

Revisiting angle stability in power systems with grid-forming power converters

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Abstract-

This letter presents a comprehensive analysis of the stability phenomenon related to the ability of generators remain in synchronism when subjected to small or large disturbances, in power systems with both synchronous machines and grid-forming voltage source converters (GFM-VSC). This phenomenon is associated with two stability classes in the IEEE/PES classification, namely, rotor-angle stability (when involving synchronous machines) and slow-interaction converter driven stability (when involving power converters). However, this work shows that this phenomenon is fully characterised with the slow dynamics of the angle difference between the voltage sources connected to the power system, regardless of whether they are synchronous machines (with rotors) or GFMVSCs. Therefore, we suggest using the term angle stability to refer to this phenomenon, while slow-interaction converter driven stability should only include slow interactions of different nature involving power converters.

Index Terms- Voltage source converter, VSC, grid forming, angle stability, transient stability, low-frequency oscillations; Convertidores fuente de tensión, VSC, grid-forming, auto-sincronización, estabilidad de ángulo, estabilidad transitoria, oscilaciones de baja frecuencia.

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