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On Stability of Automatic Generation Control

John W. Simpson-Porco and Nima Monshizadeh

Abstract—Automatic generation control (AGC) is one of the oldest and most important feedback control systems in large-scale interconnected power grids, yet no general and rigorous closed-loop stability analysis is readily available in the literature. We show in this talk how control-theoretic tools can be leveraged to perform a rigorous nonlinear dynamic stability analysis of classical AGC implemented on a reasonably generic nonlinear power system. The analysis combines several technical tools, including singular perturbation theory, composite Lyapunov functions, and novel results on diagonal stability of matrices with a rank-1 structure. We conclude by commenting on the implications of the analysis for quantitatively assessing the dynamic performance of AGC.

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