Modified Particle Swarm Optimization Based on Lead-Lag Power System Stabilizer for Improve Stability in Multi-Machine Power System

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Abstract

Inter-area oscillations not only limit the transferred bulk power but can extend to isolate the areas and may cause the blackout in some parts of the system or all the system. This paper depicts the improvement process of power system stability by using the modified particle swarm optimization (PSO) technique to optimize the lead-lag power system stabilizer (PSS) parameters offline to improve its performance. PSO modified by adjusting the damping boundary condition to prevent the particles from an outing of the searching space which improves the optimization process. Optimized PSS structure is a conventional lead-lag PSS (IEEE typePSS1A) with speed deviation input signal. Proposed PSS performance compared with bacterial foraging based lead-lag PSS, and a simplified multi-band PSS: IEEEÈ type PSS4B. A comparison process applied to the system divided into two areas 11-bus 4-generators. Furthermore, performance indices as Eigenvalue, damping ratio, participation factor, maximum overshoots, settling time, and steady-state error used to utilize the analysis. The simulation results clarify the strength of the proposed PSS over the other compared PSSs. Simulation results in mathematical analysis prove that the proposed PSS improves the overall system stability better than the BG based lead-lag PSS by (23.02835%) and the MB-PSS by (94.14835%).

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