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Article

Advanced Power Electronics Converter For Hybrid Power Systems

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Abstract: This paper deals with the modified form full bridge power electronics converter for hybrid power system. At present situation, many converter topology is available for improving the input voltage. The main problem of all converter are having switching stress and difficult to used for hybrid system. This article deals with the overcoming of above problem using advanced power electronics converter. Asymmetrical pulse width modulation is used to power the proposed converter. Both control switches in the proposed converter operate at zero voltage. The output diodes can also be switched at zero current. The voltages around the semiconductor devices are essentially clamped by the projected converter, which can give high voltage gain. This Suggested converter is put into a steady-state review. The theoretical converter is prototyped in the lab, and the findings of the experiments are provided for confirmation.

Keywords: AC-DC converter; Full Bridge Converter; Solar Energy, Buck-Boost Converter; TPC

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1. INTRODUCTION

Solar energy is the most abundant renewable-energy source in terms of availability. The sunlight is a non-quantifiable resource that can be used both intrinsically and extrinsically. The photovoltaic cell is the perfect medium for converting intangible solar energy into useful energy. The Sun provides more than 1 million times the energy that people use on a yearly basis. Wind, Solar, geothermal, and hydropower energies are all renewable options with many advantages. Carbon dioxide emissions, water use, and waste will all be reduced using these resources[1].Clean air is important on this planet and it can help people with health issues like asthma (which is more common in children) and lung disease. Renewable energy will also contribute to environmental protection by preventing depletion and stimulating the economy by increasing employment opportunities[2].

Renewable energy devices, which can harvest energy from solar panels for example, are used in a variety of applications including hybrid and electric vehicles, satellites, stop lights, and mobile communication systems[3]. Since the production power of renewable sources is uncertain and the sources lack energy storage capabilities, energy sources like neither batteries nor super capacitors were suggested to enhance battery stability and equilibrium characteristics[4].

A 3 port converter which can interface with renewable energy, storage components, and supplies all at once is a great candidate for a renewable electricity grid, and it has recently piqued the attention of researchers[5].TPC system has solitary stage exchange flanked by these 2 of the 3 ports, superior device reliability, smaller modules, quicker reaction, lightweight wrapping, and incorporated power consumption surrounded by the ports by centralized run, compared to traditional systems that use multiple converters[6]. Many TPCs have recently been suggested for a number of applications that demand of these extraordinary merits. Connecting multiple exchange stages to a standard direct current bus is single way to create a TPC. However, since only a few computers are shared, this is not an automated approach [7].

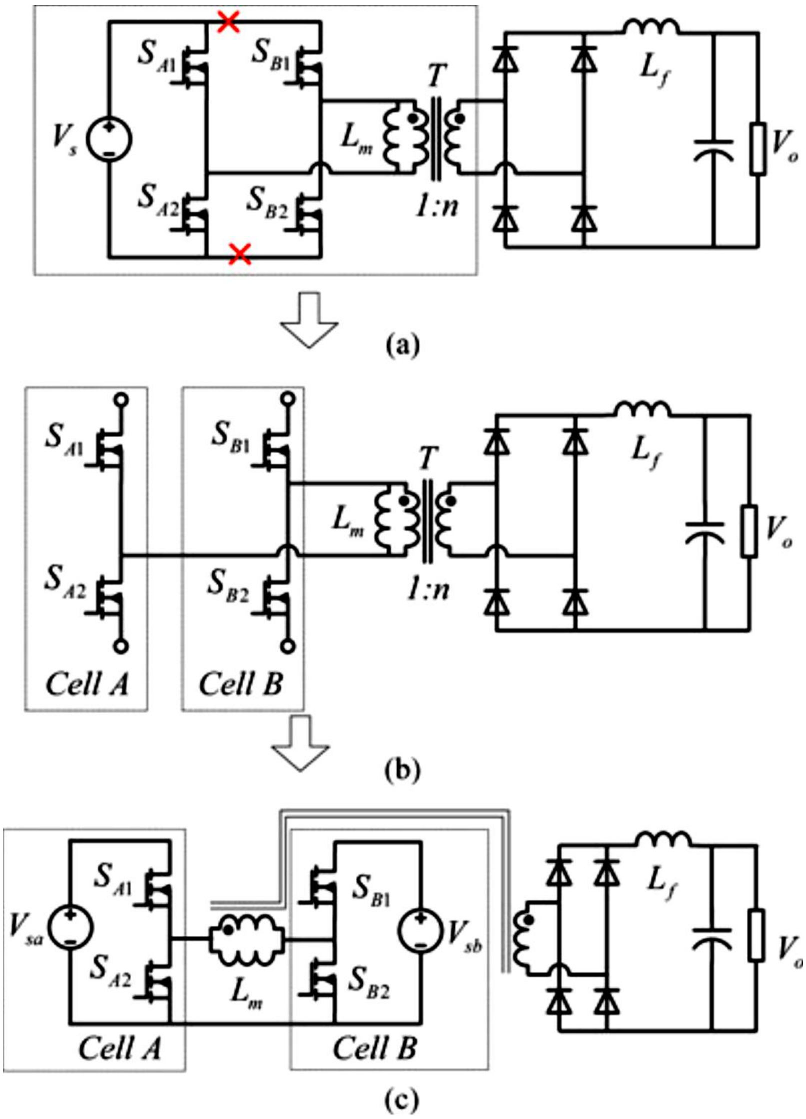

Figure 1. Proposed full bridge 3 port converter. (a) Full bridge converter. (b) 2 switching cells. (c) Full bridge 3 port converter

A few TPCs are made from, series resonant, half bridge, or full bridge configurations using magnetic coupling via a multiple winding transformer. To obtain power flow control and zero voltage switching, phase shift control flanked by different switching bridges is being used, which meets the same principles as the dual active bridge configuration. Separation and bidirectional coordination are also possible with series resonant topology [8]. Even so, an excessive number of active switches were worn, resultant in a complex drive and control circuit that could compromise the integrated converters' efficiency as well as efficiency [9].

2. PROPOSED SYSTEM

The main purpose of this work is the development of a logical method for generates TPC topologies as of FBCs, as well as the discovery of a original complete bridge TPC works from FB to TPC with solitary stage power conversion at all flanked by the 2 of the 3 ports[10]. Moreover, since a buck boost (DC-DC) converter is included in the projected FB to TPC, it is able to respond to application by means of a broad basis voltage spectrum from a topological standpoint[11].

The main side of FBC, as seen in Fig. 1 (a), is made up of 2 switching legs, SA1, SA2, SB 1 and SB 2, which are linked in equivalent to a standard input source Vs. The voltage following balance theory of Lm is the restriction state of the FBC's exploit on the main side[12-13]. This imply that the 2 switching legs of the FBC be able to also be alienated into 2 symmetrical segments, cells from a topological standpoint, if merely Lm satisfy the voltage subsequent balance theorem, because seen in Fig.1 (b).

As seen in Fig. 1(c), the 2 cells can be bound in the direction of separate outlets, Vsb, and Vsa and a new FB TPC can be formed. The voltage of the FB-two TPC's sources can be set to any value. In condition Vsa still contemporaries Vsb, the 2 cells can be immediately paralleled, and the straight FBC can be extracted. As a result, as seen in Fig. 3.1, the FBC be able to be considered a particular case of the FB TPC (c). Close inspection reveals that the FB-TPC is symmetrical, with both Vsa and Vsb capable of supplying electricity to the load Vo.

3. PERFORMANCE OF FB TPC FOR THE STAND SYSTEM APPLIANCE

To check proposed topology, the FB to TPC is added to a standalone PV power source with support batteries, as shown in Fig. 1(b). The suggested FB to TPC topology is again drawn in Fig. 2 to help understand the process theory. The 2 different ports are associated to a PV source and a battery. Whereas the output port is subjected to load. In a standalone PV power system, there are 3 power flows:

i) Photovoltaic to load
ii) Photovoltaic to battery
iii) Photovoltaic to load.

In the case of the FB to TPC, the pack port must typically be closely controlled to satisfy load specifications, while the input from the Photovoltaic must use full power monitoring to extract the most electricity. As a result, the power imbalance flanked by the photovoltaic resource and the output load must be exciting into or discharge as of the battery passage, implying to 2 of 3 ports in the FB to TPC can be operated separately, with the third serving as a power balancer. As a consequence, two variables that are independently regulated are needed[14-15].

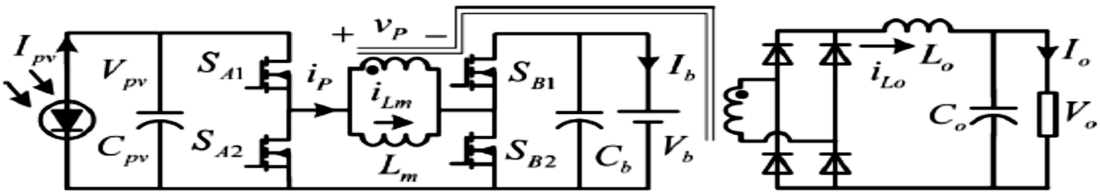

Figure 2. Topology of the proposed FB-TPC.

Switching State Analysis

There are three potential operating modes for the FB to TPC:

i) dual output form, by means of $P_{PV} \geq P_O$, where the battery consumes excess solar power and both the load and the battery draw power from the PV;

(ii) dual input form, by means of $P_{PV} \leq P_O$ and $P_{PV} > 0$, where the battery discharge to supply the output load as well as the Photovoltaic; and

(iii) single input single output mode, with PPV= 0, where the battery provides the load power alone. at what time PPV = Po, the converter runs in a border condition of DI and DO mode, allowing the solar to provide all of the load capacity. This condition can be classified as either DI or DO mode. The activity of the converter inside this condition is almost the similar as SISO mode, anywhere even the battery feed the output load alone, since the FB to TPC has a symmetrical configuration.

Switching state in various operating modes are the similar, and distinction flanked by them is the worth and orientation of iLm, depending on whether it is positively or negatively, as seen in Fig 3. Let's look at the DO mode as an example. The below assertions are made for the sake of simplicity:

1) The voltages of the 3 terminals, Vpv, Vo, and Vb, are steady throughout the steady condition;

2) The $V_{pv} \geq V_b$ is used as a reference for the switching condition review.

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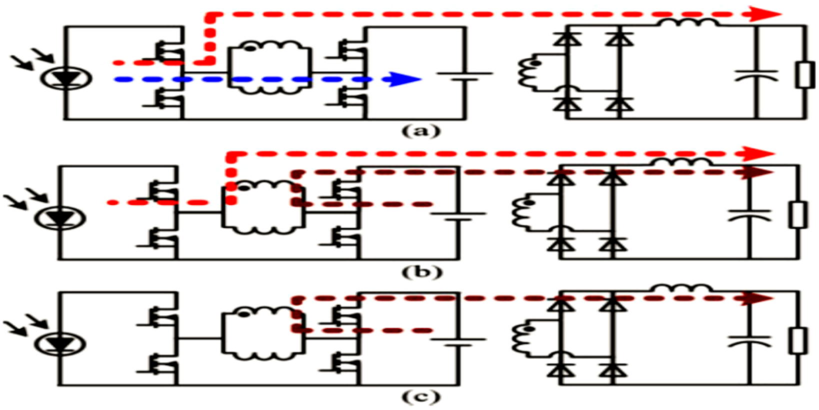

Figure 3. Power flow directions of each operation mode, (a) DO mode. (b) DI mode. (c) SISO mode.

4. SIMULATION RESULTS OF PROPOSED CONVERTER

The performance of the proposed converter is simulated with help MATLAB/Simulink. Fig 4 shown simulation modal of proposed advanced converter for hybrid power system.

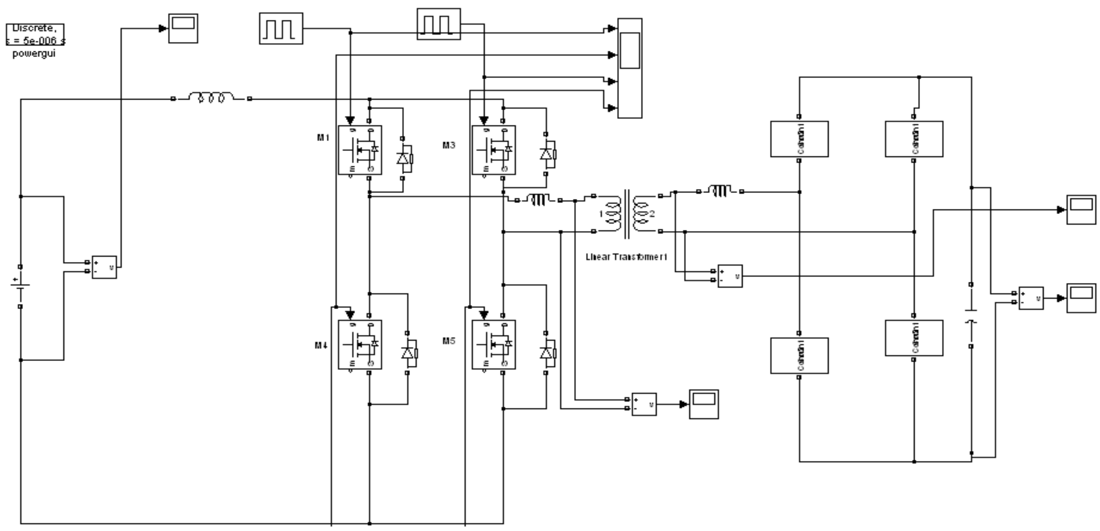

Figure 4. Simulation model for proposed advanced converter

Fig 5 shows the simulation result of proposed converter. It can be clearly understand the performance of proposed converter for power factor correction.

(a)

(b)

(c)

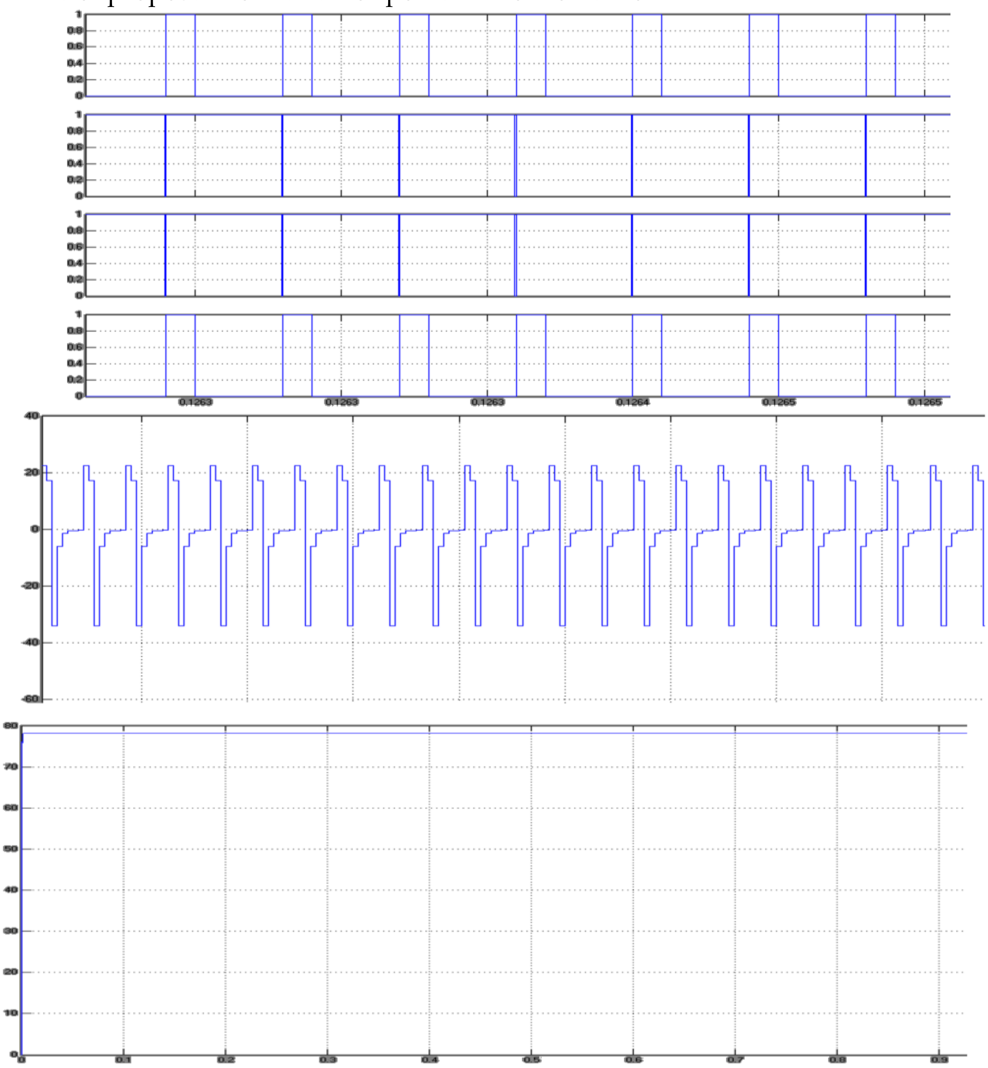

Figure 5. Simulation result for proposed advanced converter, (a) Switching Pulse, (b) Transformer voltage, and (c) Output voltage

5. CONCLUSIONS

In this work, novel FB to TPCs is projected and investigates. FB to TPCs is created by separating the FBC two switching legs through 2 switching cells, linking the 2 cells to separate outlets, with using transformer's magnetizing inductance since a pass through a filter inductor. The FB to TPC has a buck-boost converter that is worn to customize the control flow direction flanked by both the 2 ports on the main part of the converter, and can accommodate a broad variety of source voltage. By using the power contained in transformer’s leak inductance, ZVS has been achieving for every one key part switches. As a result, conversion efficiency is high. The principle of configuration generation is expanded, and new TPCs and 3 port converters are derived. Easy topologies and manage, a smaller amount of modules, a solitary stage power shift at all flanked by the 2 of the 3 ports are all benefits of proposed converters. They are ideal for solar, thermoelectric generator and other green energy systems with voltages ranging from low to high. The modulation projected is used for validate the projected topology source process by analyzing the in use principles and investigational effects of FB to TPC.

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