

Abstract

The process of heat exchange in thermal systems is generally characterized by complex phenomena that involve many uncertain, varying and distributed parameters. Reliable physical modeling of heat exchangers is rather difficult to achieve because of the complex dynamics. Approximations through lumping are usually considered for simplified modeling. However, simplifying assumptions might impact the model performance. Relying on lumped-parameter models limitations, this chapter presents an alternative swarm based fuzzy modeling methodology to design reliable temperature prediction models for heat exchanger process. Fuzzy rule-based models are self-generated from process measurements to predict temperature variations in the heat exchanger using a nonlinear modeling strategy based on artificial bee colony optimization. Experimental data collected from a parallel heat exchanger is used to test the designed temperature prediction models. An application study on water leak detection is also presented in order to assess the feasibility of the swarm fuzzy modeling methodology.