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An Overview of Three Port Bidirectional DC–DC Converter Using Photo Voltaic Application

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Abstract- A three-port dc–dc converter coordinating photovoltaic (PV) and battery power for high stride up applications is proposed. The topology incorporates five force switches, two coupled inductors, and two dynamic brace circuits. The coupled inductors are utilized to accomplish high stride up voltage pick up and to lessen the voltage anxiety of data side switches. Two arrangements of dynamic cinch circuits are utilized to reuse the vitality put away in the spillage inductors and to enhance the framework proficiency. The operation mode does not should be changed when a move in the middle of charging and releasing happens. Besides, following most extreme force purpose of the PV source and directing the yield voltage can be worked at the same time amid charging/releasing moves. The length of the sun illumination level is not very low, the most extreme force point following (MPPT) calculation will be incapacitated just when the battery charging voltage is too high. Thusly, the control plan of the proposed converter gives most extreme use of PV power more often than not. Subsequently, the proposed converter has benefits of high boosting level, lessened number of gadgets, and straightforward control system.

I. INTRODUCTION

Incorporated multiport converters for interfacing a few force sources and capacity gadgets are broadly utilized as a part of late years. As opposed to utilizing individual force electronic converters for each of the vitality sources, multiport converters have the preferences including less segments, lower expense, more minimal size, and better element execution. Much of the time, no less than one vitality stockpiling gadget ought to be fused. For instance, in the electric vehicle application, the regenerative vitality happens amid speeding up or startup. Consequently, it is imperative for the port joined with the vitality stockpiling to permit bidirectional force stream

II. EXISTING SYSTEMS

Different sorts of topologies have been proposed because of the benefits of multiport converters. The mix systems for the multiport converter incorporate sharing switches, capacitors, inductors, or attractive centers. An utilization of half and half vitality supply utilizing renewable vitality sources and capacity gadgets is demonstrated in Fig. 1. The dc miniaturized scale network empowered by the strong state transformer (SST) in the Future Renewable Electric Energy Delivery and Management System (FREEDM System) coordinates different disseminated renewable vitality assets (DRERs) and conveyed vitality stockpiling gadgets (DESDs). Case in point, if sun oriented force is chosen as the renewable vitality source and battery as the stockpiling gadget, the battery can either supply the heap with the sun powered vitality in the meantime or store the abundance power from the sun based boards for reinforcement utilization. Thusly, the bidirectional force way must be accommodated the battery port. The dc–dc converters interfacing the DRERs or DESDs are required to have relative high voltage transformation proportions subsequent to the dc transport of the FREEDM framework is 380 V. For the dc–dc converters joined with the sun based boards, voltage pick up augmentation cells, for example, coupled inductors, transformers, and exchanged capacitors are frequently utilized to accomplish high voltage transformation proportions. By using the voltage pick up augmentation cells, the great obligation cycles that exist in run of the mill help converters can be dodged and the voltage weight on switches can be lessened. Therefore, control switches with lower voltage rating and lower turn-on resistance can be decided for the converters to diminish conduction misfortunes. A converter utilizing coupled inductors is generally superior to anything disconnection transformers since the coupled inductors have more straightforward winding structure and lower conduction misfortune. A help converter with coupled inductor and dynamic clip circuit is proposed in one of the prior works. This help converter can yield a high stride up voltage addition, diminish the voltage weight on

switches, and reuse the vitality in the spillage inductor

III. PROPOSED SYSTEMS

A high stride up three-port dc-dc converter for the crossover PV/battery framework is proposed with the accompanying focal points:
High voltage transformation proportion is accomplished by utilizing coupled inductors;
Simple converter topology which has diminished number of the switches and partner circuits;
Simple control technique which does not have to change the operation mode after a charging/releasing move happens unless the charging voltage is too high; and
Output voltage is constantly directed at 380 V under all operation modes. For the MPP-following converters, working reach must be constrained to the voltage not exactly the MPP voltage when the yield voltage or current control is dynamic. This issue could be tended to by restricting the working scope of the converter in the voltages higher than MPPT.

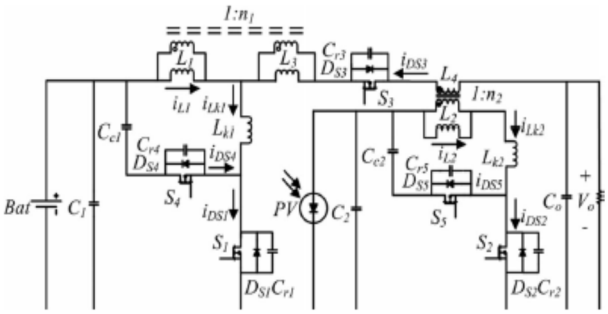

Fig. 2. Topology of the proposed converter.

As indicated in Fig. 1, contrasting with the ordinary multi-converter setup that obliges individual microcontroller for every converter, the incorporated three-port converters are controlled by a solitary microcontroller. The correspondence interface used in the multi-converter setup could be uprooted because of concentrated control of the proposed converter. Thusly, the framework expense and volume can be lessened. The real commitment is to propose a coordinated three-port converter as a non disconnected option other than commonplace disengaged topologies for high stride up three-port applications. The proposed exchanging procedure permits the converter to be controlled by the same two obligation cycles in diverse operation modes.

IV. PRINCIPLE OF OPERATION

The converter is made out of two principle switches S_1 and S_2 for the battery and PV port. Synchronous switch S_3is driven correlatively to S_1 such that bidirectional force stream for the battery port can be accomplished. Two coupled inductors with winding proportions n_1 and n_2 are utilized as voltage increase augmentation cells. Two arrangements of dynamic cinch circuits shaped byS_4, L_k1, C_c1 and S_5, L_k2, C_c2 are utilized to reuse the spillage vitality. L_k1 and L_k2 are both made out of a little spillage inductor from the coupled inductor and an outer spillage inductor. Two autonomous control variables, obligation cycles d_1 and d_2 , permit the control more than two ports of the converter, while the third port is for the force offset. The settled recurrence driving signs of the helper switches S_3 and S_4 are reciprocal to essential switchS_1. Once more, S_3 gives a bidirectional way to the battery port. So also, S_5 is driven in a correlative way to S_2. A 180◦ stage movement is connected between the driving signs of S_1 and S_2 . There are four operation periods taking into account the accessible sun powered force. In the first place, the sun is in the shroud stage and the sun oriented illumination is either distracted or low. This operation period is characterized as period 1, and the battery will serve as the principle force source. As the sun begins to sparkle and the introductory sun oriented light is sufficient for supplying piece of the heap request, the operation period is changed to period 2. The heap is supplied by both sun powered and battery control in this period. For period 3, the expanding disconnection makes the sunlight based force bigger than the heap request. The battery will save additional sun powered force for reinforcement utilization. Amid period 4, the charging voltage of the battery achieves the preset level and ought to be restricted to counteract cheating. As per the sunlight based light and the heap request, the proposed three-port converter can be worked under two modes. In the battery parity (mode 1), most extreme force point following (MPPT) is constantly worked for the PV port to draw greatest force from the sunlight based

boards. The battery port will keep up the force adjust by putting away the unconsumed sun oriented force amid light-load condition or giving the force deficiency amid substantial burden condition

V. PV SOURCE MODELING

Utilizing a PV generator as info source has huge impact on the converter progress. The nonlinear V −I normal for a PV generator can be demonstrated utilizing current source, diode, and resistors. The single-diode model indicated in Fig. 3(a) is generally utilized for the PV source demonstrating. This model gives an exchange off in the middle of precision and many-sided quality.

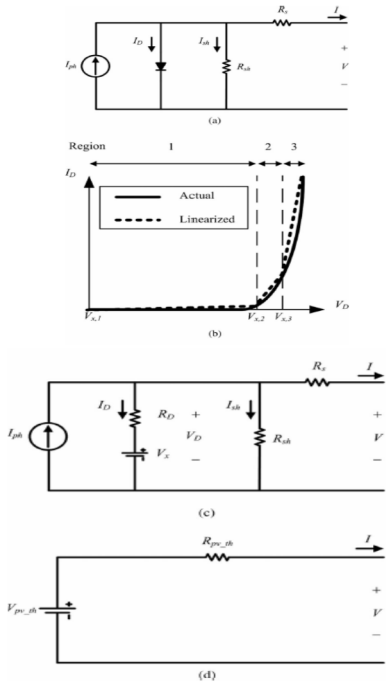

Fig. 3. Thevenin's equivalent circuit derived from the single-diode model. (a) Single-diode model of a PV generator.(b) $V-I$ characteristic of diode: actual and linear approximation [34]. (c) Single-diode model with linearized diode. (d) Thevenin's equivalent circuit for a single-diode model with linearized diode.

Thevenin's proportionate model with non consistent voltages and resistances has been proposed to firmly rough the normal for PV generator. The Thevenin-based model gives easier expectation and reckoning to the greatest force purpose of PV cluster under diverse working conditions. Thevenin's hypothesis is not legitimate for a nonlinear model, but rather the nonlinear model could be spoken to by a direct one with non consistent parameters. Case in point, the piecewise linearization is utilized to linearize the diode. The parameters in Fig. 3(a) can be evaluated utilizing the producer's datasheet. As demonstrated in Fig. 3(b), the genuine diode trademark has been separated into three areas and the trademark in every area is approximated as a straight line

VI.MODELING AND CONTROL STRATEGY

The operation modes of the converter are determined by the conditions of available solar power and battery charging states. Controlling the converter in each mode requires different state variables to regulate voltages of the input and output ports. There are three control loops for the proposed converter: output voltage control (OVC), SVC, and BVC. The control scheme is shown in Fig. 6. The OVC is a simple voltage regulation loop. The SVC and BVC loops share the same control variable d2 to achieve smooth mode transitions. SVC is used to regulate the voltage of the PV port and implement the MPPT algorithm. BVC is the battery voltage regulation loop to prevent overcharging. It is noted that the PV port is operated under SVC most of the time. Therefore, BVC would not be active under normal operation. Only one control loop between SVC and BVC is performed. Moreover, once BVC starts to take control over d2 , SVC will be disabled immediately to avoid the noise issue caused by the MPPT algorithm [27]. In fact, the

cross-coupled control loops is the intrinsic feature of the multiport converters since it is a high-order system. It will be a challenge to design the controllers of a multiport converter. The decoupling network for extracting separate transfer functions in such a system has been introduced by describing the system dynamics in a matrix form .

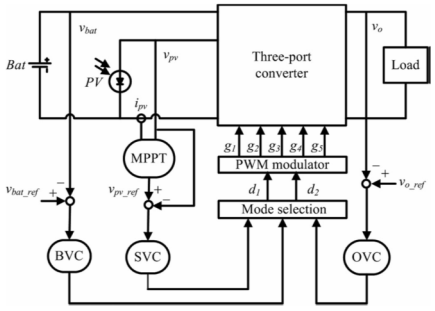

Fig. Control scheme of the proposed three-port converter

The small-signal modeling method is widely used for the power electronics converter. For a three-port converter that has two input ports, a matrix-form model will be very helpful to implement the closed-loop control and analyze the system dynamics. Since there are two operation modes for the proposed three-port converter, two sets of small-signal models will be derived. The state variables for each model are slightly different but the control variables are the same. The decoupling network is required for both models to allow separate controller design.

VII. ADVANTAGES

Initially, contrasted with the single-stage Dual Half Bridges converter, the three-stage interleaved structures lessen latent segments size, current, and voltage repulsions.

The interleaved structures lessens aggregate data current repulsions by utilizing a little estimation of dc inductor, and in the meantime, a vast current swell in each dc inductors may help to enhance the smooth switching conditions further.

Profited from the dc current swell, a Zero Voltage Source may be ensured in diverse operational modes notwithstanding when the photo voltaic voltage shifts in a wide voltage ranges and the electric batteries voltage change in little voltage ranges with distinctive conditions of charge status. Likewise,

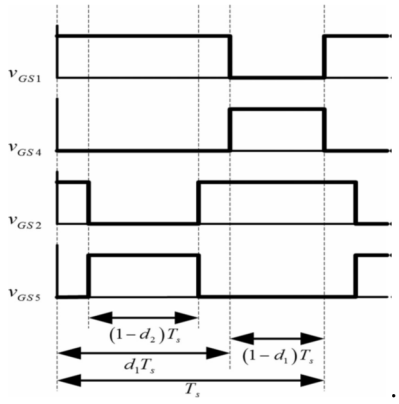

Fig.Steady-state waveforms of the three-port converter.

VIII. DISADVANTAGES

The initial installation cost solar photo voltaic panel always high .even tough subsidy program on green energy given by government to promoting usage of solar power.

The location of solar photo voltaic panel is of major factor in the generating power. Area which are remain mostly cloud full and fogs will produces power but reduces rate of requirement photo voltaic panel to generates power for your home.

Commonly photo voltaic panel are made up of silicon and other toxic metal particals, which may pollute the environmental condition also degrades qualities of panel.

So all the radiation from sun is not absorbs by photo voltaic panel. Therefore panel are having 40% efficiency rates which mean 60% of sun radiation get wasted and not used.

IX. CONCLUSION

A high stride up three-port DC–DC converter for stand-alone power frameworks is proposed to coordinate sunlight based and battery power. In the proposed topology, two coupled inductors are utilized Fig. 16. Self-governing mode move. (a) Mode 1 to mode 2. (b) Mode 2 to mode 1 (Ch1:Vo , Ch2: Vb , Ch3: Ipv , Ch4: Ipv). as voltage addition expansion cells for high voltage yield applications. Two arrangements of buck–boost sort dynamic clasp circuits are utilized to reuse the vitality put away in the spillage inductors and enhance the effectiveness. The proposed exchanging method just needs to control two obligation proportions in diverse operation modes. The test results accept the usefulness of the proposed converter under diverse sun based illumination level and burden request. The charging/releasing moves of the battery could be accomplished without changing the operation mode; hence, the MPPT operation won't be intruded. In light-load condition, once the charging voltage is higher than the present level, the operation mode will be changed quickly to shield the battery from cheating. The most astounding converter effectiveness is measured as 90.1% at 110W. The control system for the battery port could be altered for the network associated applications. Dialog from control perspectives including moving the impact of RHP-zeros to specific yield, restrictions on affectability of the framework, tradeoffs in the criticism controller configuration, and usage of an enhanced decoupling technique ought to be exhibited in our future work.

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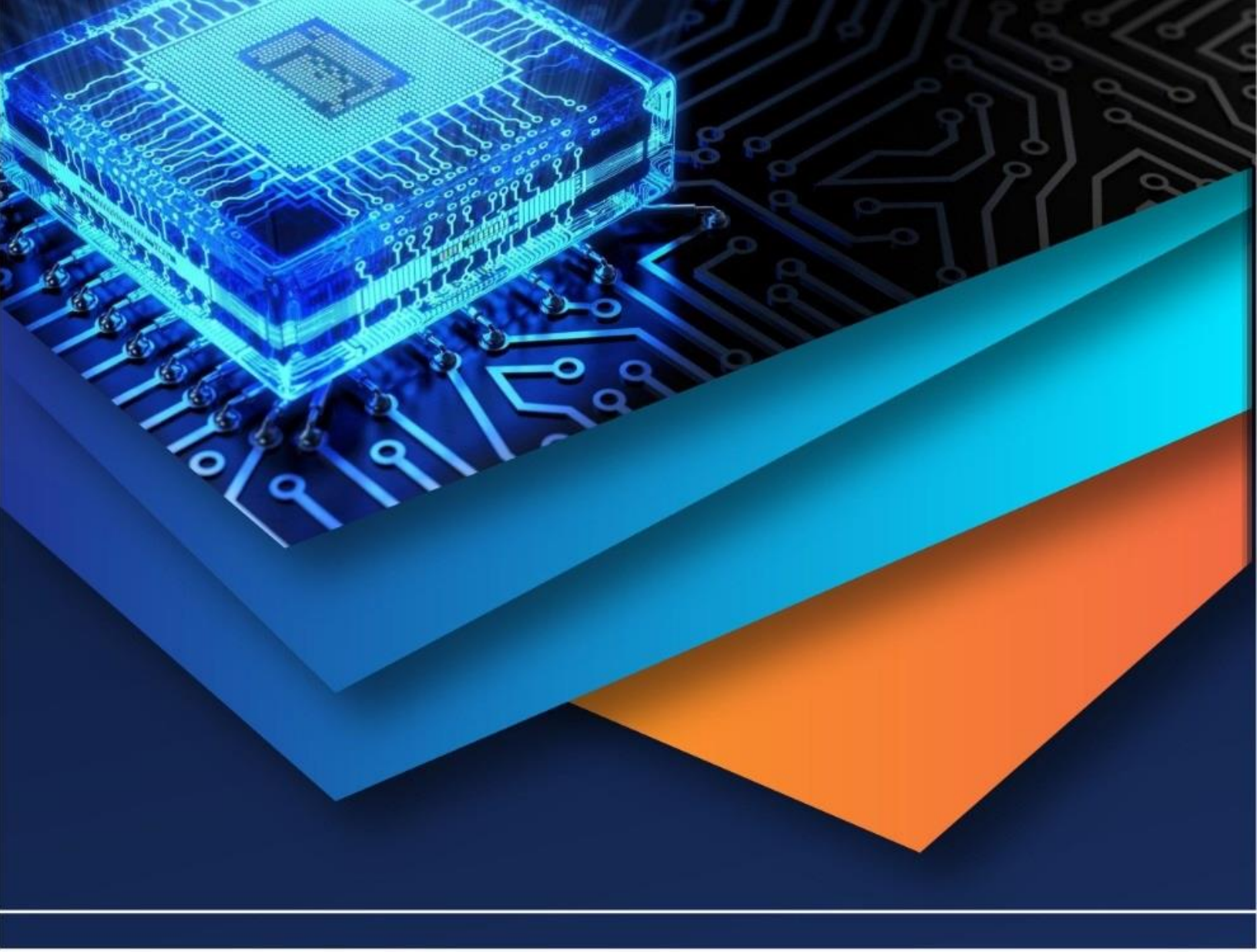
REFERENCES

[1] D. Nilsson and A. Sannino, “Efficiency analysis of low- and medium voltage DC distribution systems,” in Proc. IEEE Power Eng. Soc. Gen.Meet., Jun. 6–10, 2004, vol. 2, pp. 2315–2321.
[2] W. Kramer, S. Chakraborty, B. Kroposki, and H. Thomas, “Advanced power electronic interfaces for distributed energy systems—I: System and topologies,” National Renewable Energy Laboratory, Golden, CO, Tech. Rep. NREL/TP-581–42672, Mar. 2008.
[3] K. Kurohane, A. Uehara, T. Senjyu, A. Yona, N. Urasaki, T. Funabashi, and C. Kim, “Control strategy for a distributed DC power system with renewable energy,” Renewable Energy, vol. 36, no. 1, pp. 42–49, Jan. 2011.
[4] G. Byeon, H. Lee, T. Yoon, G. Jang, W. Chae, and J. Kim, “A research on the characteristics of fault current of DC distribution system and AC distribution system,” in Proc. IEEE 8th Int. Conf. Power Electron. ECCE Asia, May 30–Jun. 3, 2011, pp. 543–550.
[5] M. Brenna, E. Tironi, and G. Ubezio, “Proposal of a local DC distribution network with distributed energy resources,” in Proc. 11th Int. Conf.Harmonics Quality Power, Sep. 12–15, 2004, pp. 397–402.



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