SOFT-SWITCHED OF HIGH STEP-UP DC-AC INVERTER FOR A BUCKBOOST VOLTAGE SOURCE INVERTER WITH AN SPLIT CAPACITOR

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Received: January 27, 2019 Accepted: March 02, 2019

ABSTRACT:*Renewable power systems as distributed generation (DG) units often experience big changes in the inverter input voltage due to fluctuations of energy resources. Often, a front-end boost converter is added to step up the DC voltage when the energy resources are at a weak point. However, when a very high boost gain is demanded, the duty cycle may come to its extreme, and large duty cycle causes serious reverse-recovery problem. This paper proposes a novel single-stage boost-type inverter especially for wind power generation. By introducing a passive network including coupled inductors to the classic three phase bridge inverter, and adjusting the shoot-through duty, the converter can output a stable AC voltage even when it is at a weak wind level. The single stage operation of the converter can lead to improved reliability and higher efficiency. Theoretical analysis, simulation and experimental results are presented to verify its good performance.*

Key Words:*Single-stage boosts inverter; Wind power generation; Coupled inductors; Shoot-through state.*

1. INTRODUCTION

The increasing tension of the globe energy supply has given a high impetus to the use of renewable energy re-sources. This presents a significant opportunity for distributed power generation (DG) systems using renewable energy resources, including wind turbines, photovoltaic (PV) generators, small hydro systems and fuel cells. These DG units produce a wide range of voltages due to the fluctuations of energy resources and impose stringent requirements for the inverter topologies and controls. Usually, a boost type DC-DC converter is added after the DG units to step up the DC voltage. However, the classic boost converter may not be able to provide enough DC voltage gain when the input is very low, even for an extreme duty cycle. Large duty cycle operation may also result in serious reverse-recovery problem and increase the rating of switching devices. Furthermore, the added converter may deteriorate the system's efficiency, increase system size, weight and cost. So it's desirable to have a single-stage high-gain inverter if it's efficiency effective. Single-stage topologies, which integrate performance of each stage in a multistage power converter, are becoming a research focus. Though they may result in increasing control complexity, they have the attractive potentials of higher efficiency, reliability, and lower cost.

2. EXSISITING SYSTEM

A control strategy for power flow management of a grid-connected hybrid PV-wind-battery based system with an efficient multi-input transformer coupled bidirectional dc-dc converter is presented. The proposed system aims to satisfy the load demand, manage the power flow from different sources, inject surplus power into the grid and charge the battery from grid as and when required. A transformer coupled boost half-bridge converter is used to harness power from wind, while bidirectional buck-boost converter is used to harness power from PV along with battery charging/discharging control. The proposed converter architecture has reduced number of power conversion stages with less component count, and reduced losses compared to existing grid-connected hybrid systems. This improves the efficiency and reliability of the system.
Diode-assisted buck-boost voltage-source inverter achieves high voltage gain by introducing a switch-capacitor based high step-up dc-dc circuit between the dc source and inverter bridge. As for the unique structure, various pulse width modulation (PWM) strategies are developed with regard to the chopped

intermediate dc-link voltage. In order to maximize voltage gain and increase efficiency, this paper proposes a novel PWM strategy. It regulates the average value of intermediate dc-link voltage in one switching time period (T s) the same as the instantaneous maximum value of three-phase line voltage by controlling the front boost circuit.

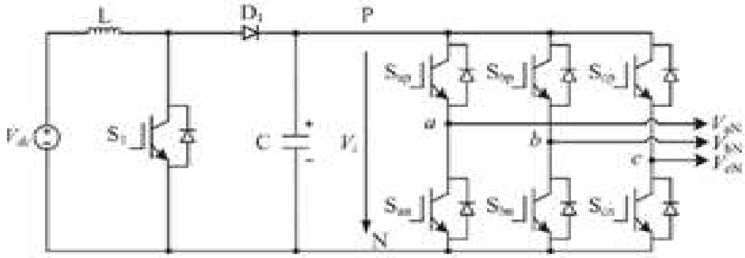

Fig.1 existing circuit diagram

3.PROPOSED METHOD

The proposed system aims to satisfy the load demand, manage the power flow from different sources, inject surplus power into the grid and charge the battery from grid as and when required. A transformer coupled boost half-bridge converter is used to harness power from wind, while bidirectional boost converter is used to harness power from PV along with battery charging/discharging control.A single-phase full-bridge bidirectional DC-DC converter is used for feeding ac loads and interaction with grid.

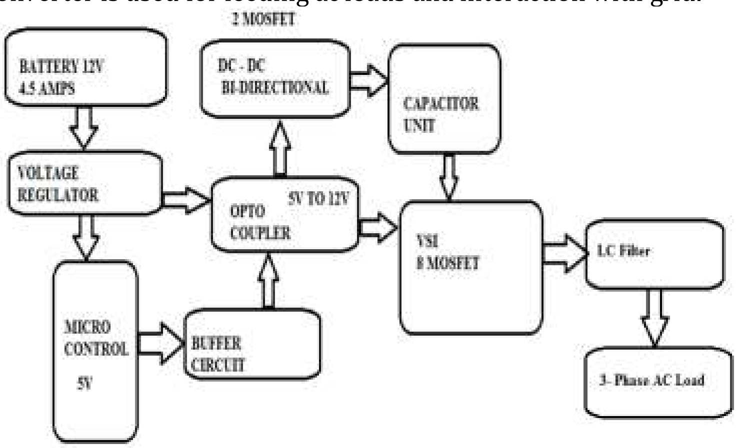

Fig.2. Proposed block diagram

The proposed soft switching bidirectional ac link converter is shown in Fig.2. It consists of two full bridge circuits composed of reverse blocking bidirectional switches, a link composed of low reactive rating inductance and capacitance, and the filter capacitors. The converter operates by charging the link from the inputs and then discharging the stored energy to the output. The converter is fed with the output current references. The link is charged to an amount which makes the discharging current exactly meet these references. Since charging and discharging take place separately, an estimate of how much the link needs to be charged to supply the output correctly is required. The controller handles this by translating the output references to input references. The input reference is derived by the simple equation that Input Power = Output Power + Losses.

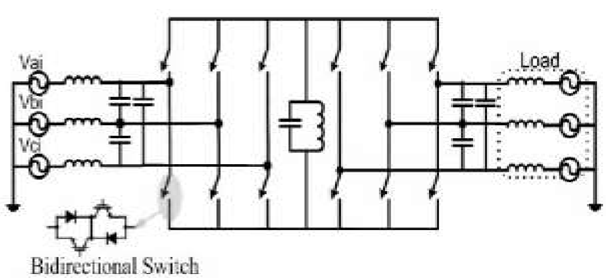

Fig.3. Proposed circuit diagram

RMS value of the output reference current is used to determine the RMS of the input current for an ideal converter. A loss component is added to this from the loss estimator to get the exact input command. The instantaneous value of the output reference commands could be phase shifted with respect to the output voltages as the load demands. Normally, the instantaneous values of the input current commands are in phase or are phase adjusted with respect to the input voltages so as to achieve unity power factor, but non-unity power factor. Typical waveforms illustrating the operating principles of the proposed converter may also be achieved if desired.

4. SIMULATION RESULT

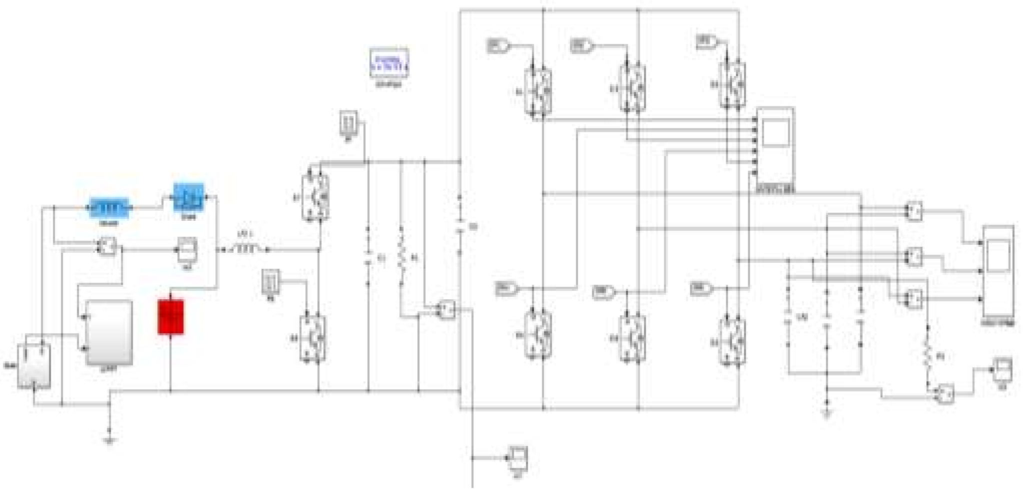

Fig.4. Simulation circuit diagram

Modeling of a high step-up converter where it contains seven parts including a PV module input circuit, a primary-side circuit, a secondary-side circuit, a passive regenerative snobbery circuit, a filter circuit, a dc output circuit, and a feedback control mechanism. Shows in Figure 4

Fig.5. Input voltage from PV

We get source from solar power, when the load voltages of the given input to the converter are shown in the figure 5. The characteristics of proposed solar power. The output of solar is 12 KVA

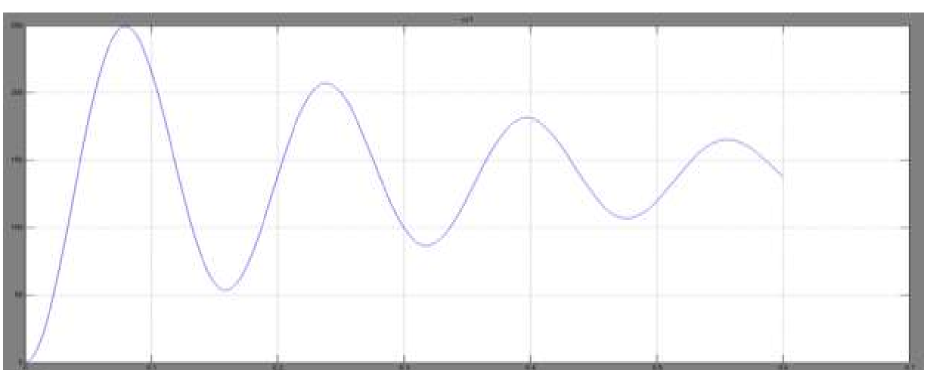

Fig.6. Output voltage of converter

Here, the figure 6 represent the converter voltages waveform, the DC-DC converter of the output voltages is 35V.

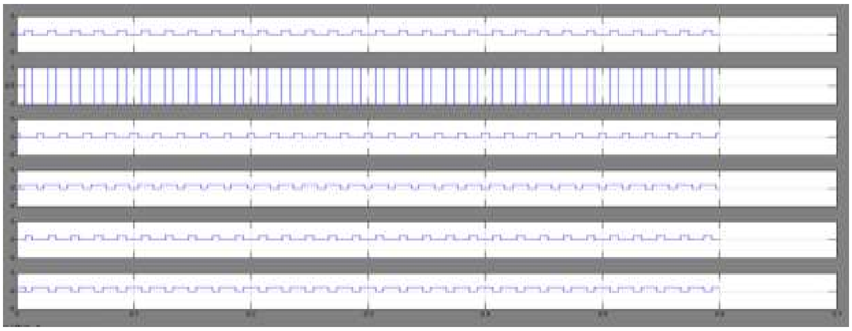

Fig.7. Gate pulses

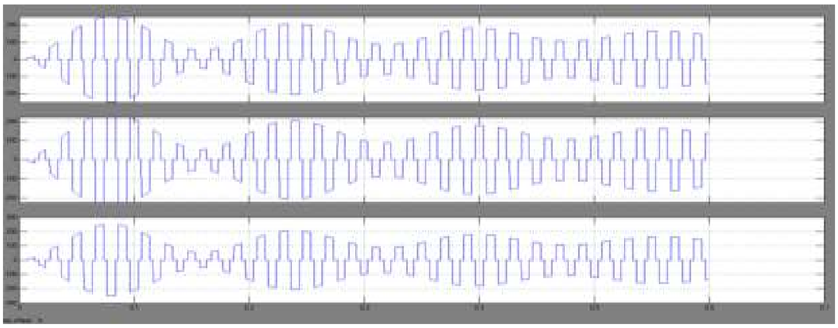

Fig.8. Inverter output voltage

The filtered output phase voltage is 220.3V. All these measured values are a little larger than the theoretical values of 317.3, 634.6, and 220V, respectively. This is due to the voltage drop of switching devices and the voltage loss of the dead zone in the inverter.

5. CONCLUTION

This project, proves that the voltage gain of the boost converter with proposed 4-stage SC-cell is higher than the basic boost converter for the same duty ratio, at the cost of lower efficiency as the SC-cell stages are increased, which is due to increase in component count. However if the objective is to obtain the same voltage gain, the 4-stage SC-cell boost based converter gives the same gain at a lower duty ratio, resulting in increase of efficiency compared with the basic boost converter. Even though the cost of 4-stage SC based boost converter is higher than that of a basic boost converter, it allows the extension of the voltage gain that would otherwise not be practically viable with the basic boost. Furthermore, the difference in terms of efficiency for basic boost compared with 4-stage SC based boost converter is quite marginal, especially for practical duty in the range of 0.5-0.8. All this assures the suitability of SC-based boost converter to replace basic boost converter for high voltage gain application.

6. REFERENCE

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