Amin Masoumi, Mert Korkali, Transient-Stability-Aware Frequency Provision in IBR-Rich Grids via Information Gap Decision Theory and Deep Learning.

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Abstract This paper introduces a framework to address the critical loss of transient stability caused by reduced inertia in grids with high inverter-based resource (IBR) penetration. The proposed method integrates a predictive deep learning (DL) model with information gap decision theory (IGDT) to create a risk-averse dispatch strategy. By reformulating the conventional virtual inertia scheduling (VIS) problem, the framework uses early predictions of post-fault dynamics to proactively redispatch resources, ensuring the system's center of inertia remains stable under worst-case contingencies. Validated on the IEEE 39-bus system with 70% IBR penetration, the proposed approach prevents system collapse where a conventional VIS strategy fails, ensuring frequency stability at a cost increase of only 5%.

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