A Review on Design of Bidirectional Converter

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***Abstract*-The study represents bidirectional DC-DC converter, which has simple circuit structure. The voltage gain of proposed converter is double the DC-DC conventional bidirectional converter in step up and step down modes. Power systems design, layout and computation for photovoltaic's form of national action plan for "Solar India". Power switching converters are used in numerous solar based application. The rapid increase in standalone and grid based structure employee circuit regulation using buck ,boost ,buck boost ,bidirectional converter technique. Along with these all techniques to optimize the performance of the battery is the main perspective of this paper.**

Key Words:-Bidirectional DC-DC converter, coupled inductor, etc

INTRODUCTION

Since the usage of the fossil fuel results in environmental pollution, the clean energies become very important in the world. In recent years we have witnessed a rise in renewable power systems/sources mostly from photo-voltaic system, fuel cell system etc. because the renewable energy source cannot provide stable for user, renewable energy source and battery can be used as the hybrid power systems. If the renewable energy source is insufficient to provide energy Solar being abundant disturbed, pollution less and recyclable appear as primary source of energy to meet global demand in power engineering. Renewable energy Accounts 33% primary energy need in India and in that solar merely shares 18% in it. To then the battery should be operated there to full fill the load demand obtain that energy as of its maximum value we need to process that through a set of various controllers. With the direct motto is to improve the optimization of performance of battery it's also necessary to sufficiently feed the load through either solar power or through battery source. The battery type like lithium ion or lead acid can be used as per the given status of the application. To use battery efficiently as possible for the better feed purpose of the load is the ultimate aim here.

BI-DIRECTIONAL CONVERTER

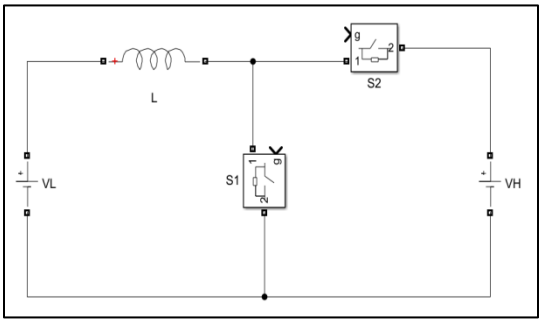

Fig.1.Conventional bidirectional DC-DC buck boost Converter

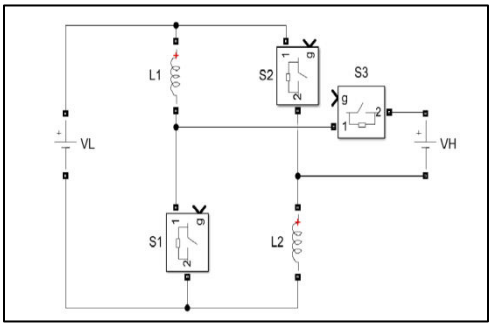

Fig.2. Typical bidirectional DC-DC buck boost converter

There are actual two types of dc-dc bi-directional converters such as:-

1) convention type
2) typical type

Many bidirectional dc-dc converters have been researched. The bidirectional dc-dc fly back converters are more attractive due to simple structure and easy control (1),(2),(3).The use of conventional type of applications. The circuit configuration of the typical converter is very simple. The Typical converter has higher step-up and step-down voltage gains and lower average value of the switch current than the conventional bidirectional boost/buck converter.

STEP UP MODE FOR CONVENTIONAL TYPE CONVERTER

mode1, (to,t1): The switches s2and s3 are turned on and the switches s1 and s4 are turned off. The current-flow path of the conventional converter is shown in fig. 10a. The energy of the low-voltage side v1 is transferred to the inductor L1. The capacitors cH1 and cH2 are stacked to discharge for the load RH. Thus, the voltage across the inductor l, is given by Mode 2, (t1,t2): The switches s1and s3 are turned on and the switches s2 and s4 are turned off. Meantime, the switch s1 is used for the synchronous rectifier. The current- flow path of the conventional converter is shown in fig. 10b. The energies of the low-voltage side vL and inductor l1 are series to release their energies to the capacitor cH1. The capacitors cH1 and cH2 are stacked to discharge for the load RH.

STEP-DOWN MODE OF THE CONVENTIONAL CONVERTER

In the step-down mode, the equivalent circuit of the proposed converter is shown in fig. 2. The pulse-width modulation (PWM) technique is used to control the switches s1 and s4. The switches s2 and s4 are used for the synchronous rectifiers.fig. 3 shows some typical waveforms in continuous-conduction-mode (CCM) operation. The operating principles and steady-state analyses are described as follows:-

Mode 1, (t0,t1): The switches s1 and s3 are turned on and the switches s2 and s4 are turned off. Meantime, the switch s3 is used for the synchronous rectifier. The current-flow path of the proposed converter is shown in fig. 4a. The energy of the high-voltage side vH1 is transferred to thee inductor L1, capacitor C 1, and load R1.

MOSFET AND IGBT DRIVE CIRCUIT

Low side drivers:-

The MOSFET is voltage control device and is relatively simple to turn ON and OFF, which gives it an advantage over a bipolar junction transistor (BJT). Typically, the MOSFET gate- to-source voltage for the on state in switching circuits is between 10 and 20 volts, although some MOSFET are designed for logic-level control voltages. A MOSFET driver circuit must be capable of rapidly sourcing and sinking currents for high-speed switching, if the input signal is from low-voltage digital logic devices, the logic output may not be sufficient to turn on the MOSFET. A better drive circuit has shown below, the double emitter-follower consists of a matched NPN and PNP bipolar transistor pair.

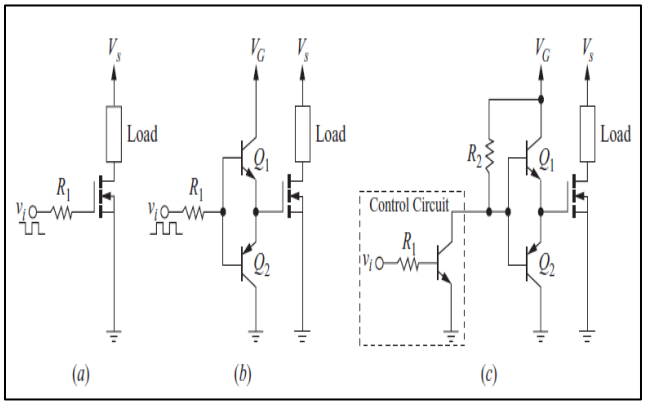

Fig.3. Typical low side MOSFET Drive Circuit

High-Side Drivers:-

Some converter topologies such as buck converter using an N-channel MOSFET have high-side switches. The source terminal of the high-side MOSFET is not connected to the circuit ground, as it would be in a low-side switch in a converter such as a boost converter. To turn on the MOSFET, the gate-to-source voltage must be sufficiently high. When the MOSFET is in a buck converter, for example, the voltage at the source terminal of the MOSFET is the same as the supply voltage Vs. Therefore, the gate voltage must be greater than the supply voltage. A way to achieve a voltage higher than the source is to use switched-capacitor converter. As per the fig. shown below it concludes that the voltage at the load becomes the same as the source voltage Vs, causing the voltage at the upper capacitor terminal to be 2Vs. The drive circuit is called a bootstrap circuit.

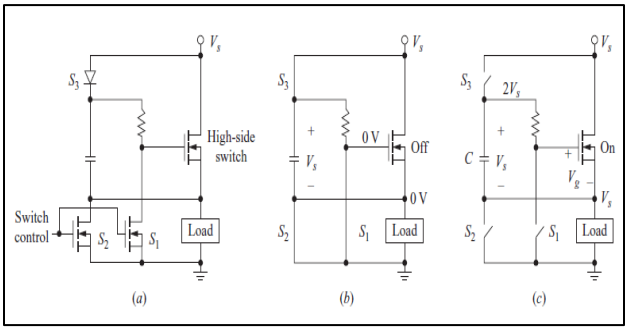

Fig.4. Typical high Side MOSFET Driver Circuit

OPTIMIZATION OF THE BATTERY

Bidirectional converter is set by changing the value of the duty cycle D. This control system works when DC Voltage link is not equal to the reference voltage. If the DC voltage link is more than the reference voltage, the value of D will be seen reducing gradually. If suppose DC Voltage link is less than the reference voltage; the value of D is seen increased. For the practical use of charging and discharging purpose of the battery we are taking 14 volts for the charging purpose of the battery. For the trickle charging purpose which generally occurs at the 90-100% of charging we need to take slightly less voltage for charging purpose in that region. Then analytical data of working of battery for various applied load conditions will be taken in account and it will be compared to the ideal or it's previously collected analytical data sheet. Then the comparison of the stats of battery such as charging stats and discharging stats will be taken in study to improvise the efficiency of battery by changing the program or duty cycle of bi-directional converter.

COMPARISON

The modeling performances of three different converters are studied based on four modeling constraints. It can be concluded that prior to the voltage boosting, reducing or both action boost buck, buck-boost converter is selected. Affecting of Phase delay from the result by introduction of not available the behavior of circuits which is in discrete steps becomes compulsory. From the perfective of the performance it would be determined that buck converter output is almost same for the both delay or no delay circuit. With inverted outputs it can be seen that Buck-boost converter can help in achieving dual purpose. The converters are should be chosen such as to fulfill the requirement of the load.

FUTURE WORKS

As we are witnessing the rise in the use of solar power as a trustworthy renewable source it will be much easier to use the bi-directional converter for the applications which includes the use of solar power. Solar converters work as best renewable power sources for changing battery of operation of appliances. Studies could be made prior to analyze efficiency and determine losses in converters. In future possibilities of using aurdino over microcontroller would be possible with Fuzzy logic for the better purpose of control.

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