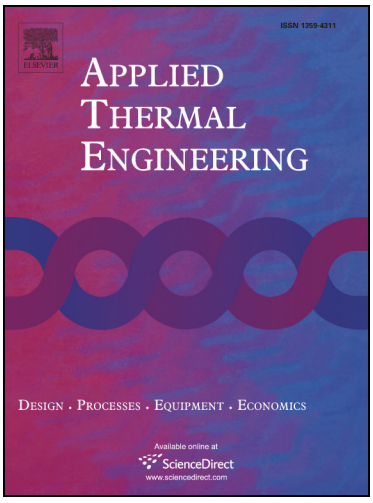

Research Paper

Identifying the geometry parameters and fin type that lead to enhanced performance in tube-and-fin geometries

A. Morales-Fuentes, Y.A. Loredo-Sáenz

PII: S1359-4311(17)35783-6
DOI: https://doi.org/10.1016/j.applthermaleng.2017.12.057
Reference: ATE 11578

To appear in: *Applied Thermal Engineering*

Received Date: 5 September 2017
Revised Date: 27 November 2017
Accepted Date: 16 December 2017

Please cite this article as: A. Morales-Fuentes, Y.A. Loredo-Sáenz, Identifying the geometry parameters and fin type that lead to enhanced performance in tube-and-fin geometries, *Applied Thermal Engineering* (2017), doi: https://doi.org/10.1016/j.applthermaleng.2017.12.057

Identifying the geometry parameters and fin type that lead to enhanced performance in tube-and-fin geometries

A. Morales-Fuentes*, Y. A. Loredo-Sáenz
Universidad Autónoma de Nuevo León, Facultad de Ingeniería Mecánica y Eléctrica, FIME, San Nicolás de los Garza, Nuevo León, México

Abstract

Several fin types geometries have been developed seeking improvements on the thermal and hydraulic characteristics of compact heat exchangers. The geometry selection is generally base on the comparison of performance data available in open literature, unfortunately, information is only existing for few geometries types and the performance analysis is assessed in several ways. Furthermore, the parameters used as means of comparison might be derived from different reference values, making the geometry selection not a straight forward task. In this study, the thermal and hydraulic characteristics of plain fin, annular fin and pin fin attached to circular tubes are obtained using 3D CFD simulation using commercial software. The frontal velocities range from 1 to 4 m/s and the performance comparison is carried out using a volume goodness factor plot. The results show that a geometry with larger surface area to volume ratio leads to enhanced performance.

Keywords: Thermal and hydraulic performance, compactness ratio, fin efficiency, Plain fin-and-tube, Annular fins, Pin fins.

1. Introduction

In several heat exchange engineering applications where air is used as the heat sink or source, extended surfaces are used as a passive technique for heat enhancement. The aim of the technique is to improve the heat transfer characteristics by the selection of a geometry layout or through variations on the geometric parameters. The heat enhancement is given due to the formation of horseshoe vortices originated by flow patterns modifications that are usually associated to pressure drop penalties. In refrigeration and air conditioning applications, the geometry most extensively used as an evaporator is the plain fin-and-tube layout, due to its ease of manufacture and drainage capability, however several new configurations such as annular fins, and pin fin -among others- are available in the market.

* Corresponding author.
FIME, Av. Universidad s/n, Ciudad Universitaria, C.P.66451
Tel.: +(52) 811 340 4020, Ext. 1619; Fax: +(52) 811 052 3321
e-mail address: arturo.moralesfn@uanl.edu.mx