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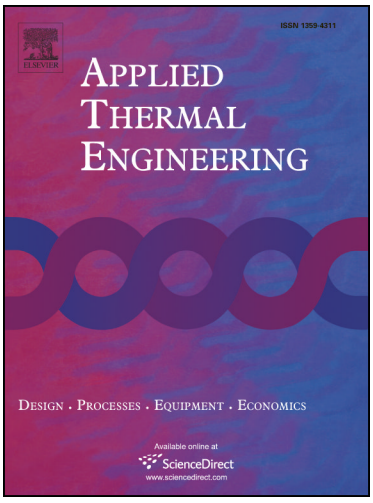

Research Paper

Heat transfer analysis of a rectangular channel having tubular router in different winglet configurations with Taguchi method

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Heat transfer analysis of a rectangular channel having tubular router in different winglet configurations with Taguchi method

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Abstract

This study consists of experimental heat transfer analysis of a cross flow forced convection heat exchanger having rectangular duct channel with different tubular routers (flow pin-fins). The pin-fins are placed at the top and bottom plates periodically and perpendicular to the flow direction and they are structured in-line and staggered sheet layout. The pressure drop and heat transfer characteristics of the heat exchanger with heat recovery unit are investigated for certain Reynolds number interval in different temperatures and the flow rates of working fluids. To analyze the heat transfer properties of the designed heat exchanger the Taguchi method with L_{25} orthogonal array is used. The factors and levels of performance characteristics are examined individually by using the signal-to-noise ratios and analysis of variance (ANOVA) methods for various geometries and optimum condition. The thermal performance analysis of the heat exchanger is accomplished in terms of effectiveness-number of transfer unit (ε-*NTU*) method. The results indicated that the model having the best thermal performance is hexagonal pin-fins. The second best model is determined to be square-angle pin-fins configuration. The effect of the heat transfer and pressure drop are also discussed in terms of various fin geometries via obtaining the correlations of Nusselt number, friction factor and Colburn factor as a function of Reynolds number.

Key words: Cross flow heat exchanger, Ansys-Fluent, effectiveness, Taguchi method, Convection heat transfer, tubular routers

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