Novel farmland fertility algorithm based PIDPSS design for SMIB angular stability enhancement

ABSTRACT

For this study, design of proportional integral derivative (PID) PSS (PIDPSS) is proposed for damping oscillations and improve angular stability in single machine infinite bus (SMIB) power system modeled and simulated in MATLAB/SIMULINK. A new metaheuristics method called Farmland Fertility Algorithm (FFA) inspired by nature is proposed for optimal design of PIDPSS using a robust ISTSE objective function which had to be minimized. The robustness of the ISTSE objective function was tested using numerical simulation of four well-known time integral performance criteria for calculating the integral error of the two damping controllers. The two controllers are the proposed FFA PIDPSS which was compare with trial and error parameter Conventional PIDPSS (CPIDPSS) controller and well-known Differential Evolution (DE) algorithm tuned PIDPSS controller for plausible application. The phasor simulation results shows that the proposed ISTSE, the speed deviation SMIB transient response such as rise time, settling time, peak time were all significantly improved by an amount of 6.26%, 33.73%, 37.37% and 7.36% respectively by the proposed FFA approach compare to the DE method. This result validate the effectiveness of the proposed FFA tuned PIDPSS for LFO mitigation and SMIB angular stability enhancement which demonstrates robustness, efficiency and convergence speed ability than the trial and error parameter CPIDPSS and DE tuned PIDPSS method.

Keyword: Differential evolution algorithm; Farmland fertility algorithm; Power system stabilizer; SMIB