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Fast voltage boosters to improve transient stability of power systems with 100% of grid-forming VSC-based generation

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Abstract-

Grid-forming voltage source converter (GF-VSC) has been identified as the key technology for the operation of future converter-dominated power systems. Among many other issues, transient stability of these types of power systems remains an open topic of research because it is still a key limiting factor for stressed power systems. Previous studies have proposed control strategies for GF-VSCs to improve the transient stability of systems of this type by suitable current-limitation algorithms and/or control of active-power injections. As an alternative, this paper proposes two fast voltage boosters to improve the transient stability of power systems with 100 % of GF-VSC-based generation with virtual synchronous machine (VSM). One control strategy uses local measurements, whereas the other one uses global measurements of the frequency of the centre of inertia (COI). Both strategies improve transient stability of these types of systems significantly. The advantage of using fast voltage boosters for this purpose is that the set points linked to frequency/active-power injection (i.e., set points linked to the primary energy source of the VSCs) will not be modified. Furthermore, strategies such as current-limitation, active-power control and fast voltage controllers for transient stability improvement are compatible and complementary.

Index Terms- Voltage source converter, VSC, grid forming, transient stability.

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