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Active power control strategies for transient stability enhancement of AC/DC grids with VSC-HVDC multi-terminal systems

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Abstract— Multi-terminal High Voltage Direct Current (HVDC) using Voltage Source Converters (VSC-HVDC) is a promising technology which provides flexible control of active and reactive power and facilitates remote renewable energy integration, above all using long cables. This paper analyses an active power control strategy for multi-terminal VSC-HVDC systems tailored to enhance transient stability of hybrid AC/DC grids. The proposed strategy controls each VSC using frequency measurements of all terminals. Its performance is compared to a strategy in which each VSC is controlled using only local frequency measurements of the AC side, proving that the proposed strategy shows better performance, even taking into account reasonable communication delays. The paper also shows that the proposed strategy generally gives similar results to those obtained when each VSC is controlled using the speed of the centre of inertia (COI). The speed of the COI is a more comprehensive and richer figure than the one proposed in this paper but it is also much more complex to obtain. Simulation results with PSS/E of a test system have been used to illustrate the comparisons and the main contributions of the proposal.

Index Terms— HVDC transmission control, power electronics, power system stability, power system transient stability

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