Towards a Robust Fractional Order PID Stabilizer for Electric Power Systems

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Abstract This chapter deals with the design and application of a robust Fractional Order PID (FOPID) power system stabilizer tuned by Genetic Algorithm (GA). The system's robustness is assured through the application of *Kharitonov's* theorem to overcome the effect of system parameter's changes within upper and lower pounds. The FOPID stabilizer has been simplified during the optimization using the Oustaloup's approximation for fractional calculus and the "nipid" toolbox of Matlab during simulation. The objective is to keep robust stabilization with maximum attained degree of stability against system's uncertainty. This optimization will be achieved with the proper choice of the FOPID stabilizer's coefficients (k_p, k_i, k_d, λ, and δ) as discussed later in this chapter. The optimization has been done using the GA which limits the boundaries of the tuned parameters within the allowable domain. The calculations have been applied to a single machine infinite bus (SMIB) power system using Matlab and Simulink. The results show superior behavior of the proposed stabilizer over the traditional PID.

Keywords Power system · Power system stabilizer (PSS) · Genetic algorithm · Robust control · Single machine infinite bus (SMIB) · Kharitonov's theorem · Matlab/simulink

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