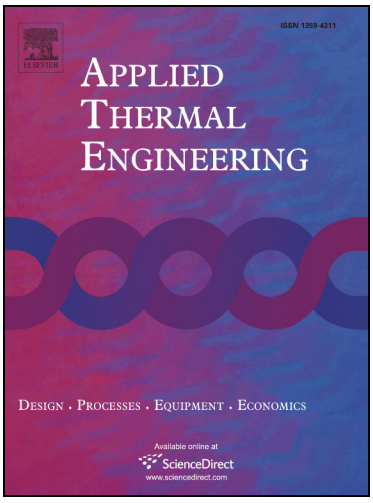

Research Paper

Optimization study of cross-cut flow control for heat transfer enhancement in wavy fin heat exchangers: Concept of cross-cut reference length

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PII: S1359-4311(17)36628-0
DOI: https://doi.org/10.1016/j.applthermaleng.2018.02.021
Reference: ATE 11803

To appear in: *Applied Thermal Engineering*

Received Date: 16 October 2017
Revised Date: 13 December 2017
Accepted Date: 8 February 2018

Please cite this article as: G. Woo Kim, G. Hoon Rhee, Optimization study of cross-cut flow control for heat transfer enhancement in wavy fin heat exchangers: Concept of cross-cut reference length, *Applied Thermal Engineering* (2018), doi: https://doi.org/10.1016/j.applthermaleng.2018.02.021

Optimization study of cross-cut flow control for heat transfer enhancement in wavy fin heat exchangers: Concept of cross-cut reference length

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ABSTRACT

The numerical study to find the optimum cross-cut length in wavy fin heat exchangers with various corrugation angle is conducted in this paper. Two-dimensional five-waved wavy fin with various corrugation angles is used as a simulation domain. The space ratio (fin pitch divided by wavelength) of wavy fin is fixed at 0.15. Non-dimensionlized conservation equations for steady laminar flow are used with working fluid of water. To track the optimum cross-cut length conveniently, the concept of cross-cut reference length (CRL) is devised and applied. As a result of parametric study, the optimal heat transfer performance is achieved when the cross-cut is applied with 0.4 CRL in all corrugation angles. Qualitatively, the heat transfer performance increases until the cross-cut length reaches 0.4 CRL, by up to 21.71% compared with typical wavy, then decreases thereafter. However, the degree of heat transfer enhancement is dependent on the corrugation angle and Reynolds number. The pressure drop (pressure difference between entrance and exit of wavy fin) also increases when the cross-cut is applied optimally; however, the increment is smaller compared to the heat transfer enhancement. Evaluating the overall thermal performance (j/f) considering the degree of pressure drop shows that the optimum cross-cut length is changed to 0.5 CRL in certain cases.

Keywords

Wavy fin, Cross-cut, Passive flow control, Heat transfer enhancement, CFD