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TRANSFORMER-BASED Z-SOURCE INVERTER WITH MVDC LINK

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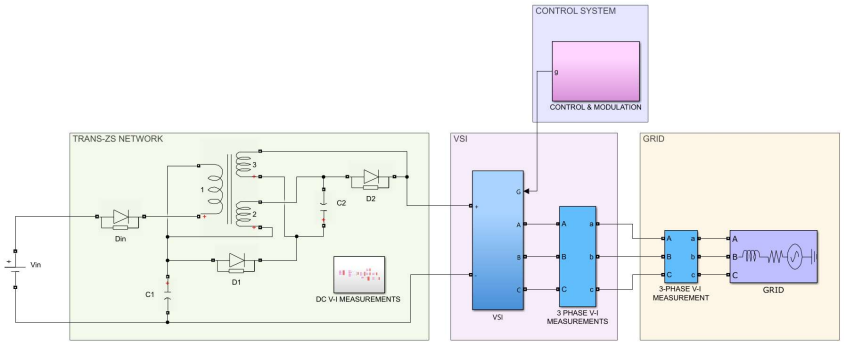
1. Introduction

This work focuses on implementing a grid-connected trans-ZSI with MVDC link, with control of the active and reactive powers, and MVDC link voltage. The dynamic performance is evaluated under different operating conditions.

2. System under Study

The proposed microgrid structure is shown next.



Trans-ZSI network. An impedance network composed of 2 capacitors, 3 diodes, and a double winding magnetically coupled transformer to raise the gain and modulation ratio.

VSI. A detailed model of an IGBT inverter converts the DC voltage to AC voltage. A ZSVM6 control system is adopted to adequate the output voltage magnitude to the desired magnitude.

Grid. A MVAC grid with a filter to reduce the harmonics injections.

Parameter	Value
DC input voltage	1300 V
Grid voltage	1850 V
Inverter nom. power	200 kW
System Frequency	50 Hz

Parameter	Value
Nom. DC voltage	3800 V
MVDC voltage	1500 V
Switching Freq.	10 kHz
Max. ST duty ratio	0,3

Parameter	Value
Trans. turn ratio	2
Trans. mag. inductance	220 µH
Capacitors, C_1-C_2	68,44 µF
Output filter, R-L	39 mΩ, 39mH

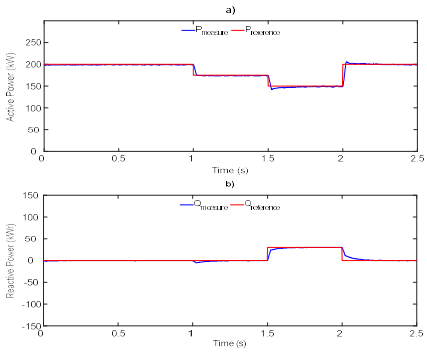
3. Control System

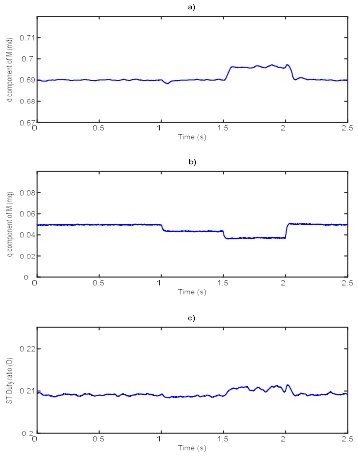
Modulation Technique. ZSVM6 modulation is considered because it allows higher DC-link voltage utilization, lower harmonic distortion, higher boost capability and lower switch voltage stress than other vectorial modulations.

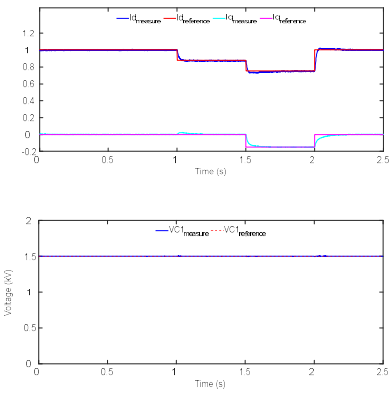
Control Strategy. The control strategy is designed to control the MVDC link voltage (voltage across capacitor C1) and the active and reactive powers delivered to the grid, through the *dq* components of the modulation index. Hence, a PI controller is used to control D to maintain the MVDC link voltage at the desired value.

4. Results

The results are summarized in the next figures:







5. Conclusions

This paper presented a trans-ZSI based on three magnetically coupled inductors, two diodes and two capacitors that can be used to integrate an energy storage system and create a MVDC link where other renewable energy systems an energy storage systems can be connected. The control of the active and reactive power delivered to the grid was performed by acting on the *dq* components of the modulation index and the MVDC link voltage was controlled by acting on the shoot-through duty cycle of the converter. The trans-ZSI with MVDC link under study and its control were evaluated under changes in the active and reactive powers, and the results illustrated the right configuration and operation of the converter.

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