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GRID CONNECTED QUASI Z SOURCE PV INVERTER FOR ELECTRIC VEHICLE CHARGING STATION

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ABSTRACT

Energy source such as photovoltaic (PV) becomes increasingly applied in the EV charging station infrastructure. In this paper, a new method of integration between PV inverter systems with utility grid for vehicle charging station based on the quasi-Z-source (QZSI) topology is proposed. The proposed system realizes a bidirectional power flow management between PV sources, energy storage unit and the utility grid. The main advantage is the flexibility of the proposed topology with various voltage levels of the inverter DC link and the battery storage, with no circuit modification requirement.

Keywords - Quasi-Z-Source, ac to dc power conversion, multilevel converters, photo voltic panels, pulse width modulation, single phase grid tie control.

1. INTRODUCTION

Nowadays, relating multilevel inverters to photovoltaic (PV) power systems is fast more and more devotion. The nonstop progress of energy demand is moving a fast development of grid-connected photovoltaic (PV) power generation. The quasi-Z-source inverter (qZSI) was largely examined for PV power systems for of its single stage power change in management the 1:2 PV-panel voltage difference. Among the typical multilevel inverter topologies, cascade multilevel inverter (CMI) is more widely used due to its attractive features, such as achieving the distributed maximum power point tracking (MPPT) and high voltage/ high power grid-tie without transformer. Buck inverter in the conventional CMI based PV power system, and each module's PV voltage variation will cause the entire system's dc-link voltages imbalanced. Considering the unique features of Z source inverter (ZSI) and quasi-Z source inverter (qZSI), i.e., implementing voltage boost/buck and inversion in a single stage the ZS/qZS-based PV power systems have been proposed in to overcome the aforementioned disadvantages of conventional CMI based PV system. This paper proposes a Quasi Z Source with Flexibility And higher DC-DC boost capability with less component Especially for the business & contributing to the promotion of a cleaner technology based PV power system by combining PWM.In particular, Gann devices were used in ZS/qZS based PV systems to achieve high efficiency. PWM inverters are commonly employed as the grid interfaces for small distributed generation (DG) units because of their low distortion current injection, adjustable power factor (up to 1) operation and reversible power flow capability. Three modulation methods, i.e., phase-shifted sinusoidal PWM (PS-SPWM), phase-shifted pulse-width- amplitude modulation (PS-PWAM), and modular multilevel space vector modulation (MMSVM) were proposed for qZS based PV system. The single-phase qZSI was used as a power module in the Quasi Z Source inverter or as an independent power conversion system in. No matter which application it is in, the double-line-

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frequency (2ω) pulsating power will flow back and forth between ac and dc sides of the single-phase qZSI. The resultant 2ω voltage ripple of dc link has to be limited within the engineering tolerant range in the conventional pulse-width modulation (PWM)-based single-phase qZSI, to ensure quality ac output voltage. The qZS capacitance, qZS inductance, and PV panel terminal capacitance were designed to reduce the 2ω voltage and current components of dc side in and. However, large qZS capacitance and inductance were inevitable. Moreover, the traditional PWM methods caused high switching loss of the qZSI because of additional shoot-through actions and high switching voltage stress. The reduction of qZS capacitance and inductance and power loss is still an open topic for the single-phase. At the PWM period, the qZSI works as the conventional VSI without shoot-through action also with low dc-link voltage. It contribute to improve the qZSI efficiency.

2. PROPOSED METHOD

In proposed system Quasi Z Source with Pv panel. Increases the current and voltage stability. QZSI will boost up the voltage. Energy from PV is directly used for charging and the remaining energy is stored/deliver to the grid. Cost of power sources is decreased .Bi-directional charging method is implemented .Single stage conversion by using QZSI inverter.

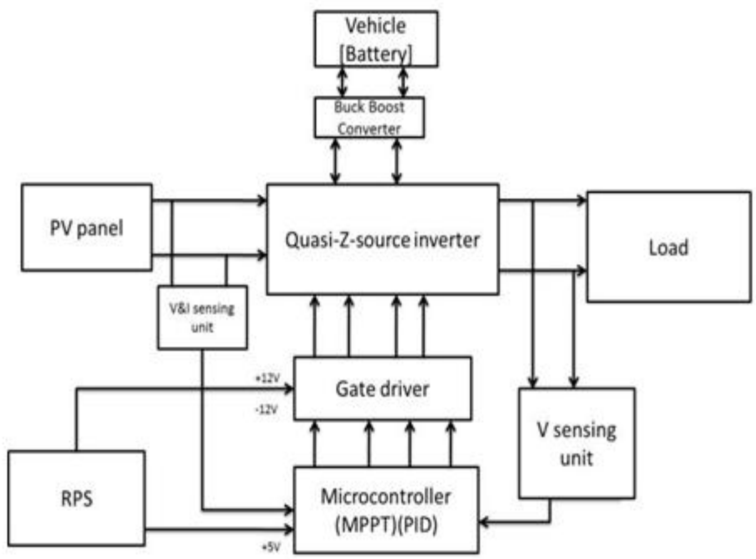

Fig.1. Block Diagram of Proposed system

1. PV PANEL

Photovoltaics (PV) covers the conversion of light into electricity using semiconducting materials that exhibit the photovoltaic effect, a phenomenon studied in physics, photochemistry, and electrochemistry. A typical photovoltaic system employs solar panels, each comprising a number of solar cells, which generate electrical power. PV installations may be

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Fig.2. Pv Panel

ground-mounted, rooftop mounted or wall mounted. The mount may be fixed, or use a solar tracker to follow the sun across the sky.The operation of solar PV generates no pollution. The direct conversion of sunlight to electricity occurs without any moving parts. Photovoltaic systems have been used for fifty years in specialized applications, standalone and grid-connected PV systems have been in use for more than twenty years. They were first mass-produced in 2000, when German environmentalists and the Eurosolar organization got government funding for a ten thousand roof program. PV systems have the major disadvantage that the power output is dependent on direct sunlight, so about 10-25% is lost if a tracking system is not used, since the cell will not be directly facing the sun at all times. Dust, clouds, and other things in the atmosphere also diminish the power output. This may be made up by other power sources, usually hydrocarbon. Advances in technology and increased manufacturing scale have reduced the cost, increased the reliability, and increased the efficiency of photovoltaic installations and the levelised cost of electricity from PV is competitive, on a kilowatt-hour basis, with conventional electricity sources in an expanding list of geographic regions.

2. QUASI Z SOURCE

Single-phase qZSI for grid-tie PV power conversion. A capacitor Cp is connected in parallel to the PV panel terminal. The qZS network consists of the inductors L1 and L2, the capacitors C1 and C2, and the diode D1 to boost PV voltage. The H-bridge phase legs 1 and 2 are connected to the single-phase ac grid through a filter inductor Lf. The qZSI presents shoot-through and non-shoot through states in the continuous conduction mode, as shown in Fig. 2. At the shoot-through state of Fig. 2 (a), the PV panel and qZS capacitors charge the qZS inductors, and the diode D1 is cut off.

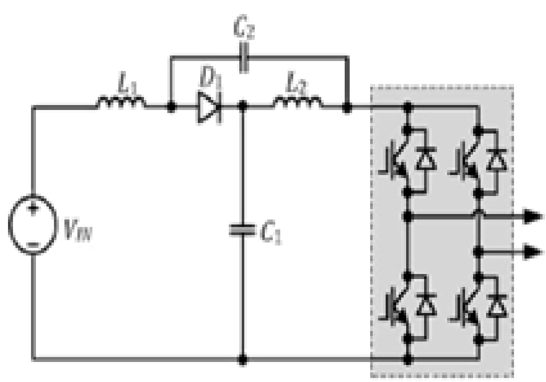

Fig.3. Single phase quasi Z source

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where PV denotes the PV-panel voltage; vL1, vL2 and iL1, iL2 denote the voltages and currents of qZS inductors L1 and L2; vC1, vC2 and iC1, iC2 denote the voltages and currents of qZS capacitors C1 and C2; vD1 denotes the qZS diode voltage; vDC and iDC denote the dc-link voltage and current, respectively. At the non-shoot-through state of Fig. 2 (b), the PV panel and qZS inductors charge the qZS capacitors and provide the power to the ac output, and the diode D1 turns on. There is L1 CPV 1 −= vvv , , CCDC 21 += vvv , vD1 = 0 , DCLC −= iii 11 , DCLC −= iii 22Fig. 1. Single-phase qZSI-based grid-tie PV power system. (a) (b) Fig. 2. Equivalent circuits of single-phase qZSI in (a) shoot-through state and (b) non-shoot-through state. With the high frequency shoot-through switching, the average qZS capacitor voltages VC1 and VC2, and the dc-link peak voltage VDC are, respectively [1] C VPV D D V 21 1 1 − − = , C VPV D D V 21 2 − = , DC VPV D V 21 1 − = (3) where D is the shoot-through duty cycle and VPV denotes the average PV-panel voltage. No matter what modulations are employed, the output voltage vH of single-phase qZSI should contain the fundamental-frequency voltage of tVv = oo sinω (4) besides little high-frequency harmonics, where Vo denotes the amplitude of fundamental-frequency voltage and ω denotes the fundamental angular frequency.

3. BUCK-BOOST CONVERTER

A buck (step-down) converter combined with a boost (step-up) converter.

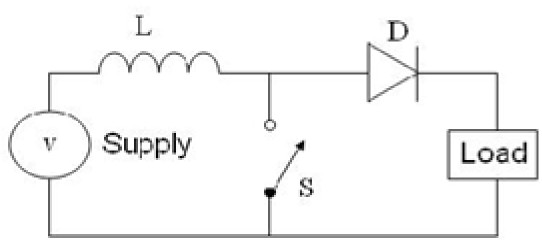

Fig.4. Buck Booster Conveter

The buck–boost converter is a type of DC-to-DC converter that has an output voltage magnitude that is either greater than or less than the input voltage magnitude. It is equivalent to a flyback converter using a single inductor instead of a transformer.Two different topologies are called buck–boost converter. Both of them can produce a range of output voltages, ranging from much larger (in absolute magnitude) than the input voltage, down to almost zero.The inverting topology.The output voltage is of the opposite polarity than the input. This is a switched-mode power supply with a similar circuit topology to the boost converter and the buck converter. The output voltage is adjustable based on the duty cycle of the switching transistor. One possible drawback of this converter is that the switch does not have a terminal at ground; this complicates the driving circuitry. However, this drawback is of no consequence if the power supply is isolated from the load circuit (if, for example, the supply is a battery) because the supply and diode polarity can simply be reversed. When they can be reversed, the switch can be on either the ground side or the supply side.The output voltage is typically of the same polarity of the input, and can be lower or higher than the input. Such a non-inverting buck-boost converter may use a single inductor which is

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used for both the buck inductor mode and the boost inductor mode, using switches instead of diodes, sometimes called a "four-switch buck-boost converter",it may use multiple inductors but only a single switch as in the SEPIC and Ćuk topologies.

4. DC MOTOR

The stator is the stationary outside part of a motor. The rotor is the inner part which rotates. Just as the rotor reaches alignment, the brushes move across the commutator contacts and energize the next winding. The brushes of a dc motor have several limitations; brush life, brush residue, maximum speed, and electrical noise.

5. PID CONTROLLER

A proportional–integral–derivative controller (PID controller) is a control loop feedback mechanism (controller) commonly used in industrial control systems. A PID controller continuously calculates an error value as the difference between a measured process variable and a desired set point. The controller attempts to minimize the error over time by adjustment of a control variable, such as the position of a control valve, a damper, or the power supplied to a heating element, to a new value determined.

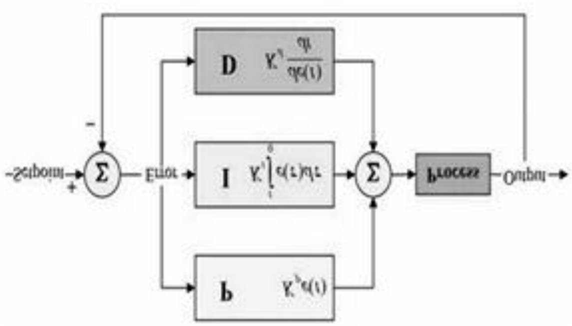

Fig.5. Block Diagram of PID Controller

where K_p, K_i, and K_d, all non-negative, denote the coefficients for the propotinal, integral and derivative terms,

6. ISO COUPLER

In electronics, an opto-isolator, also called an optocoupler, photocoupler, or optical isolator, is a component that transfers electrical signals between two isolated circuits by using light.Opto-isolators prevent high voltages from affecting the system receiving the signal.Commercially available opto-isolators withstand input-to-output voltages up to 10 kV and voltage transients with speeds up to 10 kV/μs. A common type of opto-isolator consists of an LED and a phototransistor in the same opaque package. Other types of source-sensor combinations include LED-photodiode, LED-LASCR, and lamp-photoresistor pairs. Usually opto-isolators transfer digital (on-off) signals, but some techniques allow

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them to be used with analog signals. About the electronic component. For the optical component, see optical isolator.

Source of light (LED) on the left, dielectric barrier in the center, and sensor (phototransistor) on the right. In electronics, an opto-isolator, also called an opt coupler, photo coupler, or optical isolator, is a component that transfers electrical signals between two isolated circuits by using light. Opto-isolators prevent high voltages from affecting the system receiving the signal. Commercially available opto-isolators withstand input-to-output voltages up to 10 kV and voltage transients with speeds up to 10 kV/μs. A common type of opto-isolator consists of an LED and a phototransistor in the same opaque package. Other types of source-sensor combinations include LED-photodiode, LED-LASCR, and lamp-photoresistor pairs. Usually opto-isolators transfer digital (on-off) signals, but some techniques allow them to be used with analog signals

7. REGULATED POWER SUPPLY

Dual power supplies units are most common equipment for an Electronics hobbyist. The circuit given here is of a regulated dual power supply that provides +12V and -12V from the AC. The transformer steps down the AC mains voltage. It gives positive polarity, negative polarity and ground potential. It uses Three types of voltage regulator ICs 7805, 7812 and 7912.7805 For +5V.7812 is a positive voltage regulator where as 7912 is a negative voltage regulator IC.

8. GATE DRIVERS

A gate driver is a power amplifier that accepts a low-power input from a controller IC and produces a high-current drive input for the gate of a high-power transistor such as an IGBT or power MOSFET. Gate drivers can be provided either on-chip or as a discrete module. In essence, a gate driver consists of a level shifter in combination with an amplifier. In contrast to bipolar transistors, MOSFETs do not require constant power input, as long as they are not being switched on or off. The isolated gate-electrode of the MOSFET forms a capacitor (gate capacitor), which must be charged or discharged each time the MOSFET is switched on or off. As a transistor requires a particular gate voltage in order to switch on, the gate capacitor must be charged to at least the required gate voltage for the transistor to be switched on. Similarly, to switch the transistor off, this charge must be dissipated, i.e. the gate capacitor must be discharged. When a transistor is switched on or off, it does not immediately switch from a non-conducting to a conducting state; and may transiently support both a high voltage and conduct a high current. Consequently, when gate current is applied to a transistor to cause it to switch, a certain amount of heat is generated which can, in some cases, be enough to destroy the transistor. Therefore, it is necessary to keep the switching time as short as possible, so as to minimize switching loss. Typical switching times are in the range of microseconds. The switching time of a transistor is inversely proportional to the amount of current used to charge the gate. Therefore, switching currents are often required in the range of several hundred milliamperes, or even in the range of amperes. For typical gate voltages of approximately 10-15V, several watts of power may be required to drive the switch. When large currents are switched at high

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frequencies, e.g. in DC-to-DC converters or large electric motors, multiple transistors are sometimes provided in parallel, so as to provide sufficiently high switching currents and switching power.

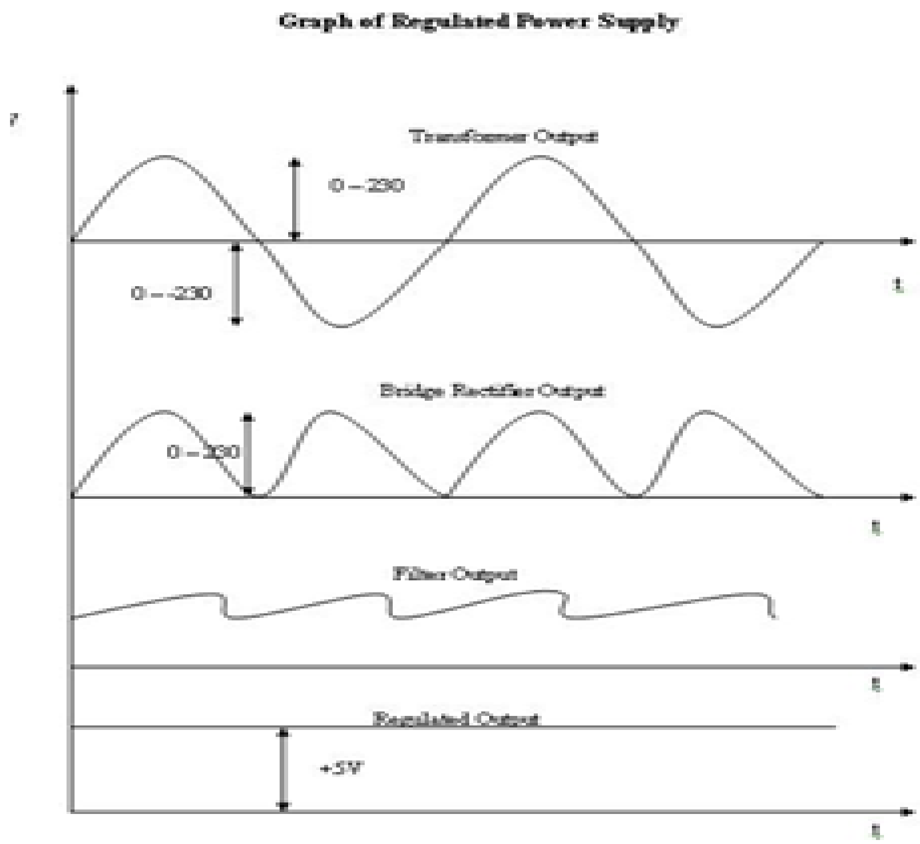

Fig.6. Graph of Regulated Power Supply

4. RESULT AND OUTPUT

The vehicle charing station combines the two modes.

Forward Mode
Reverse Mode

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S.NO	MODE	OBSERVATION	OUTPUT
1)	Forward mode	Works supply on ac	Connected to resistive n load. It stores the energy in battery.
2)	Reverse mode	Works on dc supply directly for solar.	The motor starts Rotating by Dc supply or From battery

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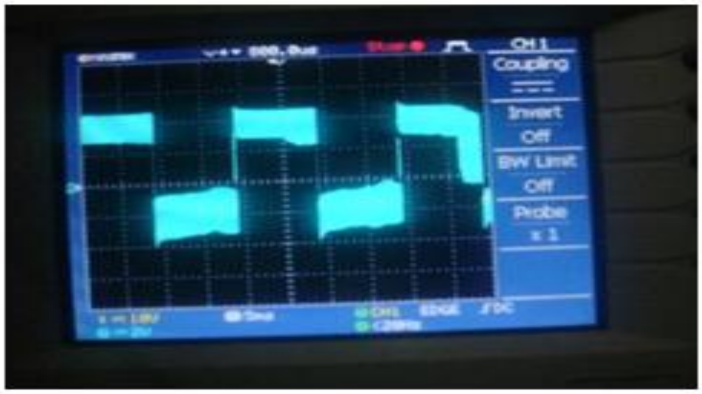
FORWARD MODE

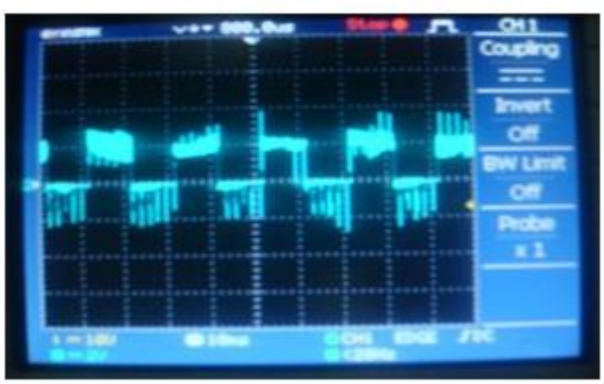
AC OUTPUT VOLTAGE



DC OUTPUT VOLTAGE

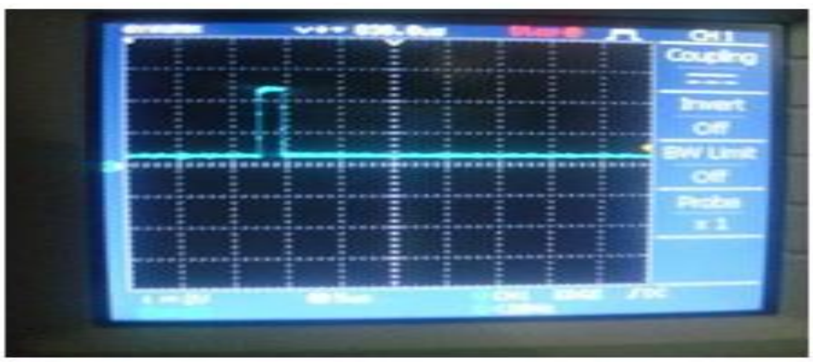
REVERSE MODE

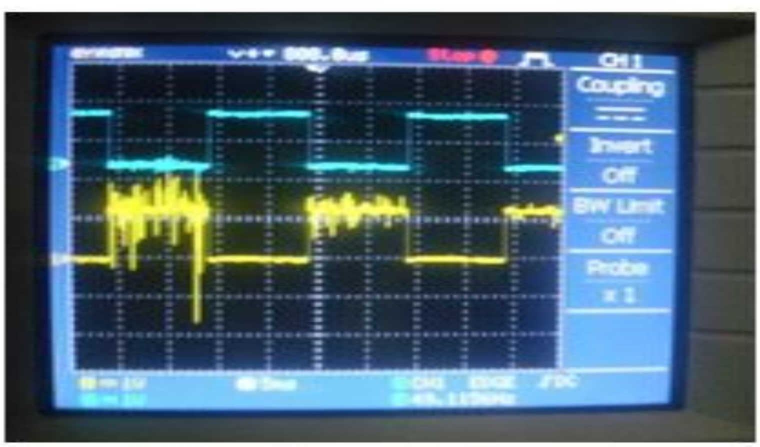
AC VOLTAGE



DC VOLTAGE

PULSE





CONCLUSION

Grid-Connected Quasi-Z-Source Pv inverter for vehicle charging station has more Flexibility, higher DC-DC boost capability with less component, Reducing the load demand on the utility grid, Saving cost of energy usage to the utility provides. Especially for the business & contributing to the promotion of a cleaner technology.

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