Enhancing general primary frequency control algorithms for a technologically isolated power system.

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This paper addresses the challenge of inefficient General Primary Frequency Control (GPFC) in isolated power systems during specific emergency scenarios. A comprehensive mathematical model was developed in the MATLAB environment to simulate the dynamics of synchronous machines, regulators with adjustable parameters, and the interconnections between power system components. The model was verified with the data from a real-world emergency event in an isolated Russian power system, which was characterized by ultra-low frequency oscillations (ULFO) during GPFC. Using this validated model, two enhanced GPFC methods were tested: a combined regulation method and an adaptive participation method. The proposed approaches aim to mitigate undamped frequency oscillations and improve the stability of primary frequency control in low-inertia systems.

Key words: general primary frequency control, ultra-low frequency oscillations, isolated power systems, mathematical modeling, adaptive control, frequency stability, MATLAB simulation.