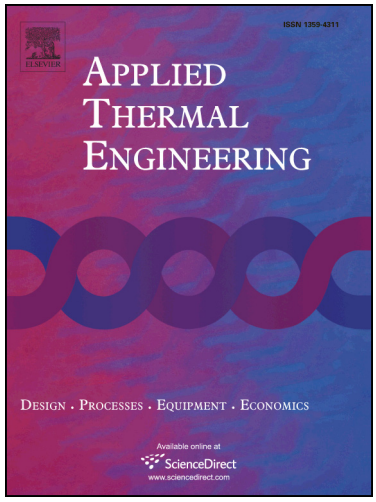

Research Paper

Multi-objective shape optimization of a heat exchanger tube fitted with compound inserts

Sunil Chamoli, Peng Yu, Shimin Yu

PII: S1359-4311(16)34035-2
DOI: http://dx.doi.org/10.1016/j.applthermaleng.2017.02.047
Reference: ATE 9928

To appear in: *Applied Thermal Engineering*

Received Date: 16 December 2016
Revised Date: 27 January 2017
Accepted Date: 11 February 2017

Please cite this article as: S. Chamoli, P. Yu, S. Yu, Multi-objective shape optimization of a heat exchanger tube fitted with compound inserts, *Applied Thermal Engineering* (2017), doi: http://dx.doi.org/10.1016/j.applthermaleng.2017.02.047

Multi-objective shape optimization of a heat exchanger tube fitted with compound inserts

Sunil Chamoli[1, 2], Peng Yu[1, *], Shimin Yu[1]

[1] Department of Mechanics and Aerospace Engineering, Southern University of Science and Technology, 518055

[2] Department of Mechanical Engineering, DIT University, Dehradun 248009

[*] Corresponding author, Email: yup6@sustc.edu.cn Ph: +86-755-8801-8911

Abstract

This paper reports a multi-objective optimization of a heat exchanger tube fitted with compound insert geometries to obtain a maximum convective heat transfer rate and minimum pressure loss. A series of experimental runs has been constructed using response surface methodology (RSM) to study the effect of geometrical and flow parameters on heat transfer and friction characteristics along with parameter optimization. The study involves the dimensionless parameters: Reynolds number (*Re*), pitch ratio (*PR*), twist ratio (*TR*), and twisted tape number (*N*). The characteristic numbers involving heat transfer characteristics (Nusselt number ratio, Nu/Nu_s) and friction characteristics (friction factor ratio, f/f_s) calculated from experimental data are served as the response variables for RSM. The objective functions for Nu/Nu_s and f/f_s are constructed using RSM and utilized in multi-objective genetic algorithm to obtain the Pareto-optimal fronts. The results show that the decrease in the *PR*, *TR* and increase in *N*, *Re* are measured in the augmentation of both the objective functions. It is concluded that the acquired Pareto optimal configurations provide principal understanding into the design parameters and allow autonomy of selection among the optimal solutions. A thermal enhancement factor is used to study the thermal-hydraulic performance of the Pareto optimal solutions.

Keywords: Heat exchanger tube; compound inserts; Heat transfer enhancement; RSM; Multi-objective optimization