Performance assessment of bacterial foraging based power system stabilizer in multi-machine power system

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Abstract

This paper describes the process of power system stabilizer (PSS) optimization by using bacterial foraging (BG) to improve the power system stability and damping out the oscillation during large and small disturbances in a multi-machine power system. The proposed PSS type is P. Kundur (Lead-Lag) with speed deviation as the input signal. BG used to optimize the PSS gains. The proposed BG based delta w lead-lag PSS (P. Kundur structure) (BG-PSS) evaluated in the wellknown benchmark simulation problem P. Kundur 4machines 11-buses 2-areas power system. The BG-PSS compared with MB-PSS with simplified settings: IEEEÈ type PSS4B according to IEEE Std. 421.5, Conventional Delta w PSS (as the proposed PSS without optimization) from P. Kundur, and Conventional Acceleration Power (Delta Pa) PSS to demonstrate its robustness and superiority versus the three PSSs types to damp out the inter-area oscillations in a multi-machine power system. The damping ratio and the real part of the eigenvalues used as the fitness function in the optimization process. The nonlinear simulation results obtained in the MATLAB / SIMULINK environment prove that the proposed PSS is highly effective, robust, & superior to the other used controllers in restrictive the inter-area oscillation in a large power system & to maintain the wide-area stability of the system. Also, the performance indices eigenvalue analysis, peak overshoot, settling time, and steady-state error used to validate the superior oscillation damping and fast recovered transient dynamic behavior over the three considered controllers.

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