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Zero Voltage Switching Technique for Bidirectional DC/DC Converters with Voltage Doubler Based on Phase Shift Control Method

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ABSTRACT: Utility of electrical power especially direct current is more suitable especially Power Electronics based circuits we can achieve high efficiency and high power density with the DC to DC circuits even they are operating at half of its duty cycle. we can achieve the more the output voltage at DC to DC devices however the output voltage control cannot be regulated even though we are using the traditional methods, to achieve the controlling of output voltage we have to use filters, among the active power filters and other rectifier, we are proposing the Active Boost Rectifiers ABR. Basically the proposal rectifier is the combination of a traditional diode rectifier and a bidirectional switch as we know that everything is required pulse based switch control. So here we are adopting phase shift control, between the primary and secondary sides in switching the output voltage regulation can be achieved this can be possible with this a b are active boost rectifier as a result a family of soft switching can be achieved . When the converter operates in soft switching continuous conduction mode the zero voltage switching technique can be adapted for all primary and secondary sides also included when the converter operates at that discontinuous conduction mode zero current switching for the primary side and zero voltage switching technique for the secondary side or can be achieved. In future if the diode in Reverse recovery problem and it is elevated by employing active boost rectifier. As an example the full bridge converter with doubler diodes filter is analysed, to verify the existing concept of this ABR and converters the operating principles of voltage conversion ratio and output characteristics are analysed. In this paper finally the simulation results has shown for the feasibility and effectiveness

KEYWORDS: Active boost rectifier (ABR), DC-DC converter, full bridge converter (FBC), soft switching, voltage doubler (VD).

I.INTRODUCTION

DC to DC Converter is the most implemented and the portable electronic devices. Which are implementation in electronics and power electronics applications which are employed by using power conversion of high voltage to low voltage and low voltage to High Voltage applications even though if we are having fixed voltage to variable voltage and variable voltages. Which are in application of electrical and electronics we are using the DC power for the further improvements on the performance of efficiency and power density and the electromagnetic noise many kind of switching converters are there based on the DC to DC Converter overcome the disadvantages in hard switching and sparks in switching the DC to DC Converter adopted among almost the phase shift full bridge converter placing avoid role in the field of this converters the phase shift Bridge converters operating with zero voltage switching technique and zero current switching techniques are very badly using so without losing any switching losses in secondary side and in primary side and circulating the current related power loss and duty cycle loss has been shown consequently high productivity and high power can be effectively achieved.

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II. PROPOSED DC-DC CONVERTERS WITH ABR FILTER

As an example, a FBC with a VD rectifier shown in Fig. 1 is used to describe the concept of an ABR. When this converter operates as a dc transformer, the duty cycles of all the switches are fixed at 0.5. The voltage-source full-bridge inverter, which is composed of a dc input voltage source U_{in} and four switches $S1 - S4$, generates an ac square-wave voltage u_p , applying to the primary winding of the transformer. Therefore, the converter shown in Fig. 1 can be represented by the one shown in Fig. 2(a). For simplicity, considering an ideal transformer T with turn's ratio of 1, this circuit can be further simplified to a uncontrolled rectifier, as shown in Fig. 2(b). It is obvious that the output Voltage cannot be regulated if the duty cycles of all the switches are fixed at 0.5. To make the output voltage controllable, a bidirectional switch S_b can be introduced to the circuit of Fig. 2(b), then a principle circuit of ABR is derived, as shown in Fig. 3, where a Boost circuit is built by the inductor L_k , switch S_b ,

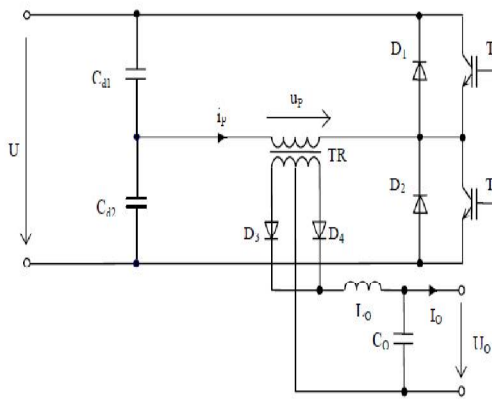


Figure 2
Half-bridge converter

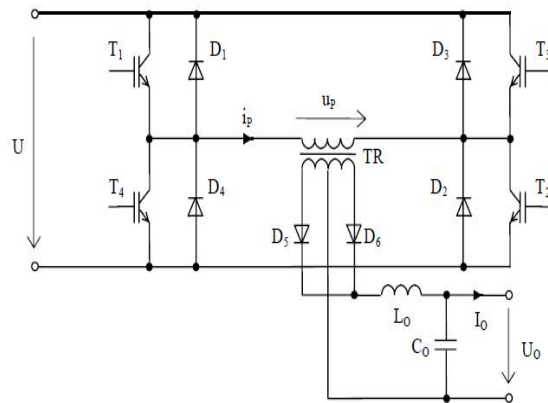


Figure 1
Full-bridge converter

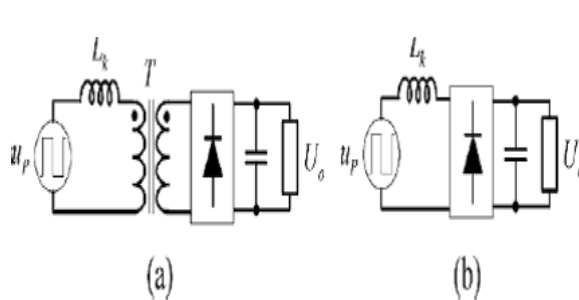


Fig 1.a Topology of Voltage Doubler Rectifier

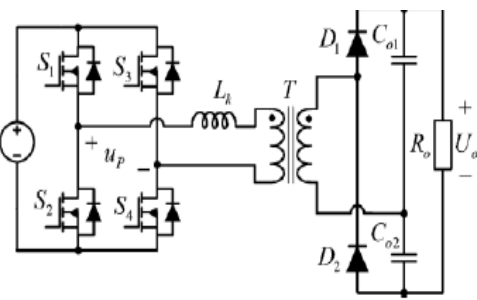


Fig 2.b Simplified Bridge Converter

The proposed system block diagram is shown in figure 1. In the proposed system we have used the PWM logic controlling technique to improve the efficiency of the system. The system circuit diagram and operation of the proposed system is discussed below. The FBC-VD-ABR is redrawn in Fig. 2, where all the switches on the primary and secondary sides have a constant duty cycle of 0.5. $S1$ and $S4$ are always turned- ON/OFF simultaneously, and the same with $S2$ and $S3$. A phase shift angle between the primary- and secondary-side An active switch is employed to regulate the output power and voltage. L_f stands for the total of the transformer leakage inductance and external inductor. The output series capacitors C_{o1} and C_{o2} have the same capacitance and are

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large enough to clamp the voltage stresses of the secondary-side switches and diodes to half of the output voltage. u_{DS1} , u_{DS4} , and u_{DS6} are the drain to source voltages of S1, S4, and S6, Rectifying diodes. This circuit is similar to the conventional power factor correction boost converter. As a result, the output voltage can be regulated by the bidirectional switch S_b . In this paper, the rectifier composed of the active bidirectional switch S_b and diodes is named ABR. It is easy to understand that the output voltage of a dc transformer can be controlled by improving the uncontrolled diode rectifier to an ABR. For example, when we apply the ABR to the FBC of Fig. 1, a new circuit can be derived.

III. DC-DC CONVERTERS BASED ON ABR FILTERS

1) *Circuits of ABR*: In the analysis aforementioned, an ABR circuit has been derived based on a conventional VD diode rectifier. This concept can also be applied to the conventional full-bridge and full-wave diode rectifiers, as shown should be noted that, as shown .because the transformer has two secondary windings, two unidirectional switches S_{u1} and S_{u2} , instead of one bidirectional switch, are introduced to build an ABR. A bidirectional switch can be realized through the combination of MOSFETs and diodes, while a unidirectional switch can be realized through a series connection of a MOSFET and a diode. Some possible realizations of the bidirectional and unidirectional switches are illustrated. Based on these switches, a family of ABR circuits can be derived. Some example topologies are shown .On the other hand, for the full-bridge diode rectifier, a bidirectionalSwitch which is paralleled with the transformer winding can also be built by replacing the two diodes in the rectifier with two MOSFETs. As a result, simplified full-bridge ABR topologies can be derived and shown in Fig. 8, where the bidirectional switches have been highlighted with red color. It is obvious that two diodes can be reduced compared.

2) *Primary-Side Circuits*: As illustrated in, the primary-side circuit should be able to generate an ac square wave Voltage. In addition to the voltage-sourced full-bridge topology, there are many other selections for the primary-sideCircuit. Some of the topologies, including the boost full-bridge, that the operating principles and performance of the topologyshown .have been analyzed in [2] and [12], which can verify the feasibility and advantages of this topology, and prove the effectiveness of the ABR concept proposed in this paper. It should be noted that, although some circuits have been proposed and analyzed, the topological methodology of this topology family has never been pointed out systematically, which is the main contribution of this paper.

IV. FBC WITH VOLTAGE-DOUBLER ABR

Full bridge converter with voltage doubler he is rectify the repair free current and voltage which is the one of a proposal to biology with auto boost rectifier is taken as an example to analyse the section to verify the feasibility of a proposal strategies the full wave rectifier has shown below where all the switches off the primary and secondary sides has a constant duty cycle even after the simulation also will give the same if the primary current has decreased before the primary side switch commute the converter operates the DCM operation the key will forms of a full Bridge voltage differential has 8 stages in one switching period with the symmetry of the circuit only four stages are analysed hear the corresponding equal and circuits for each and operations stages as shown below. High-power application, the conventional phase-shift FBC and the full-bridge LLC resonant converter are selected due to the similarity in structure and application, while others may not be suitable for comparison and are out of the scope of this paper. The comparison in Table I provide detailed tradeoff for all three converters. It is clear that each converter has its advantages and disadvantages. Overall, since soft switching, low stress, and Boost and Buck conversion can be achieved with the FBCVD- ABR, the proposed converter is a good candidate for high efficiency, high frequency and wide input/output voltage ranges applications, for example, the photovoltaic or battery-sourced Power system, battery charging or discharging power system, etc. In addition, with the voltage-doubler ABR, high voltage gain can be achieved easily. Thus, the proposed converter can also be used for the applications where high step-up is required, i.e., the front-end converter for renewable power system.

has successfully executed primary side and switchAssimilating the above diagrams the given pulse diagrams and input voltage and output voltage exactly shown in the trigger and we can observe that the input voltage is a 3 phase voltage and the output voltage is more than required the lord hence the output come without any ripples and transient as shown in figure which has successfully executed.

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Vol. 7, Issue 11, November 2018

C. Soft-Switching Characteristics

According to the operation principles of the converter, the ZVS turn-on of all the primary-side power MOSFETs can be achieved when the converter operates in the SS-CCM and HSCCM modes. The ZVS turn-off of primary side MOSFETs can also be obtained thanks to the parasitic or parallel capacitors on the drain to source of MOSFETs. When the converter operates in the SS-CCM, ZVS turn-on of the secondary-side MOSFETs and zero current switching (ZCS) turn-off of rectifier diodes can also be achieved. However, when the converter operates in HS-CCM, soft switching of secondary-side devices will lost. But, it should be noted that, the turn-off loss of the secondary side.

MOSFETs can be minimized in the HS-CCM because the turn-off current is the minimum of these three operation modes under the same output power condition. Besides, when the converter operates in the DCM mode, ZCS can be achieved for the primary switches and secondary rectifier diodes, and ZVS can be achieved for the secondary-side MOSFETs. When analyzing the operation principles, the magnetizing inductance is ignored for simplicity. In fact, since the magnetizing current of the transformer is small, the extra conduction losses caused by the magnetizing current are quite small. What is more, the magnetizing current can help the primary-side MOSFETs to achieve ZVS more easily, whose principle is similar to the LLC resonant converter, especially in the low-power conditions. As a result, the circuit conversion efficiency can be improved.

D. Control Loop

According to the output characteristic curves shown in the output voltage and power of the FBC-VD-ABR Are regulated by the duty cycle defined in (2), which means the voltage and power can be regulated only by directly varying the phase shift angle ϕ . Thus, the traditional voltage feedback loop can be adopted to regulate the output voltage, as shown in the difference between the voltage reference and the sampled output voltage is used as the input of the PI regulator to generate the command value for the phase-shift modulator. Since the control loop is very simple, it can be implemented with either analog circuit or digital signal processor.

E. Performance Comparison

To help tradeoff design and topology selection in engineering Applications, the performance comparison between the FBCVD- ABR and other converters is necessary.

V. SIMULINK RESULTS AND OUTPUTS

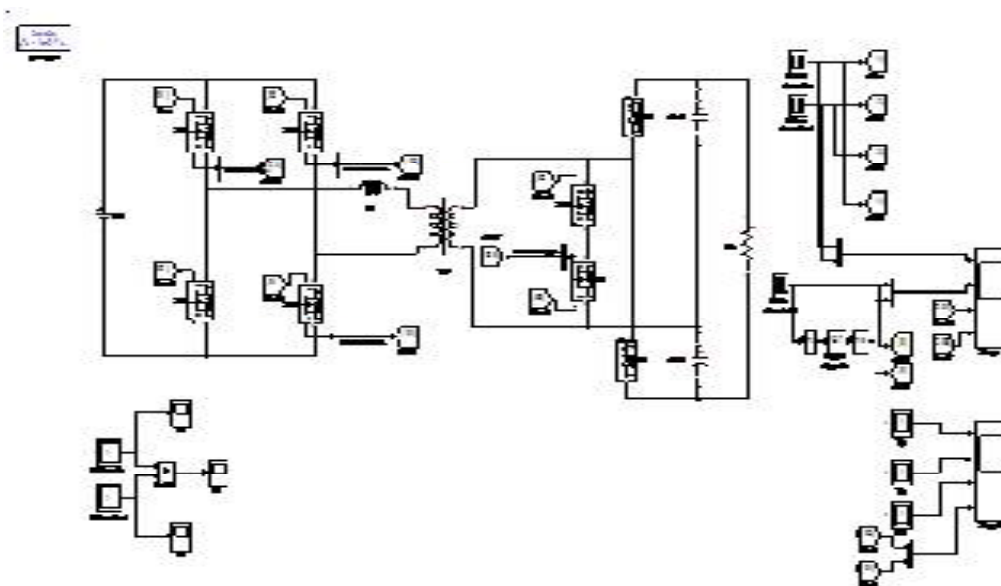


Fig 3 Proposed Circuit Diagram ABF

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The utility of a power especially with the active power filters has shown in the above simulation diagram that simulation. We can see full bridge converter with soft switching and voltage doubler circuits the AC to boost rectifier performs power filters basically the proposed. to rectifier consisting of diode rectifier and by dates are sweet which has been presented and simulated above the required pulse with bad control and where adopting the phase shift control the bidirectional converter speech and the diode has been operated with phase control as shown Above and the reasons as given below the sword switching technology proves the primary side zero voltage switching and secondary side zero current switching. ZVS can be achieved for all the primary and Secondary-side switches when the converter operates under The SS-CCM. However, from the waveforms of below it can be seen that ZVS performance can only be achieved for the primary-side switches when the converter works in the HS-CCM, and the secondary-side switches operate with hard switching. But, it should be noted that, the turn-on/OFF current of the secondary-side switches is extremely small in the HS-CCM.

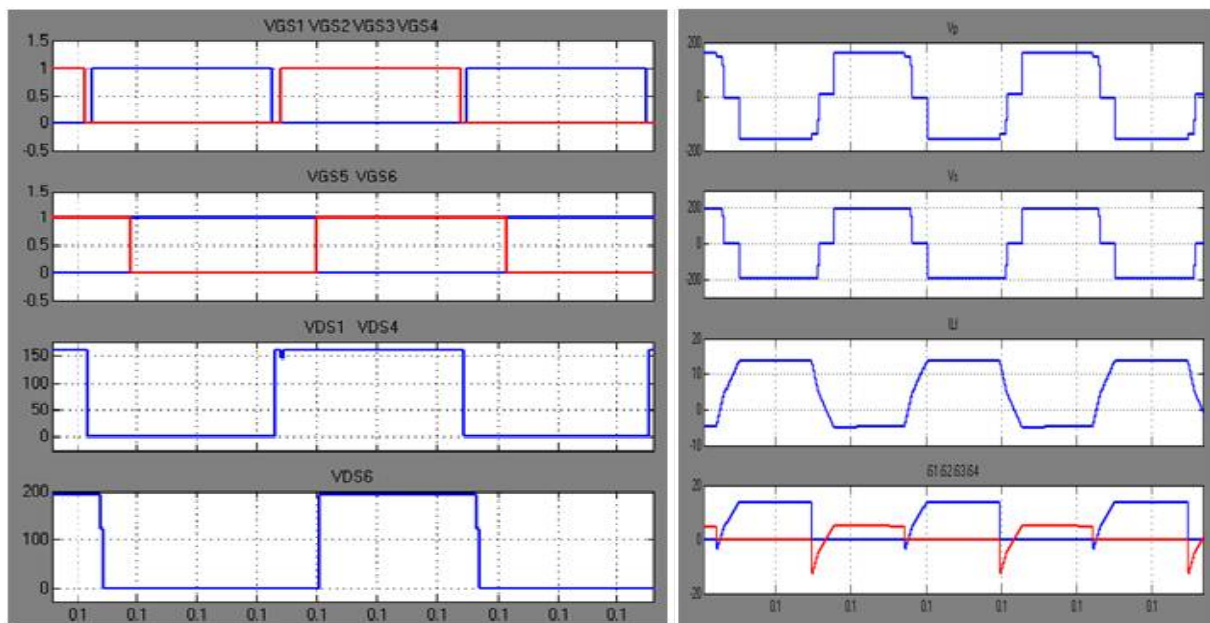


Fig. 4 Gate Pulses (Step input)

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Vol. 7, Issue 11, November 2018



Fig 5 Input Voltage

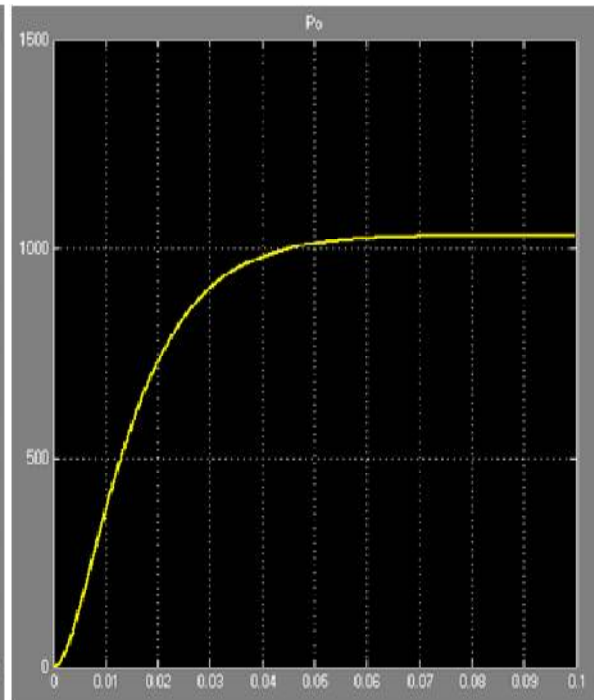


Fig 6 Output Voltage

VI. CONCLUSION

Finally switching the DC to DC converters is operated successfully with half of its duty cycle the switching losses can be reduced for high frequency low frequency high power density applications there are no switching losses has presented on over inductance leakage also product all devices voltages are clamp to output and input voltages hence the voltage overshoots of the devices are effectively suppressed finally a family of switching with ABS is proposed voltage doubler is analysed with operation principles and output characteristics as shown.

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Vol. 7, Issue 11, November 2018

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BIOGRAPHY



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