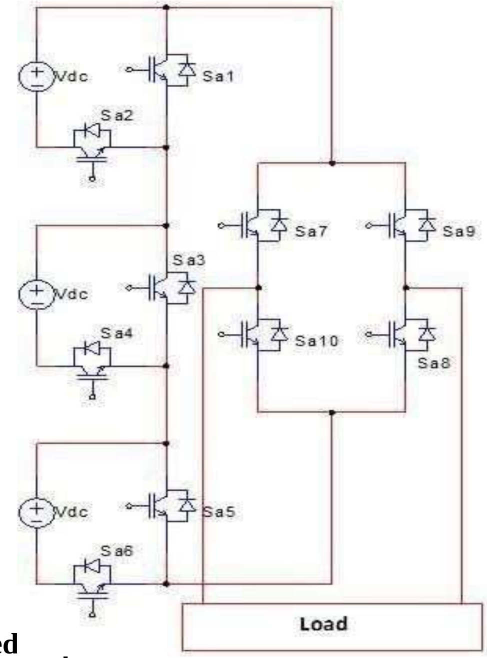
1. MPPT- MAXIMUM POWER POINT TRACKING

The constraints due to commutation phenomena are also reduced and each component supports a much smaller fraction of the DC-bus voltage when the number of step is higher.

Solar photovoltaic (PV) system generates electricity with advantages such as no pollution, no noise and many more Solar PV is well suited to remote or arid regions. Nowadays solar power is the quintessential energy source and receiving considerable attention from the researchers. The rapid evolution of semiconductor devices manufacturing technologies and the designer's orientation has enabled the development of new structures of converters (inverters) with a great performance compared to conventional structures. So, these new technologies of semiconductor are more suited to high power applications andthey enable the design of high step up converters fed inverter structures to interface the system with grid combination. The constraints due to commutation phenomena are also reduced and each component supports a much smaller fraction of the DC-bus voltage when the number of steps ishigher.

Number of Levels	Boost Cascade MLI (existing)		BDCLCRV MLI (proposed)	
	Number of switches	Number of DC sources	Number of switches	Numberof DCsources
5	10	2	9	1
7	15	3	11	1
15	35	7	19	1
31	75	15	35	1

Table 1. Comparison of DC sources and number of switches



2. SIMULATIONSTUDY

Switched

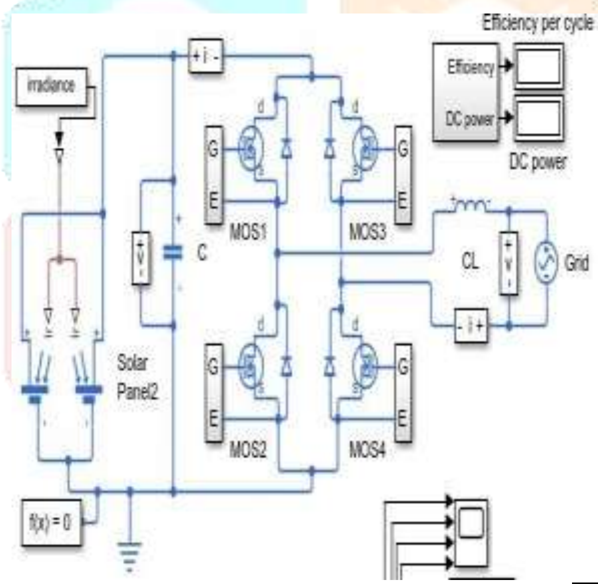


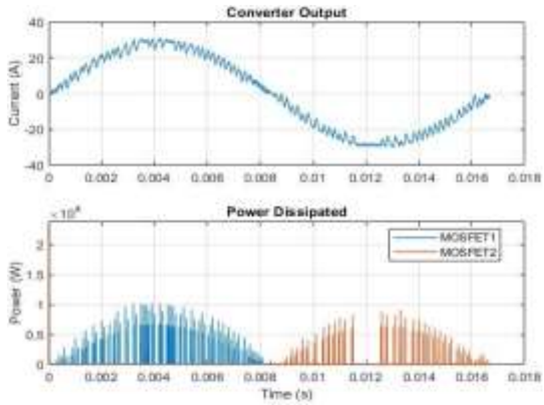
Table 2. Components comparison for producing 1–Φ seven-level output voltage

Components	Proposed	Existing
Switches	10	12
Clamping diodes	0	0
DC sources	3	3
Capacitors	0	0

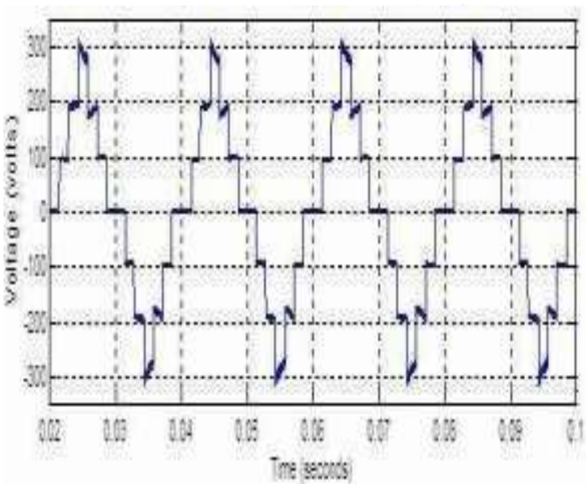
ible 3. Switching sequence to generate the 1-ϕ output voltage foϕcascade based Multi- inverter

S. No	Cascade Phaseleg		Single Phase Full Bridge		Voltage Levels
	On Switches	Off Switches	On Switches	Off Switches	
1	S_{a2}, S_{a4}, S_{a6}	S_{a1}, S_{a3}, S_{a5}	S_{a7}, S_{a8}	S_{a9}, S_{a10}	+3 V_{dc}
2	S_{a1}, S_{a4}, S_{a6}	S_{a2}, S_{a3}, S_{a5}	S_{a7}, S_{a8}	S_{a9}, S_{a10}	+2 V_{dc}
3	S_{a1}, S_{a3}, S_{a6}	S_{a2}, S_{a4}, S_{a5}	S_{a7}, S_{a8}	S_{a9}, S_{a10}	+ V_{dc}
4	S_{a1}, S_{a3}, S_{a5}	S_{a2}, S_{a4}, S_{a6}	S_{a7}, S_{a8}	S_{a9}, S_{a10}	0
5	S_{a1}, S_{a3}, S_{a6}	S_{a2}, S_{a4}, S_{a5}	S_{a9}, S_{a10}	S_{a7}, S_{a8}	- V_{dc}
6	S_{a1}, S_{a4}, S_{a6}	S_{a2}, S_{a3}, S_{a5}	S_{a9}, S_{a10}	S_{a7}, S_{a8}	-2 V_{dc}
7	S_{a2}, S_{a4}, S_{a6}	S_{a1}, S_{a3}, S_{a5}	S_{a9}, S_{a10}	S_{a7}, S_{a8}	-3 V_{dc}

3.0 SIMULATION RESULTS:



Generation of Phase Voltage wave form for Multi-Level Inverter



CONCLUSION

The switches support more high reverse voltages in high-power applications and the converter output signals are with good spectral qualities. With regard to the worldwide trend of green energy, solar power technology has become one of the most promising energy resources. The number of PV installations has had an exponential growth, mainly due to the governments and utility companies who support the idea of the green energy. This paper has proposed a novel high step-up dc–dc converter, for DG systems with the support of grid connected system. By using the capacitor charged in parallel and discharged in series by the coupled inductor, high step up voltage gain and high efficiency are achieved. This proposed level raises the THD level The steady state analyses have been discussed in detail. The simulation results have confirmed that high efficiency and high step-up voltage gain can be achieved.

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