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HYBRID DESIGN AND SIMULATION FOR THE BOOSTING CONVERTER FOR PV SYSTEM

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ABSTRACT: A half breed boosting converter(HBC) having aggregate points of interest of control ability from its support structure and upgrade of the pick up from its voltage multiplier structure is forthput in this paper. New converter joins a bipolar voltage multiplier, conspicuous symmetrical arrangement, single inductor and single switch, high pick up capacity with wide control go, low part stress,small yield swell and slavish expansion, which make it reasonable for front-end PV framework and some other sustainable power source applications. In the proposed work activity rule and voltage swell are broke down. A 200-W 35V to 415V second request HBC model utilizing open circle was planned. In proposed methodnew HBC with PI controller is designed.Thesimulation comes about guarantee the practicability of the converter. KeyWords: Bipolar voltage Multiplier (BVM), Hybrid Boosting Converter(HBC), NatureInterleaving, Renewable Vitality, Single Switch Single Inductor.

I.INTRODUCTION

There is a quick advancement of sustainable power source framework requires another age of high pick up DC/DC converters with high productivity and low cost.A MVDC converter is required which can help the voltage from 1-6 to 15- 60KV to connect the yield of generator to the MVDC line[1].Many high pick up improvement methods were examined in past to accomplish high voltage change proportion with high efficiency.Switched capacitor structure[2],tapped/coupled inductor based technique[3],[4],transformer based strategy, voltage multiplier structure[5] or on the other hand mixes of them[6] are thetechniques.But every innovation has its special points of interest and limitations.In past numerous pick up augmentation techniques ofboost converter by including just diodes and capacitors were investigated.The strategy for brushing support converter with customary Dickson multiplier and Cockcroft-Walton multiplier to produce new topologies were proposed in[7].An rudimentary circuit utilizing the Super lift procedure was proposed in[8].The idea of multilevel lift converters was researched in [9].From the above topologies, another boosting converter with a solitary switch and single inductor is proposed by utilizing bipolar voltage multiplier. The second request HBC is appeared in Fig.2.which diminishes the voltage rating of yield channel limit and displays the nature interleaving activity characteristics.A littler swell with single switch and single inductor has accomplished in this topology on keeping up high voltage gain.Manymore structures are accomplishing high pick up as of late were additionally revealed [10] yet they received atleast two inductors or switches,or some depend on tapped inductor which may entangle the circuit outline and increment cost.

II.OPERATION PRINCIPLE

A. INDUCTIVE SWITCHING CORE

Here the inductor, switch and info source fill in as an inductive exchanging center as appeared in Fig.1.This creates two reciprocal PMW voltage waveforms at port AO and port OB.Even if the two voltages waveforms have their singular high voltage level and low voltage level,the hole between the two levels is identical,which is an imperative include for interleaving task.

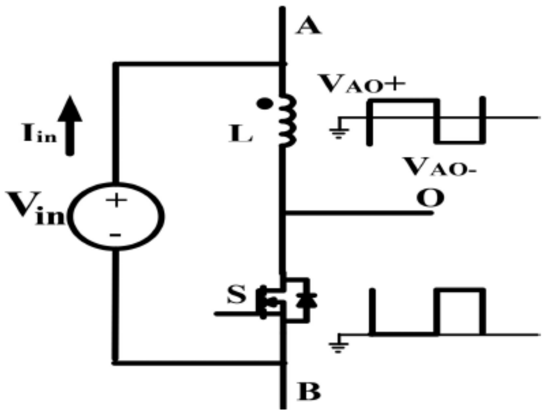

Fig.1.Inductive three-terminal switching core

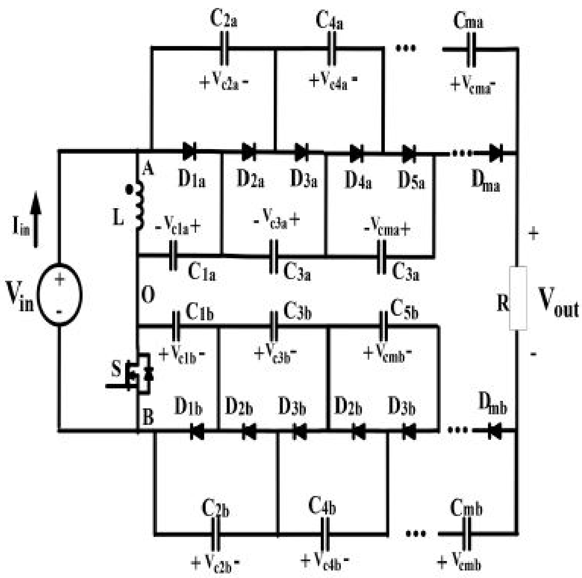

Fig.2. Even order HBC

B. BIPOLAR VOLTAGE MULTIPLIER(BVM)

A BVM comprises of a positive multiplier branch and a negative multiplier branch.Positive multiplier is the same as the traditional voltage multiplier while the negative multiplier has the input at the cathode terminal of cascaded diodes,which can generate negative voltage at anode terminal

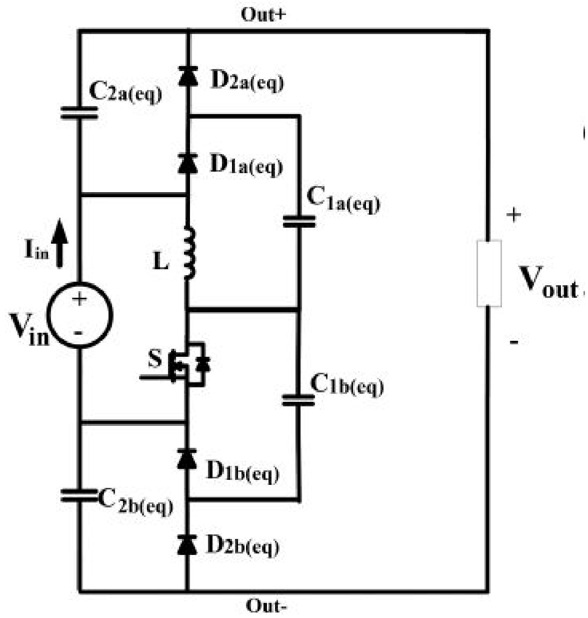

Fig.3.Equivalent even order HBC

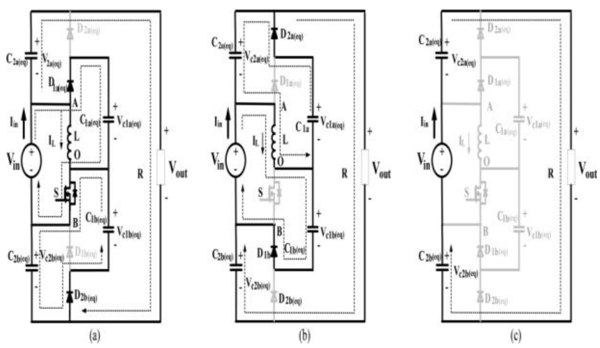

Fig.4.Three operation modes

C. OPERATION PRINCIPLE OF HBC

The general even-order HBC in Fig.2.simplied to an equivalent HBC circuit as shown in Fig.3. Careful examination indicates that two "boost" like sub circuits are intertwined through operating active switch S.The total output voltage of HBC is the sum of the output voltage of two boost sub circuits and the input voltage.Three operation modes are described as shown in Fig.4.

1) Mode 1[0,DTs]: InFig.4a, switch S is turned ON and diodes D1a(eq),D2b(eq) conduct while diodes D2a(eq) and D1b(eq) are reversely biased.The inductor L is charged by the input source. Meanwhile, capacitorC1a(eq).At this interval, following equations can be derived based on the inductive switching core analysis:

$$V_{AO+} = V_{in}V_{OB-} \tag{1}$$

2)Mode 2[DTs,(D+D1)Ts]:As picturized in Fig.4b,when S is turned OFF, the inductor current will free wheel through diodesD2a(eq) and D1b(eq).The inductor is shared by two charging boost loops. In the top loop, capacitor C1a(eq) is releasing energy to capacitor C2a(eq) and load at the same time. In the bottom loop, input source charges capacitor C1b(eq) the inductor L. During this time interval voltage, generated at AO and OB is expressed as follows based on the inductor balance principle:

$$V_{AO+} = -V_{in}\frac{D}{D_1} \tag{2}$$

3)Mode 3[(D+D1)Ts,Ts]:At this condition, the circuit will work under DCM operation mode, thus the third state in Fig.4c.appear.At this state, the switch S is kept OFF. The inductor current has dropped to zero and all the diodes are blocked.TheC2a(eq) and C1a(eq) are in series with input source to power the load. During this time interval, voltage generated at port AO is zero while at OB is Vin.

TABLE 1: PARAMETERSELECTED FOR MODELING

Name	Denomination	Value
MOSEFT	S	250 V/40 A, 29 mΩ (IRFP4330)
Inductor	L	500 μH
Diode	$D1\ a$	200 V/20 A,VF = 0.78 V(STH2002C)
	$D2\ a$	
	$D1\ b$	
	$D2\ b$	
Capacitor	$C1\ a$	250 V/100 μF, electrolytic capacitor
	$C2\ a$	
	$C1\ b$	
	$C2\ b$	
Switching frequency	fs40 KHZ	
Load	R	722 Ω

TABLE 2: COMPARISION OF VOLTAGE GAIN

S.NO	Converters	Voltage gain	diodes	capacitors
1	Boost + Dickson multiplier [7]	1.98	5	5
2	Boost + Cockcroft Walton multiplier [7]	2	5	5
3	Multilevel Boost Converter [9]	2.1	5	5
4	Proposed New HBC	4	4	4

III.SIMULATION RESULTS

In order to verify the feasibility of proposing converter and its performance, simulation results of a new HBC are provided. A 200W 35 to 415V second order HBC was designed and its specifications are listed in Table 1.The input current is pulsating without terminating to zero and no rush current is observed due to the operation frequency is chosen properly. The output voltage is boosted to 415V and kept stable without high voltage rating filtercapacitor.Fig.5. shows Simulink model of .Fig.3.where feedback method is used, output voltage is compared with that of reference voltage and sends to PI controller and tuned the error and produces pulses for switch, used in HBC. These pulses for switch used in the converter changes according to what amount of output voltage required. Four diode voltage waveforms Vd2a Vd1a,Vd1b ,Vd2bare shown in Fig.6. Moreover the voltage stress of four diodes is presented, which is relatively low and novoltage overshoot is observed. In Fig.7.drain source voltage and current are presented. New HBC may enter DCM mode under light load conditions, unnoticeably overshoot at voltage Vdsis occurred due to the capacitors buffering function. Moreover PI controller provides zero steady state error and increase the output signal by the integral term. The output voltage is boosted to 415V,shown in Fig.10.,without any high voltage rating filter capacitor.Worthwhile, a comparison on voltage gain is carried out between proposed new HBC converter and other converters listed in Table 2.

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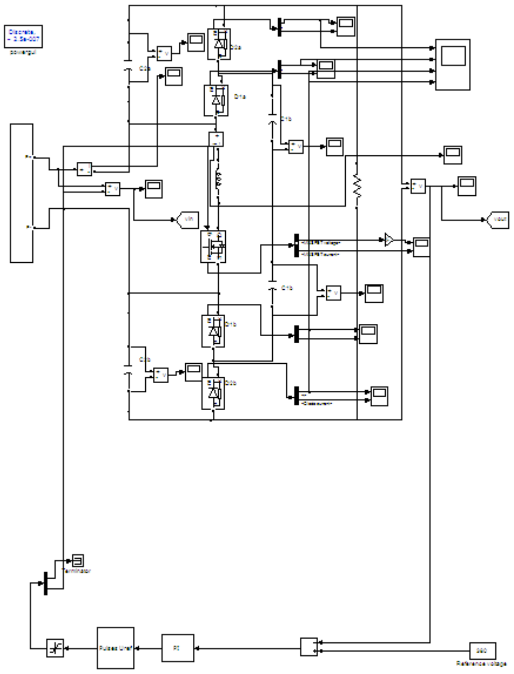

Fig.5. Simulink Model of Proposed Method

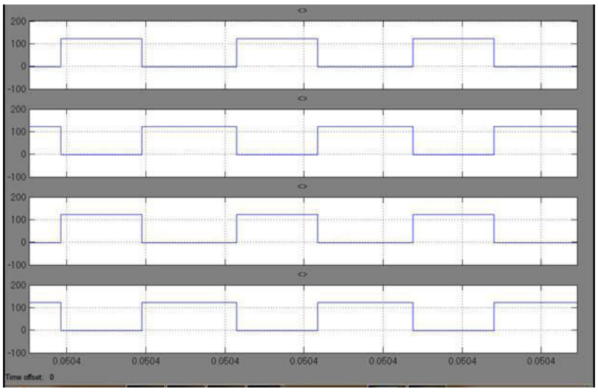

Fig.6. Simulink waveform of diode voltages in Proposed Method: Vd2a, Vd1a ,Vd1b ,Vd2b

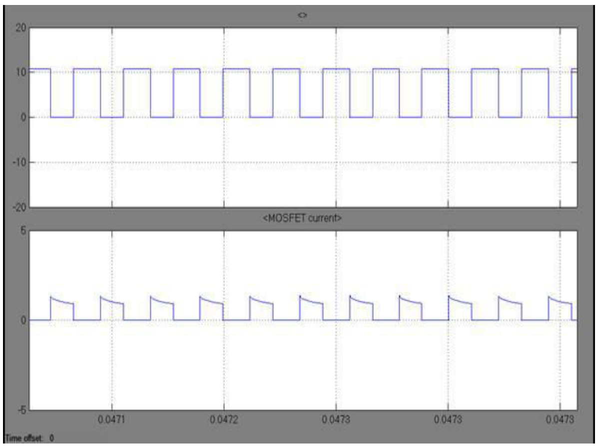

Fig.7. Simulink waveform of Vdsand Ids

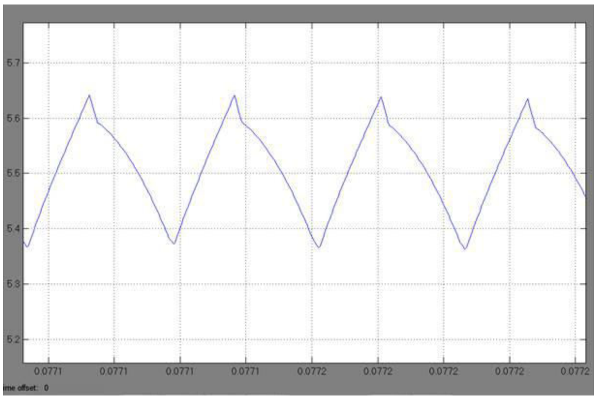

Fig.8. Simulink waveform ofIL

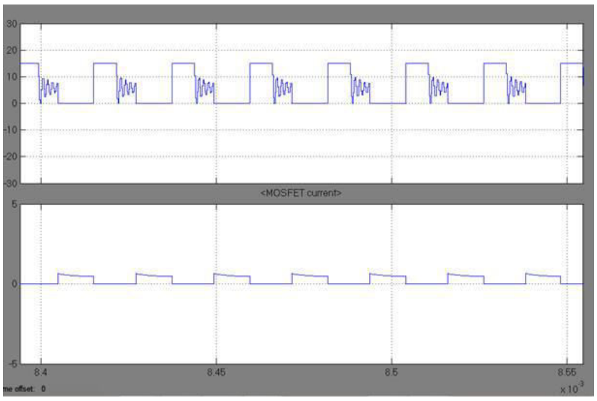

Fig.9. Simulink waveforms in DCM of Vds and Ids

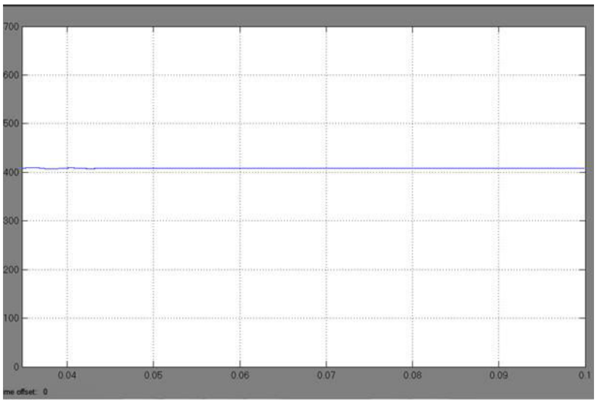

Fig.10.Simulation results of proposed method:Vout

IV.CONCLUSION

Proposed new HBC made out of an inductive center and BVM having shut circle is helpful for sustainable power source applications. Collective advantages of proposed strategy are pick up boosting method from the voltage multiplier and voltage control ability highlighting in nature interleaved operation, wide direction range, low segment stresses, small yield ripple, flexible pick up expansion and high efficiency. Compared with other pick up boosting innovations like tapped inductor or transformer based strategy the proposed topology lessens the many-sided quality which is appropriate for large scale manufacturing and it has a superior part use factor contrasted and other single switch single inductor DCDC converters. This work gives task standard and plan considerations .A 200-W35V to 415V second request HBC shut circle model was outlined which accomplished pinnacle efficiency. This converter is reasonable for some sustainable power source applications. Additionally the PI controllers give increment in speed of reactions and give applications in numerous procedures. Besides the proposed strategy has most reduced capacitor voltage push which demonstrates the prevalence for high power thickness plan and ease outline.

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