PERFORMANCE ENHANCEMENT OF FLUE GAS OXYGEN CONTROL SYSTEM IN FLUIDIZED BED BOILER USING PID TUNING BASED ON PARTICLE SWARM OPTIMIZATION ALGORITHM (PSO)

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ABSTRACT

Currently, PID controllers are widely used as a controller in the industrial processes, including in a combustion process control in the Fluidized Bed Boiler (FBB), where plant characteristic still have undershoot which is difficult to be eliminated. Whereas the determination of Kp, Ki and Kd parameters in PID all this time still use Ziegler-Nichols by trial and error based on reaction curve, or use sustain oscillation method, so that the parameters obtained do not provide optimal solution for PID setting parameters.

The solution of the problem is with PID optimal tuning using Particle Swarm Optimization (PSO) method. PSO is an optimization method that widely used to solve optimization problems, where this algorithm is capable to optimize non-linear function and multidimensional function. In the beginning PSO particle move rapidly in searching the optimum point, because there are no damping factor, so that numbers of optimum area are passed over. Research is aim to enhance PSO performance in PID tuning by adding inertia weight factor to suppress particles movement in finding the optimum points more rigorously from PID tuning that is applied in the FBB system with process dynamic which is variably to replace the static model which has been used by PSO as control test model.

The addition of weight factor in PSO capable to suppress PSO speed changing in determining optimum points of PID tuning that applied in the FBB nonlinear system to enhance transient response performance including rise time, overshoot and long delay time. From the simulation results, PSO is capable to give improvement to FBB control system with time rise of 3 s, overshoot of 0.05 % and settling time of 18 s and capable to raising the undershoot response of FBB plant by 26.66%.

Keywords: Fluidized bed boiler, Nonlinear system, PID, PSO, Ziegler-Nichols