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On Fuzzy Modeling of Superheated Steam Temperature Using Chaos Genetic Algorithm

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The boiler system is crucial parts of most power plants . It has been concerned with analyzing power system dynamics in various works. Superheated steam temperature is one of the main processes in the boiler because situated just before the turbine . In normal operating condition the superheated steam temperature of the boiler should be maintained within limits . If the temperature is too high , it will cause the damage of the superheater , the steam tube and the turbine ; if the temperature is too low , it will cause the efficiency decreasing and aggravate the erosion of turbine blade .

The drum-boiler is a highly nonlinear dynamic system. Many factors can affect superheater outlet temperature, such as steam flux, combustion condition, feed water temperature of boiler, steam enthalpy value of superheat inlet; flue gas temperature, flux, velocity of flow of traverse superheater etc[1] Traditional linear modeling technique is not suitable to the highly nonlinear plant of thermal engineering process.

Fuzzy modeling has been proven to be an effective way of building nonlinear-process, uncertain, and complex model. Takagi and Sugeno proposed T-S model in 1985[2] It approaches the dynamic system by dividing a non-linear model into a number of fuzzy linear models essentially. It describes a system by establishing relations between the relevant system variables [e.g., inputs and outputs] in the form of if-then rules, which can approach nonlinear function at a required precision. It is able to integrate experts knowledge and inputs-outputs , and the model developed has been given a linguistic interpretation, comparing to black box model.

Keywords: Fuzzy T-S Identification; Chaos Optimization;Genetic algorithm

[1] W. F. Lin, Y. Hu. Automatic control technology on unit. China Electric Power Press, 2008.
[2] T. Takagi, M. Sugeno. Fuzzy identification of systems and its applications to modeling and control, IEEE Trans. Systems Man Cybernetics, 1985, 15(1): 116-132.