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Design and Simulation of Step-Up Hybrid Converter for Dual Applications with Solar

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Abstract: Step-Up Converters are used in more applications. It is a class of Switched mode power supply containing at least two semiconductors as diode and a transistor and at least one energy storage element a capacitor, inductor, or the two in combination. To reduce voltage ripple, filters made of capacitors are normally added to such a converter's output and input.Here the paper is based on the MOSFET switch model. The single phase voltage source inverter can yields the AC output and the Boost Converter can yields the DC output. Here the input is taken from the 18 V Solar Panel. This panel can gives the boosted voltage as output that can be used for nanogrid applications. The advantage of this converter is simple design, cost is low and output voltage range is more and size is compact.

Key words: Step-Up Hybrid converter · Voltage Source Inverter · Solar Panel

INTRODUCTION

Renewable energy sources are important for better power production. Solar energy is the best source of energy since it is in abundance. Here solar is taken as a input source. The panel generates DC output which is taken as input for the Hybrid Converter.

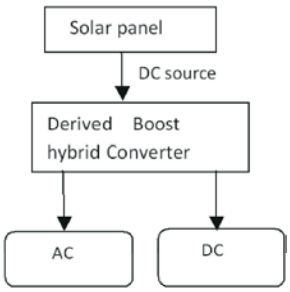

Fig. 1: Block Diagram of hybrid converter

Uses converter and inverter to obtain two outputs like AC & AC or DC & DC with a solar panel. Hybrid converter can give both Alternate Current and Direct Current outputs. The new topology of derived hybrid step up converter has the features of improved outputs

Step up Converter: The input voltage can be get boosted to high output voltage by step up converter [3]. Step up converter is a DC to DC converter in which low voltage can be steped up into high voltage. Renewable sources are important in this generation for future usage. Usually step up converter has DC source as input source but here solar is taken as input source. The solar panel can produce Dc voltage which can be used for step up converter [1].

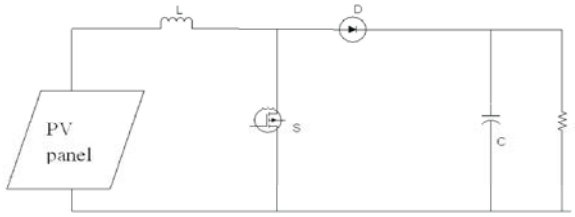

Fig. 2: Circuit Diagram of step up converter

Derived Hybrid Step up Converter: In step up converter the switch that can be controlled is MOSFET switch Sand other is a diode D which acts as a switch. The single MOSFET switch S in the step up converter is replaced by the Voltage Source Inverter. This type of step up converter with four switches is known as the Step up Derived Hybrid converter [1]. The switch can control both direct current and alternate current outputs. So, duty cycle is set for the working of converter and control pulses can be given to four set of switches for the working of inverter. The input taken for this converter is taken from the solar panel. The input from solar panel is given to the converter insist of DC source [6]. By using renewable energy we can get better outputs.

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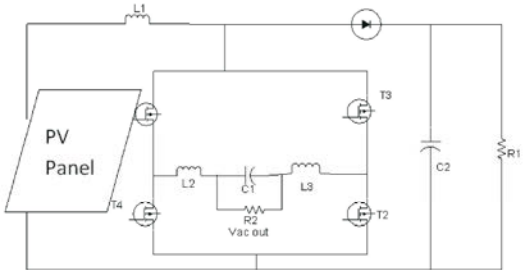


Fig. 3: Derived Hybrid step up Converter Circuit Diagram

The input can be taken from the solar panel for power mode. The solar panel input 48v is designed here. The solar input can be flows through the inductor L1. In this power mode, the opposite set of switches is switched ON [1]. The switches T1 and T2 is switched ON or the alternate pair of switches T3 and T4 is switched ON. When T1 and T2 is switched ON the solar input can be flows through the inductor L1, T1 and T2. The current can be flows through the diodeD1 and the current from diode can supplies the load [3]. The both AC and DC loads will receives the voltage.

Modes of Operation

A)MODE 1: Power Mode

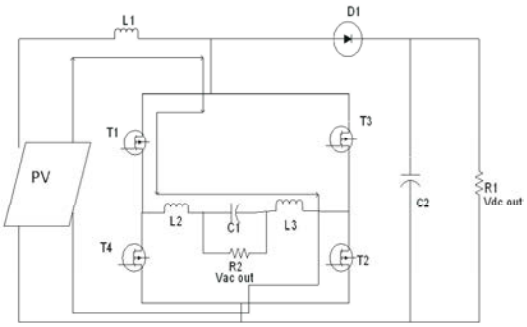


Fig. 4: Circuit Diagram of Power mode

B)MODE 2: Zero Mode

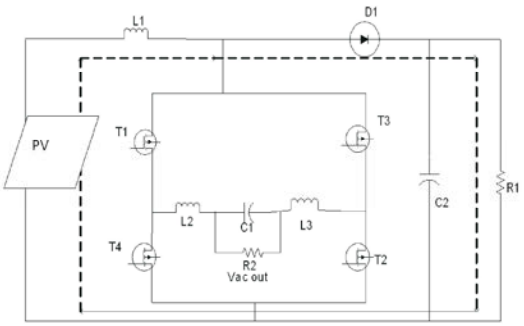


Fig. 5: Circuit Diagram of Zero Mode

This zero mode can takes the input from solar panel with its 48v. In this mode all the four switches T1,T2,T3 and T4 are at switched OFF condition. So, the solar input can be flows through the L1 and the switch D. So that the DC output can be taken from the R1 and the inverter can delivers the voltage to the R2. The R1 can give DC output and R2 can give AC output.

C)MODE 3: Shoot Through Mode

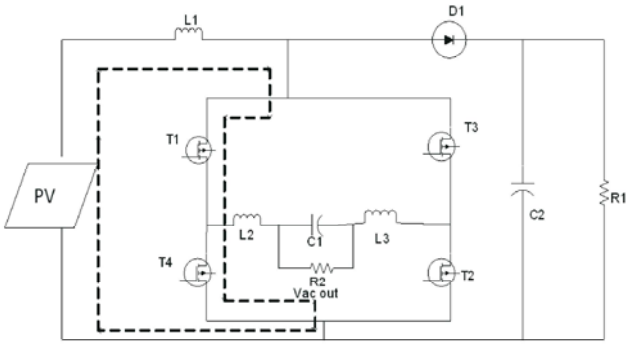


Fig. 6: Circuit Diagram of Shoot Through Mode

The input for the shoot through mode can be given by the solar panel which posses 48V. In this shoot through mode of operation the switches in the same side is switched on so we can able to fix the duty cycle for the step up converter. The switches T1 and T4 is switched ON.

Simulation Setup

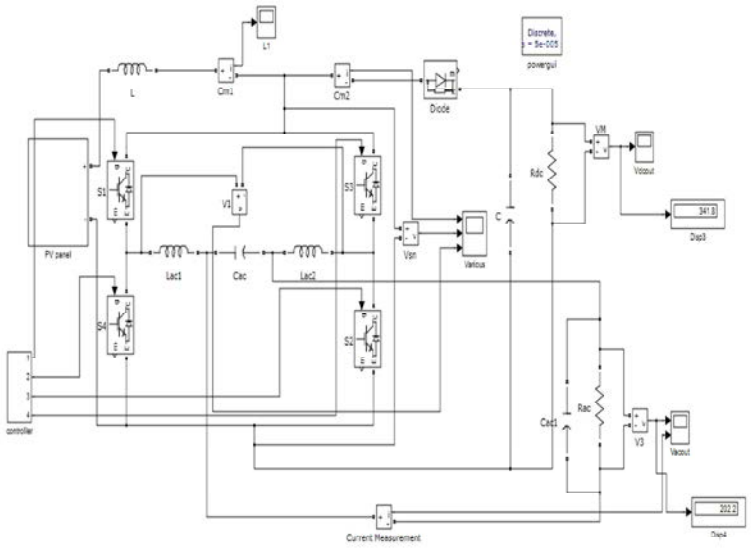
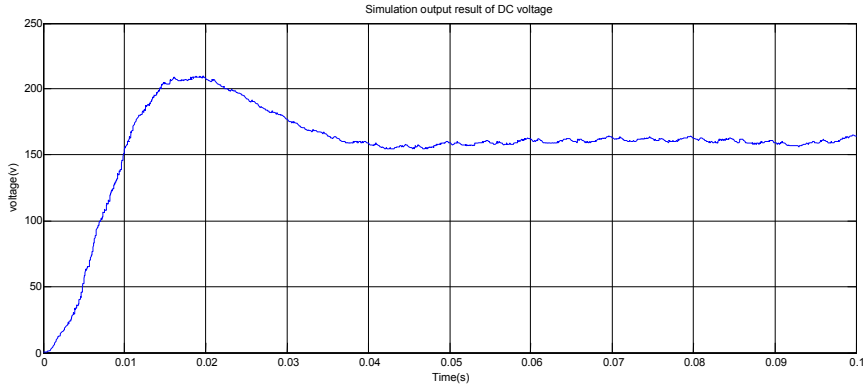


Fig. 8: Simulation Circuit of Derived Step up Hybrid Converter

Simulation Results

A) DC Output Voltage of BDHC



B) AC Output Voltage of BDHC

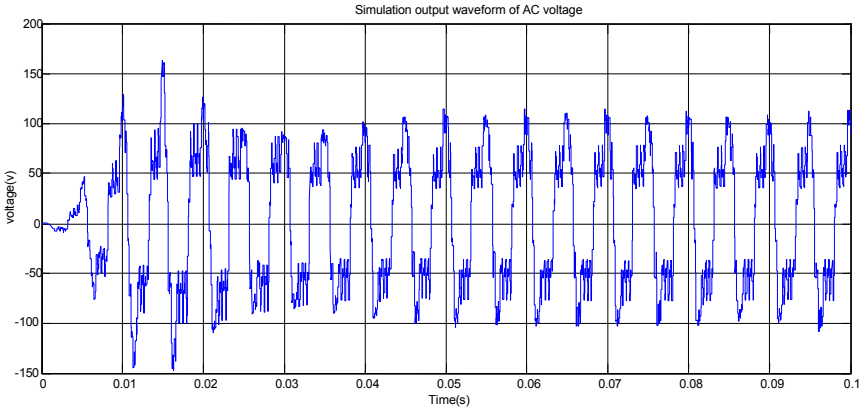


Fig. 9: Simulation Results of Derived Step up Hybrid Converter

CONCLUSION

The new Derived Step up Hybrid Converter topology will concurrently gives both the direct current and alternate current. Here the input can be taken from the solar renewable source. Renewable source can gives improved voltage production. By using this Derived Hybrid Step up converter we can able to supply both Direct current and Alternate Current. So we can use this converter for both applications [1]. The 48V solar panel can yields 150V direct current and 82V alternate current. Thus this paper topology concludes the normal step up converter can gives DC voltage output and inverter can gives AC output. So, Derived Hybrid Step up converter can used highly for the boosted outputs and improves its output range[7].

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