SINGLE STAGE HIGH- GAIN BOOST CONVERTER WITH BATTERY COMMUTATION IN SOLAR POWER APPLICATIONS

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Abstract--a single stage high-voltage gain boost converter based on the three-state commutation cell for battery charging using PV systems and a reduced number of converters. The presented converter operates in zero-voltage switching (ZVS) mode for all switches. By using the new concept of single-stage conversation, the converter can generate a dc bus with a battery bank or a photovoltaic pannels, allowing the simultaneous charging and discharging of the batteries according to the radiation level.

Index Terms-- Battery,dc–dc converter, photovoltaic panels,inductors.

I. INTRODUCTION

Now a day, there is a demand of power supply. To meet the increased demand, the power generation from renewables increases day by day. Most of renewable energy in the form of dc. To integrate this generated power from renewables to grid, it requires a cheap, robust, efficient converter i.e. an DC to DC converter &DC to AC converter

The increasing use of renewable energy in applications regarding distributed systems such as pv system, fuel cells, and wind energy etc. .In , one of the major concerns is the need of a high output dc-voltage bus to supply inverters, UPS, etc., from lowinput voltage levels. This issue has lead to the conception new several converters. In nonisolated dc–dc converters with high voltage gain have been highlighted in different applications.

The traditional high-frequency isolated converters are required a transformer responsible for processing the total power, with consequent increase of size, weight, and volume and reduction of efficiency. Converters with switched capacitors develop significant current peaks which limit the efficiency&maximum power. A study on energy efficiency of switched-capacitor converters was present in [1], the authors presented some design rules useful for developing high efficiency switched-capacitor converters.In [2] was presented several modular converter connections based on a switched-capacitors, a soft-switched technique was used in order to reduce the switching loss and EMI. In [3],

The high step up dc–dc converters based on coupled inductors and multiplier cells are presented and the major challenges. Some employ couple inductors was used reduce the voltage stress across the converter switchs. A voltage doubler rectifier as the output stage of an interleaved boost converter with coupled inductors was present in [4]. The obtained voltage gain
is twice that of traditional boost converters due to the doubler stage, as coupled inductors provide additional voltage gain, although voltage stress across the switches is not increased. In [5]was described a cascade high step-up dc–dc converter based onquadratic boost converter with coupled inductor in the second boost converter. A study of a topology based on two for-switch bridges around a *LC* circuit that does not utilize iron core transformers applied in megawatt level power transfers was present in [6]. In [7], the authors described a high step-up ZVT interleaved boost converter applied to grid-connected PV power systems.

II.CONVENTIONAL METHOD

In Conventional Method There Are Three Types Of Converters Used These Are Dc-Ac Converter, Dc-Dc Unidirectional& Bi-Directional converter. The Traditional High-Frequency Isolated Converters are Required A Transformer Responsible For Processing The Total Rated Power, With Increase Of Size, Weight, And Volume And Reduction Of Efficiency This interleaved boost converter use an active-clamp circuit as the first power processing stage, which can boost a low voltage from a PV panels up to the high-dc bus. A topology using the boost converter output terminals and flyback converter output terminal serially connected to increase the output voltage gain with the coupled inductor was presented in [8].the conventional block diagram shown in below fig.1&fig.2

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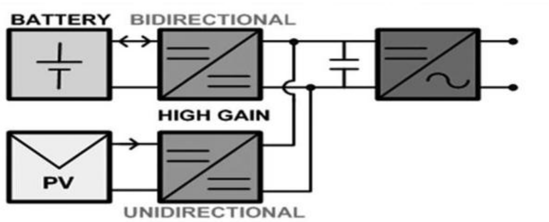

Fig.1 conventional system

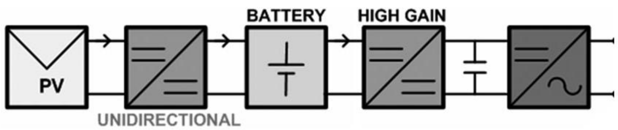

Fig.2 conventional method in single line diagram

III .PROPOSED METHOD

The low voltage side, the bidirectional converters are allows the MOSFET bridge to be supplied by either the battery or the PV pannels. the use of resonant capacitors in the full-bridge capacitors provides ZVS of the switches. The integrated topology resulting from the boost converter and the three-state switching cell is shown in Fig. 3. The main advantage the low voltage stress across the active switches, low input current ripple, and simplicity,higher efficiency. Some high-voltage gain topologies are supposed to contain three dc links as shown in Fig. 2, According to the proposed system, the battery bank and the photovoltaic panel can be connected to the low voltage side at VDC1 or VDC2,depending on the available voltage levels. Considering typical applications under 2 kW, battery bank voltage levels can be 12,24, or 48 V (in order to avoid the connection of many units in series) and photovoltaic panels can be arranged to establish a dc link with voltage level equal to about twice that of the former link

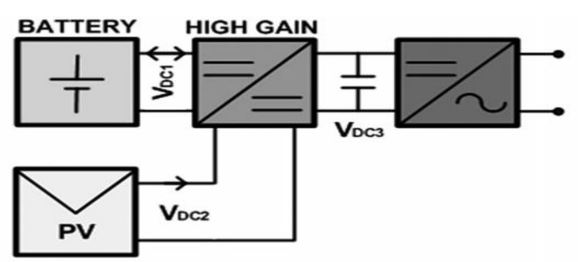

Figure 3. proposed system

The proposed system circuit diagram shown in fig 3 the proposed topology is formed by one input inductor, four controlled power switches S1–S4, two rectifier diodes D1 and D2, two transformers T1 (windings T1a and T1b) and T2 (windings T2a, T2b, T2c, and T2d) and four output capacitors C1–C4. Even though additional components are included,current sharing is maintained between (S1, S2, T1a, T2a) and(S3, S4, T1b, T2c). Then, besides the reduced current stress through the components, the instantaneous current during the turn OFF of the switches is significantly reduced for D>50%,thus leading to minimized switching losses. Also, the transformer is designed for about only 70% of the total output power. And there is no energy transfer from the input to the output during the second and fifth stages only.the cicuit diagram shown in fig.4

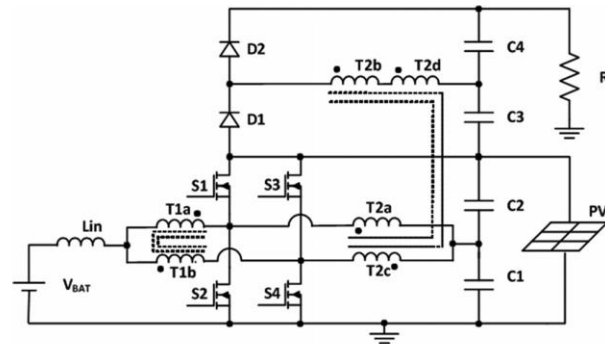

Fig.4 proposed cicuit diagram

Operation:

Frist stage[t0-t1]This stage S1 is turned OFF,causing a current flow through the antiparallel diode of switch S2, allowing the turn ON in the ZVS mode. At this moment, S3 is turned OFF, and S4 is turned ON. The current flowing through the input inductor "LIN " increases linearly and is equally divided between the two switching cells reducing the associated stresses of the active semiconductors. The current in the primary side T2a decreases linearly, while the current through T2c increases linearly. This stage ends when the currents in T2a and T2c reach zero, and the current through S2 is equal to that through S4.

Second stage[t1-t2]:Current "LIN" still increases linearly and is equally divided through the commutation cells. Additionally, all the rectifier diodes are reverse biased. The current through T2a and T2c remains null. This stage ends when S4 is turned OFF.

Third stage[t2-t3]:This stage begins when S4 is turned OFF, causing the current to flow through the anti-parallel diode of S3, allowing the turn on in ZVS mode. At this moment, S2 is already turned on. The current flowing through the input inductor 'LIN ' decreases linearly, while the currents through T1a and T1b increase and decrease linearly, respectively. The current in the primary side T2a decreases linearly, while the current through T2c increases linearly. This stage ends when S4 is turned ON and S3 is turned OFF.

Fouth stage[t3-t4]This stage begins when S4 is turned ON. When S2 is turned ON, the input current "LIN" increases linearly, and so do the currents through T1a and T1b. Also, the current through S4 increases and has flow in the opposite direction. The current through T2a linearly increases, while the one through T2c decreases. This stage

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ends when the currents in T2a and T2c reach zero, and the current through S2 is equal to the one in S4

Fifth stage[t5-t6]:This stage is similar to the second one. In this stage, "LIN" is still increasing linearly and is equally divided between the commutation cells. Besides, all the rectifier diodes are reverse biased. The current through T2a and T2c remain null. This stage ends when S2 is turned OFF.

Sixth stage[t6-t7]:This stage begins when S2 is turned OFF, causing a current flow through the antiparallel diode of S1, allowing its turn ON in the ZVS mode. At this moment, S3 is already turned OFF and S4 is turned ON. The current flowing through the input inductor "LIN" decreases linearly. The current in the primary side T2a increases linearly, while the current through T2c decreases linearly. This stage ends when the currents through T2a and T2c become null, and the current through S2 is equal to the one through S4. After this stage, a new switching cycle begins from the first stage the output wave forms as shown in below fig.5

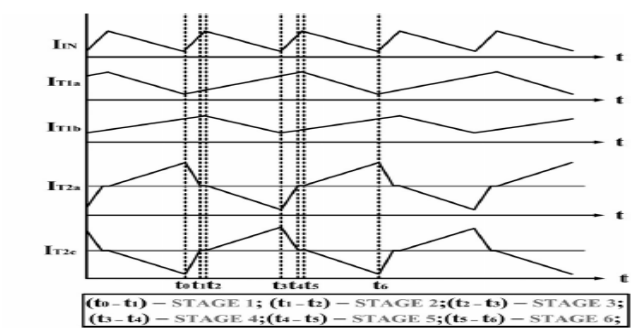

Fig.5 5 inductor&transformer current wave forms

IV . SIMULATION MODEL AND RESULTS

A simulation design svpwm controller in high gain boost converter useing is implemented in MATLAB SIMULINK with the help of pv energy, boost converter, inverter, as shown in figure 6.

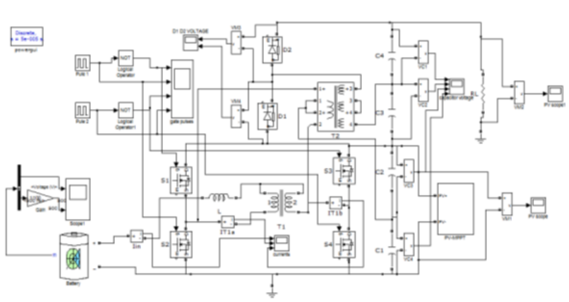

Fig. 6 Simulation model

The pv panel voltage waveform (voltage vs time) is fig 7 where the voltage is different because different sunlight.

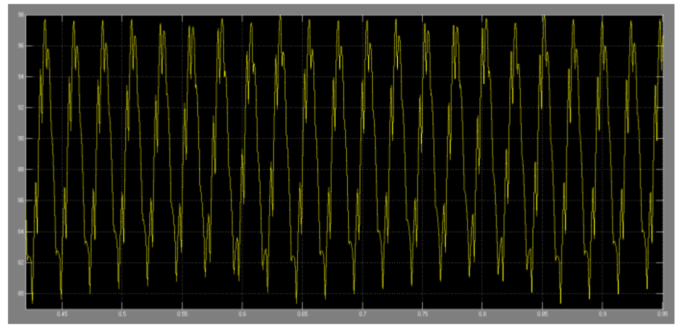

Fig.7 pv panel voltage waveform.

load voltage :load votage vs time as shown in

fig.8

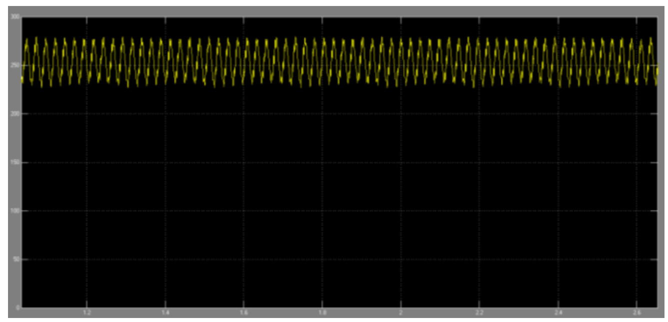

Fig.8

Inductor current and transformer currents as shown below fig.9

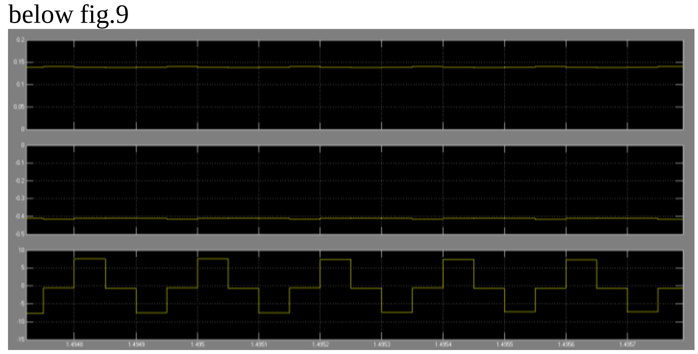

Fig.9

Capacitor voltages as shown below fig.10

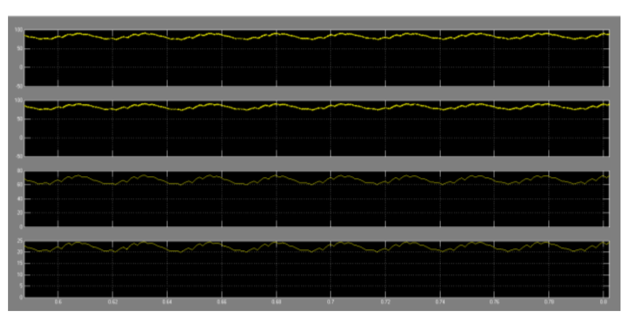

Fig.10

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V. CONCLUSION

A boost converter with high voltage gain has been presented in this paper. The relevant equations for the design procedure, the operation principle, and the main theoretical waveforms are discussed in detail. The main advantage of the topology is the wide voltage step-up ratio with reduced voltage stress across the main systems based on battery storage, such as renewable energy systems.

Experimental results obtained from a 500 W prototype have validated the concept, with high efficiency over a wide load range and smaller efficiency at the rated condition (94%), confirming the satisfactory performance of the structure. Although such curve is satisfactory for PV applications further optimization can be investigated in order to reduce conduction losses and improve efficiency in the rated condition. The concept of integrated converters in a single-stage approach seems to be promising, thus leading to the proposal of additional topologies feasible to photovoltaic and fuel cell applications.

VI. REFERENCES

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