

Adaptive super-twisting control for grid-following inverter under unbalanced current injection

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Abstract-

This paper proposes a novel adaptive Super-Twisting control algorithm for grid-following inverters, with a particular focus on meeting the positive-sequence current injection grid codes requirements and addressing negative-sequence current injection to mitigate oscillations under unbalanced operation. The aim is to fulfill the robustness requirements under Low-Voltage Ride-Through scenarios while exhibiting a smooth and rapid performance under steady-state operation conditions. Its response is compared against conventional PI and PR controllers in terms of compliance with grid code requirements and control performance quality in a simulation environment. To evaluate real-world feasibility, real-time simulation and Hardware-in-the-Loop testing are used to evaluate its impact on line-protection response.

Index Terms- Voltage source converters; Low-voltage ride-through; Negative sequence current injection; Sliding mode control; Adaptive super-twisting; Real-time simulation; Hardware-in-the-loop

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