

High Voltage DC Transmission

Overview

CURENT envisions a nation-wide transmission grid that is fully controlled for better performance and accommodation of renewable resources. To enable the wide-area control in a transmission grid with high penetration of renewable energy sources, CURENT is active in developing transmission system architectures as well as the related control and protection schemes.

Approach

Multi-terminal HVDC transmission based on the voltage source converter (VSC) is an attractive option for integrating offshore wind farms and connecting wide-area AC grids. The control and protection of multi-terminal HVDC systems and their support for wide-area system control are of central interest to CURENT.

Hybrid AC-DC transmission is also a flexible and controllable architecture, which can increase power transfer capability and improve system stability at a lower cost than full HVDC.



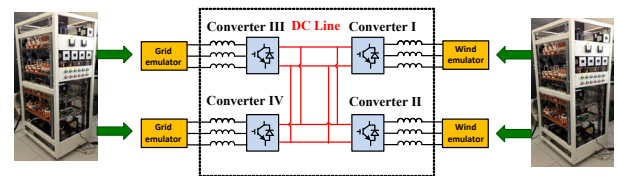
The center is developing the design, control, and protection schemes for these two transmission architectures, including:

Multi-terminal HVDC transmission

- Develop the model of the MT-HVDC

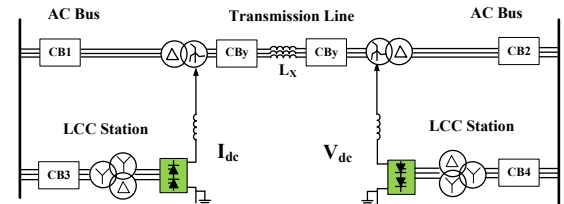
system, and investigate the control design methodology.

- Explore the characteristics of the system during fault conditions and propose the corresponding control schemes to maintain system operation.



Hybrid AC-DC transmission

- Line-commutated converter (LCC) based HVDC can maintain controllable DC current plus lower AC current under SLG fault.
- Design methodology is developed considering unbalanced line impedances to upgrade existing AC grid with enhanced power capability.



Impact

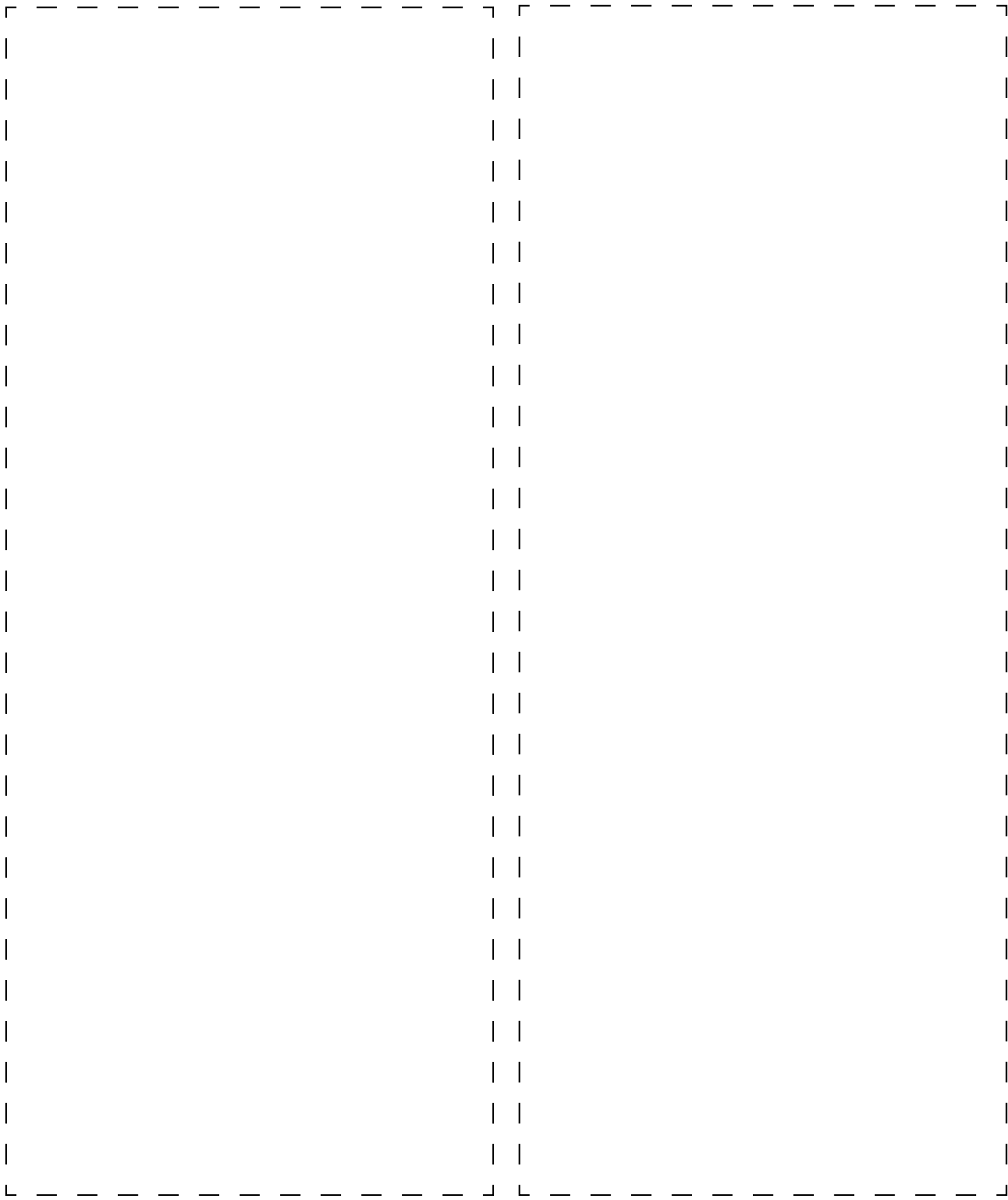
- Demonstrate how to best control multi-terminal DC systems to provide voltage and frequency support for the AC system.
- Achieve advantages of both HVAC and HVDC by complementary control of AC and DC power in a hybrid system.
- Enhance power transfer capability vs. pure AC line
- Reduced power outage under faults
- Reduced cost vs. full HVDC

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research funding generously provided by

