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High Gain Coupled Inductor-Based Dc/Dc Converter For Offshore Wind Energy Systems

S.Priyadharshini[1] ,K.Devaraj[2]
[1]PG Scholar, Department of Electrical and Electronics Engineering, Vivekanandha institute of Engineering and technology for Women, Tiruchengode, Namakkal District-637205.
Email id: priyadharshinivivi@gmail.com
[2]Assistant Professor, Department of Electrical and Electronics Engineering, Vivekanandha institute of Engineering and technology for Women, Tiruchengode, Namakkal District-637205.Email id: devatimes@yahoo.com

ABSTRACT

Now a days power demand are increased to reduce the power demand using renewable the energy systems. With the increasing integration of renewable energy generation into high-power grids, transmission at the dc level is becoming increasingly more useful than ac transmission. In this regard, emerging application, such as offshore wind farms, require a high-power offshore wind energy systems. The proposed dc/dc converter is characterized by the resonant switching transitions to achieve minimum switching losses and maximum system efficiency. Therefore, a higher switching frequency is conceivable to attain a higher power density. The double stage output voltage of the proposed converter operates at seven times as high as the input voltages with a small device count. The output capacitors are charged and discharged continuously by a 180 phase shift with respect to each other to eliminate the output voltage ripples with low capacitance requirements.The proposed series-modular and cascade configurations show the intrinsic merits of being readily applicable to multistage power switching converter. The developed topology has been implemented on a 5-kw prototype converter to test its feasibility.

I.INTRODUCTION

Offshore wind farms are growing rapidly because of their comparatively high stable wind conditions than onshore and land-based wind farms. Offshore 5-10MW marine turbines are becoming more attractive for the wind power industry. In particular, they increase the efficiency and, reduce, generation cost, compared previous wind turbine technologies. The power capacitance of these offshore behemoths result in an increase in the size of each components. Therefore, the offshore wind turbine manufacturers are attempting to create an optimal modelling for large marine turbines. The optimized design of offshore wind turbines should cope with the following challenges to make high power conversion systems a feasible alternative. Bulky and huge electrical components have high investment costs because of the more
difficult erection and the equipment transportation from the shore to the installation sites. In addition ,there is a greater need for high reliability due to the inherent lack of turbine access at sea. This makes operation and maintenance more difficult. Therefore, an optimal power conversion system should feature high-power density, high efficiency, high reliability, and low costs for high-power offshore wind energy applications.

On the other hand, the longer transmission distances from offshore wind turbines to the load center lead to higher energy losses due to the low output voltage of wind turbines. In this regard, high voltage dc(HVDC)transmission promises a very

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flexible and efficient technology for offshore wind farms that requires power conversion systems to step-up and control the wind turbine output. A conventional HVDC system uses an ac line frequency(50/60HZ) transformer to boost the voltage and ac/dc converters for rectification and power flow control. This technology is robust and reliable, but it causes a considerable increase in weight and volume, which leads to higher installation cost. A high-power density can be obtained by replacing the bulky 50/60-Hz transformers with high-frequency transformers. Unfortunately, high-frequency transformers with large turn ratios are difficult to design at high voltages and mega power levels because of the enormous expense of the magnetic material, core and dielectric losses. one of the key-enabling components for HVDC is the high power dc/dc conversion system because it has a rigid structure, is easy to control system and more compact.

To overcome the increasing power losses and maintain a high-power density

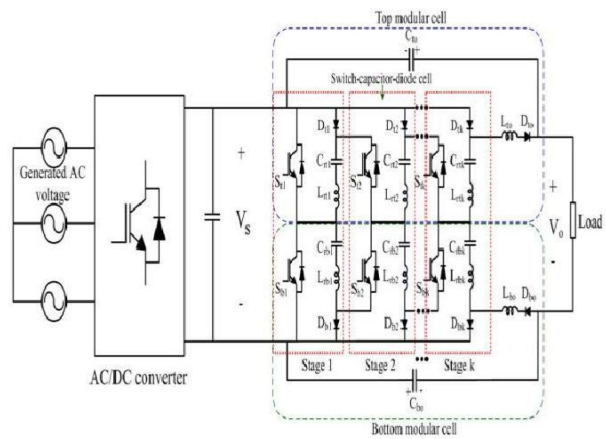
II.Conventional high gain system configuration of RSC

Converter topologies that uses a resonant operation instead of the forced charging and discharging operation. switched capacitors converters is a high efficiency even in a high output current region.

Resonant switched capacitor is converter, where the extra inductor added to form a sinusoidal manner with the capacitance to perform a soft switching. On the large number of the capacitors, high passive components losses, and of these physical size of the converters have limited of topologies in high voltage gain offshore wind energy systems.

The output voltage is the sum of the output filter capacitor voltages and input voltage. The resulting voltage has a frequency that is two times that of the switching frequency. The inherent interleaving property of the proposed circuit effectively reduces the output voltage ripple value without adding extra components. Therefore, the output capacitance requirements are one third of the capacitance in the conventional resonant switched capacitor converters for the same output voltage ripple. Advantages of the proposed series modular and cascade RSC configurations have the inherent advantages of being readily applicable to multi-stage power switching converters. A new resonant switched capacitor(RSC)cell-based dc/dc converter for high voltage gain is proposed for offshore wind energy applications. Disadvantages the resonant switched capacitor by itself has a poor regulation
property. It only realizes a designed high voltage gain and high efficiency with a fixed 50% duty cycle.High switching losses. modeling and controlling methods will be used in this systems.

Fig1.a. conventional circuit diagram



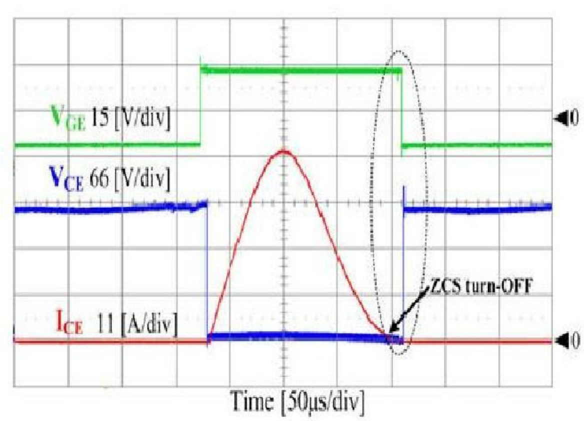


Fig1.b.voltage and current waveforms

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A .Series modular configuration

The series modular configuration there are resonant switched capacitors will be used in this existing methods. There are all the connection are series methods. The series modular configuration are such as input voltage and output voltage and input power are used in this existing methods.

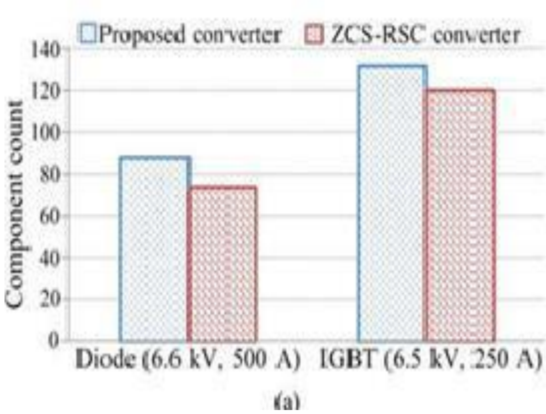

fig1.c. series modular configurations.

B. Cascade configuration

The cascade configuration are the parallel connection of them resonant switched capacitors. From the input of 10kv dc it will be increased to the 150kv dc for HVDC transmission. for all the configuration of diode comprised of several types of series and parallel connection of devices. ZCS-RSC of zero current switching configuration

.These converters are discussed in the future of them:1)passive components weights and volume; 2)losses; 3)total number of devices.

C. Output voltage of the proposed RSC converter

The output voltage will be sum of the output filter capacitor voltages and input voltages. Thus the converter topology are discussed above the inherent proposed circuit are reduces in effectively the output voltage ripple values are without adding them extra components. The conventional methods of resonant switched capacitors for the same output ripple voltages. The output capacitance values are voltage rating of them value is Vo.

Since the top resonant capacitors and bottom Resonant ca-pacitors are charged and discharged by a 180 phase shift with respect to each other

$$i_{C_{rb(k)}}(t) = -\frac{\pi P_O}{V_O}\sin(\omega_r t).$$

the bottom resonant capacitor can be ex-pressed In Mode III, all the top switches are ON, whereas all resonant capacitor currents in this mode ($T_S/2 \le t \le T_S$) can be represented as

$$i_{C_{rt(k-1)}}(t) = i_{C_{rt(k)}}(t) - i_{C_{rb(k)}}(t) = -\frac{2\pi P_o}{V_o}\sin(\omega_r t)$$

$$i_{C_{rt(k-2)}}(t) = i_{C_{rt(k-1)}}(t) - i_{C_{rb(k-1)}}(t) = -\frac{4\pi P_o}{V_o\, sint}$$

III.BLOCK DIAGRAM

A coupled inductor based high step-up dc/dc converter for high step-up application is proposed. The concept is to utilize two capacitors and one coupled inductor. The two capacitors are charged in parallel during the switch-on period by the energy stored in The Coupled inductor is Recycled The voltage stress of the main switch is reduced The switch with low resistance RDS(ON) can be adopted to reduce the conduction loss and reverse-recovery problem of the diodes is alleviated. Not only lower conduction losses but also higher power conversion efficiency is benefited from lower trunsratios. The operating principle and study-state analyses DC/AC inverter: inverter are also ac power supplies but they use stored dc electrical energy in a battery. They use High Seepd electrical switches and transforms to modify the dc to ac and then change the voltage to create 120V.inverter are mainly used for them main practical purposes. large inverter

(2) can be used for them solar (or) wind powered home. Benefits of sine wave inverter. Benefits of outback inverter.The normalized total loss values for them proposed series-moduler RSC converter to similar system losses are ZCS-RSC converter.To achieve the efficiency will be higher than 98%.

PI controller:

proposal integral (PI) to computes the and transmits a controller output signal every sample time T, to the final control element

PI comparator:

Comparator is a device that compares two voltage (or) current and output a digital signal indicating which is large.

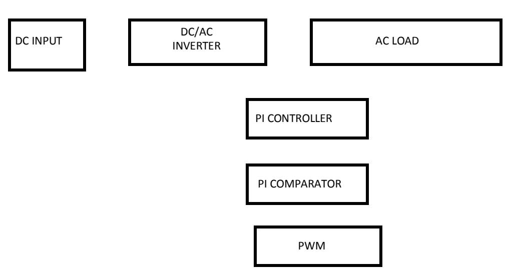

fig3.a. block diagram of proposed methods.

IV.CONCLUSION

A new coupled inductor based dc/dc converter with a high voltage gain is proposed for offshore wind energy applications. The soft-switching action is provided by the resonant condition of the circuit. Therefore, the switching losses are minimal in both ON and OFF instants, and the power density of the system can be enhanced by increasing the switching frequency. Output filter capacitor voltages are phase shifted by 180◦ with respect to each other to eliminate the output voltage ripples without adding extra components. The proposed series-modular and cascade RSC configurations have the inherent advantage of being readily applicable to multistage power switching converters. Conceptual comparisons of the proposed converter to a counterpart show that the proposed converter is well suited for high-voltage and high-power offshore wind applications requiring a high-power density and high efficiency. The simulation and experimental results confirm to verify the feasibility of the proposed converter.

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