Thermal-Economic Multi-objective Optimization of Plate Fin Heat Exchanger Using Genetic Algorithm

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Abstract

Thermal modeling and optimal design of compact heat exchangers are presented in this paper. $\varepsilon - \text{NTU}$ method was applied to estimate the heat exchanger pressure drop and effectiveness. Fin pitch, fin height, fin offset length, cold stream flow length, no-flow length and hot stream flow length were considered as six design parameters. Fast and elitist non-dominated sorting genetic algorithm (NSGA-II) was applied to obtain the maximum effectiveness and the minimum total annual cost (sum of investment and operation costs) as two objective functions. The results of optimal designs were a set of multiple optimum solutions, called 'Pareto optimal solutions'. The sensitivity analysis of change in optimum effectiveness and total annual cost with change in design parameters of the plate fin heat exchanger was also performed and the results are reported. As a short cut for choosing the system optimal design parameters the correlations between two objectives and six decision variables with acceptable precision were presented using artificial neural network analysis.

Keywords: "Plate fin heat exchanger", "Effectiveness", Total annual cost", "Objective function", "Multi-objective optimization", "NSGA-II", "Artificial Neural Network"

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