Multi-objective optimization of rotary regenerator using genetic algorithm

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Abstract

The rotary regenerator (heat wheel) is an important heat recovery equipment, which rotates between two cold and hot streams. The pressure drop and effectiveness of rotary regenerator are important parameters in optimal design of this equipment for industrial applications. For optimal design of such a system, it was thermally modeled using $\varepsilon - \mathrm{NTU}$ method to estimate its pressure drop and effectiveness. Frontal area, ratio of hot to cold frontal heat transfer area, matrix thickness, matrix rotational speed, matrix rod diameter and porosity were considered as design parameters. Then fast and elitist non-dominated sorting genetic algorithm (NSGA-II) method was applied to find the optimum values of design parameters. In the presented optimal design approach, the effectiveness and the total pressure drop are 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 pressure drop with change in design parameters of the regenerator was also performed and the results are reported.

Keywords: rotary regenerator, effectiveness, pressure drop, Multi-objective optimization

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