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Title **HYBRID LCC/VSC HVDC TRANSMISSION GRIDS WITH A MODIFIED DUAL ACTIVE BRIDGE DC/DC CONVERTER WITH INCREASED EFFICIENCY**

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Hybrid LCC/VSC HVDC Transmission Grids with a Modified Dual Active Bridge DC/DC Converter with Increased Efficiency

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Abstract

This research recommends a modified dual active bridge Dc to DC converter consist AC link capacitors that supply non reactive power is make up by reactive power consumption in order to decrease current strains and losses and boost efficiency. The connection of supply source LC and voltage source HVDC , particularly during reversal of power, is a function that ordinary DAB is unable to do. In order to evaluate the analytical and technical design of the converter, its working comparison with conventional DAB is conducted. Mat-lab/Simulink simulations are done to explicitly test converter functioning, and the operational principle of the converter is presented.

Introduction:

Dual bridge dc-dc converters are widely utilized in many applications today, including aeroplanes, HVDC, traction systems, uninterruptible /auxiliary power supplies, and hybrid/electric cars. For those applications, particularly in aerospace, significant attributes include compact size, light weight, and a unified bidirectional converter structure. Typically, the system's energy storage component consists of batteries or ultra capacitors, which are connected to the bidirectional converter's low voltage port. For greater dependability and reduced voltages. The system that will be fed by the energy system is connected to the costs, they are typically produced at low other port, which is typically at a greater voltage (a few hundred volts). High switchingfrequency is necessary to minimize the size and weight of the converters, however soft switching techniques should be used to reduce large switching losses. These methods also enhance the converter's other quality elements, such as EMI a switching sounds, when compared to hard switched converters. Dual active bridge (DAB), one of the first established bidirectional soft switched converters is one of the most popular options for medium to high power isolated bidirectional dc-dc converters. The MMC topology form of the converter can also be realized. Reactive power generated by the proposed improved DAB converter can therefore be applied to all loads. Using a DAB (dual active bridge) with an ac link capacitor to reduce the uneven current stresses boosted the output efficiency. During power reversal, this design connects the current.

Converter Topology

The 1 phase variant will be used. To make examination , blueprint, working , and comparison with conventional 1-phase DAB easier. A CLC circuit with an isolating transformer enhancement joins the two bridges of the converter, which comprises of bridges with two switches switches on each. Remember that although though there are twice as many switching devices as in a conventional DAB, only one of them will ever be conducting with the other device's series diode at any given time, indicating that the same number of devices are really conducting.

While using involves cascading semiconductor chips in a valve—the recommended better DAB still uses a number of other improvements (as shown in Fig. 1) it is most likely to be HVDC systemwhere r, derived from the rated power equation, is the phase shift angle (11).

As a result, the peak voltage is as follows (assuming a sinusoidal waveform):

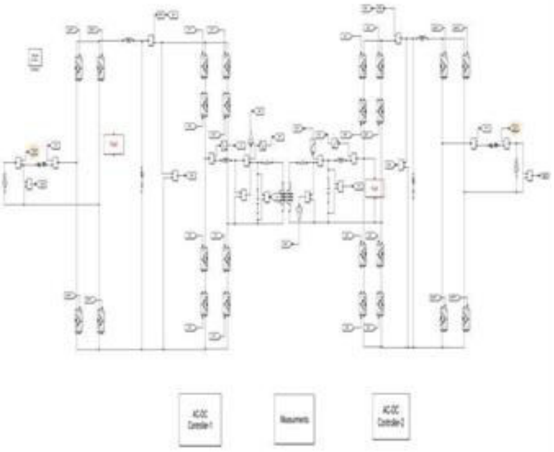


fig1: Conventional DAB converter single phase proposed topology.

Analysis of Performance and Design Procedure

The steps that make up the whole design process for converter components are as follows:

1. This system will be functioning, the following would be the key converter requirements: Rated voltages of DC Vdc1 and Vdc2 and rated power Pr.
2. Decide on the parameters of k/r current and frequency ratio. Page: 3
3. Using (20) and, determine the L1, L2, C1, and C2 parameters of AC circuit (21).
4. Calculate the recommended phase shiftangler by using (11).
5. Determine the Ldc1 and Ldc2 DC link inductors from (25) and (26) using the required current ripple specifications.

The major phase in the converter design process is step 2 above.

It requires the both of which affect the converter's operational performance and component size. These criteria must be selected carefully; they cannot be picked at random. It will be examined how these two parameters affect peak capacitor voltages (Vc1pk and Vc2pk), which have an effect on peak voltage strains on switching devices.

$$P_{core} = C_m f^{\alpha} B_m^{\beta}$$

Based on this study, the best value for the two parameters (k and r) will be chosen. A comparison with traditional DAB converter is conducted to serve as a baseline and to give this study additional context. To keep the study general and unrelated to any particular rating, the two converters are evaluated unit-by-unit.

As a result, it has been shown that the revised 7 networks with higher interoperability and efficiency is a potential method for tackling the challenges of integrating renewable energy sources into the grid. The recommended converter is more cost-effective, more efficient, and more interoperable with existing power electronics converters used often in HVDC transmissionsystems.

The new DAB converter has a variety of benefits for hybrid LCC/VSC HVDC transmission grids, including better efficiency, reduced losses, and improved interoperability. As a result, it is a technology that has the potential to significantly aid in the construction of renewable energy sources and has tremendous promise for making it easier to integrate them into the grid.

As the I ratio parameter doesn't exist for a specifications , examine is performed by modifying the design parameters for the proposed converter & merely r for standard DAB. The steady state analysis in this case. Peak voltage stresses establish the recommended to stack inside the valve. The empirical value of 0.005pu is chosen for the parasitic resistance of the DC inductor. The AC inductor's parasitic resistance is assumed to be a little bit higher to account for the skin effect (0.015pu). depicts how the two converters are affected by adjusting k and r. (standard and modified DAB). The rated frequency r for a frequency of 500Hz will be shown in units of per. The effectiveness of classical DAB is not dependent of k and declines with fre, as seen in Fig. 4(a).

Simulations of The Time Domain

This section describes the suggested DC/DC converter's MATLAB/Simulink time domain simulation modelling for several operating situations. Table 1 contains the system's characteristics, which were chosen based on section III's selection criteria for maximum efficiency k=1.3 and r=1.1pu.

Converter connectingtwo VSC HVDC lines

Fig. 7 depicts the transient behavior during power reversal at rated loading to demonstrate that the proposed DC/DC converter operates successfully with bi- directional power flow. The converter starts out with forward power flow (from bridge 1 to bridge 2) and switches to reverse power flow at time t=3 seconds. Power may be smoothly injected between the two terminals in both directions by the converter. Currents change polarity at both bridges in a complimentary way whereas voltages have fixed polarities.

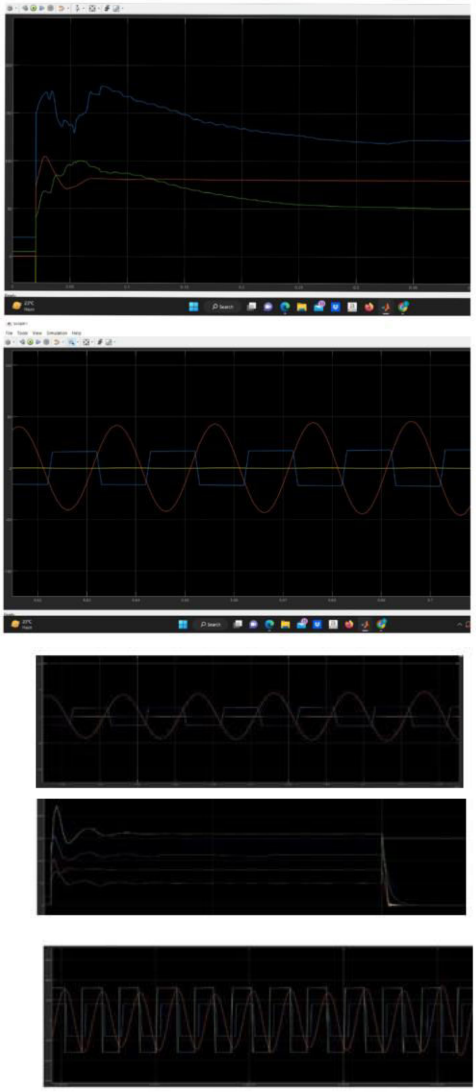


Fig3.1: LCC steady state simulationresults.

LCC and VSC HVDC lines are connected via a converter .An LCC-HVDC is connected to the VSCHVDC line in this subsection using the suggested DC/DC converter. Figure 9 displays the steady state simulation results when electricity is supplied starting bridge 2 ending at bridge 1 (LCCHVDC). As shown in Fig. 9, Vdc1 has two directional polarity because it is connected to the LCC-HVDC, which has a –ve voltage capacity, whereas Vdc2 has unidirectional polarity since it is added to the VSC-HVDC (a).

Depending using involed cascaded semiconductor chips in a valve the recomemded better DAB still uses a number of other improvements it is HVDC system where r,derived with rated power equation ,is phase shift angle.

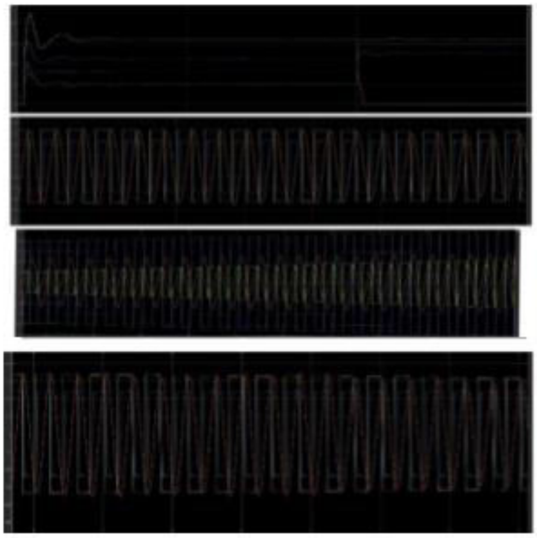


Fig3.2:LCC steady state with faultsimulations results.

The converter's transient behavior during a power reversal at rated loading is depicted in Fig. 10. Although thyristor zed LCC-HVDC systems function with unipolar DC link current Vdc1 changes polarity bridge1

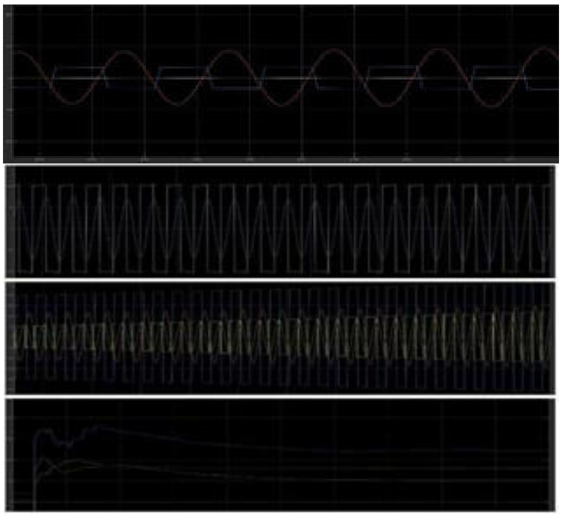


Fig3.3:LCC steady state with sign change simulation results.

Results for the case of a head to head failure at bridge 1's DC side are shown in Fig. 11. When the fault is applied at t=1.5s, bridge 2 is supplying full rated power. When Vdc1=0, current at bridge 2 drops to 0 , as shown in Fig. 11(a), exhibiting a error identical to the one previously described. The impact of AC link flaws is also investigated while receiving power from bridge and having a SC fault placed across the terminals AC of bridge 2 . As a result of the fault beingapplied at C2 at t=1.5s, the results of Fig.

12 demonstrate that bridge 2 is interrupted because Vc2 dropped at 0 and current flow at AC side . This stops power transfer by to roughly 10kV, regulating Idc1 to its rated value (1250A). Vc1 and Iac1 are out of phase 90 because the equivalent impedance perceived from the AC terminals of bridge 1 is completely reactive. IL1 is the fault current that is 30% greater then the rated value of IL1 in Fig. 9 and is flowing.

Fig3.4:LCC AC fault stimulation results

A 20% adjustment will be made to the parameters of passive circuit L1, L2, C1, and C2 in order to test how sensitive the proposed design is to changes in the circuit parameters. Fig. 13 illustrates how this parameter modification affects the rated power and results efficiency.

This a result of their advantageous operating characteristics, which include modular design with submodules, remove of series connection of semiconductor devices, semiconductor switching losses, higher output power quality, and reduced dv/dt stresses on transformers.

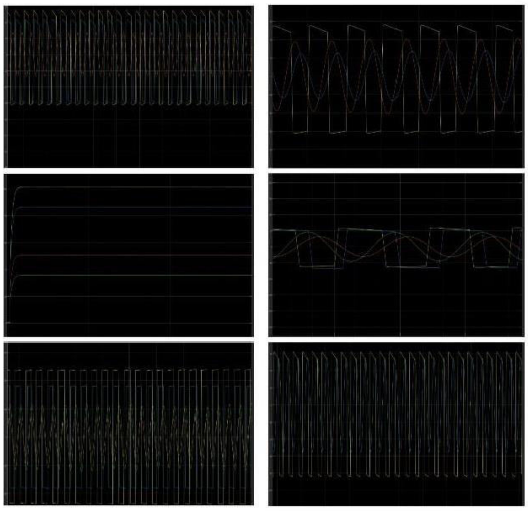


Fig4.1:MMC based steadystate Simulinkresults.

In this study, a modified DAB produces with di/dt that, when switched on, produce high voltage transients.

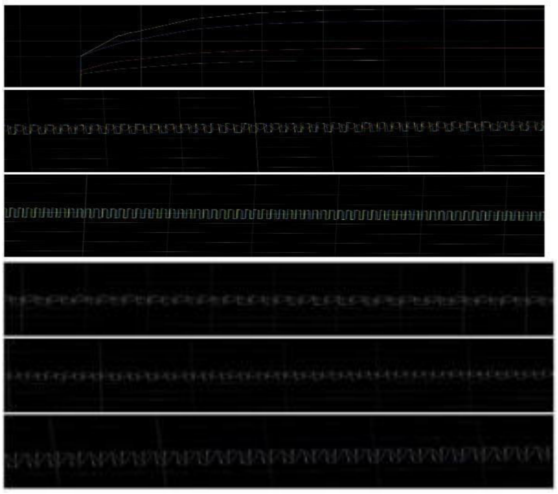
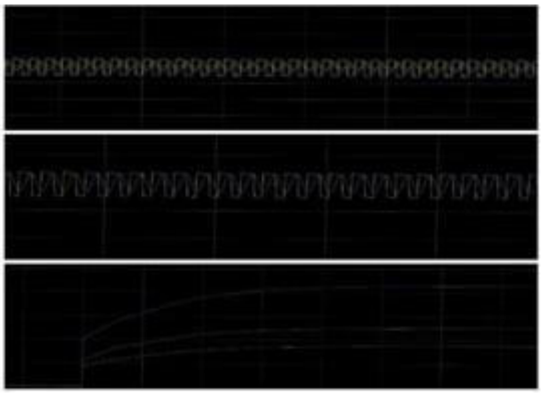


Fig 4.2 MMC fault simulation results

To take advantage of the aforementioned benefits and make the proposed modified DAB more suitable for HVDC transmission.



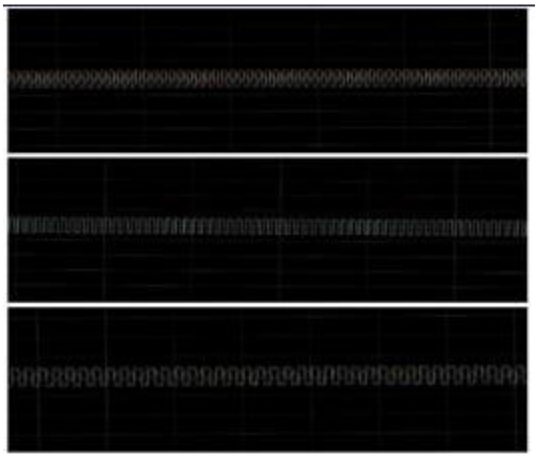


Fig4.3:MMC interchange with fault simulationresults

Bridges 1 and 2 current source mode, creating AC currents, hence the bridges would have to be constructed to give output AC current rather than the voltage. That would have to make use of this as current and voltage source converters have many circuits. Using the dual current source MMC architecture that was previously covered in, the recommended DC/DC converter is put into practise. Sub-modules , which are made of fully bridge cells and contain a DC inductor , source of energy storage, are connected in series and share voltage via an AC capacitor. The bulky l are replaced by the small SM inductors in the 2-level architecture. The SM are able to handle common power sources in order to AC.

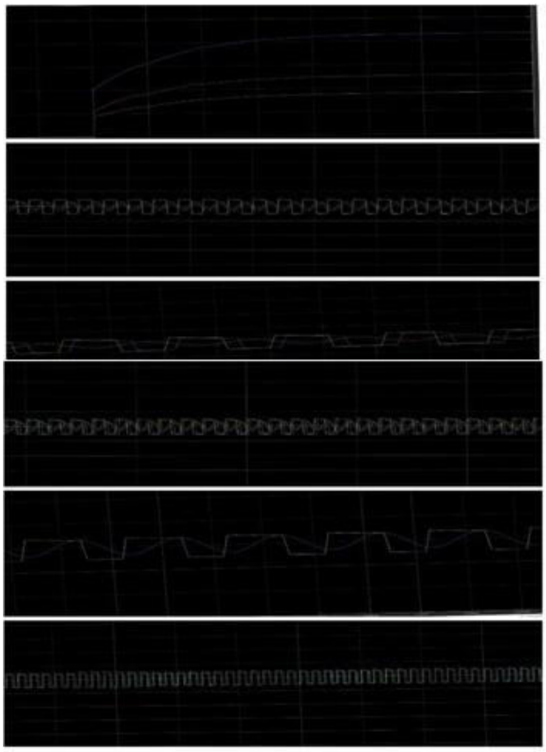


Fig4.4:MMC ac side fault simulation

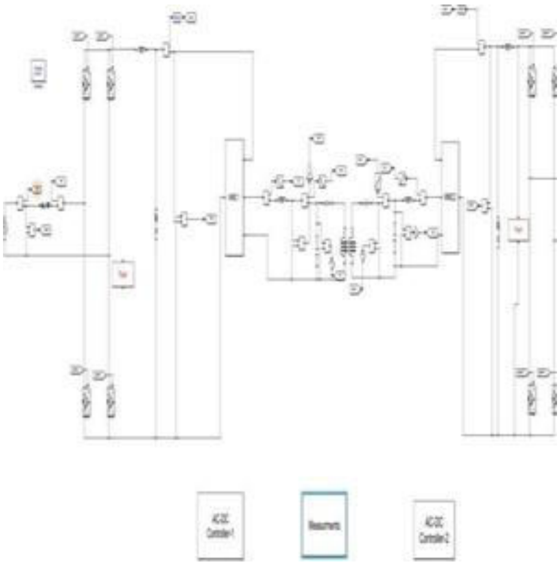


Fig5 : MMC circuit diagram

Conclusion:

As a result, it has been shown that the revised networks with higher interoperability and efficiency is a potential method for tackling the challenges of integrating renewable energy sources into the grid. The recommended converter is more cost-effective, more efficient, and more interoperable with existing power electronics converters used often in HVDC transmission systems. The new DAB converter has a varietyof benefitsfor hybrid LCC/VSC transmission grids, including better efficiency, reduced losses, and improved interoperability. As a result, it is a technology that has the potential to significantly aid in the construction of renewable energy sources and has tremendous promise for making it easier to integrate them into the grid.

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