

Theoretical and experimental limitations of RoCoF estimation: A geometric approach

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Abstract-

A precise estimation of the Rate of Change of Frequency (RoCoF) is crucial for secure power system operation. In fact, RoCoF is strictly related to the amount of the available physical and/or virtual inertia of the system and the severity of the active power unbalance following a disturbance. For this reason, it is widely exploited in different protection systems, e.g., Anti-Islanding, Under Frequency Load Shedding (UFLS) and wide-area protection systems. The new paradigm of modern power systems, with a low-inertia and converter-based generation assets, is increasing the transient severity, making the frequency and the RoCoF estimation more complex and less precise for the actual devices. This work addresses this issue by proposing a numerically robust approach based on concepts inherited from differential geometry and fluid mechanics. The proposed approach is then tested with high-sampling real experimental measurements and used to develop a faster control logic for a RoCoF-based UFLS control scheme. The proposed approach provides information to protections regarding the nature of the contingency which can be used to improve its response.

Index Terms- Differential geometry; Fluid mechanics; RoCoF measurement; Signal processing; Under-frequency load shedding

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Citation:

Gutiérrez-Florensa, J.; Sanniti, F.; Tedeschi, D.; Sigrist, L.; Ortega, A.; Milano, F. "Theoretical and experimental limitations of RoCoF estimation: A geometric approach", Electric Power Systems Research, vol.262, pp.113529, January, 2027.