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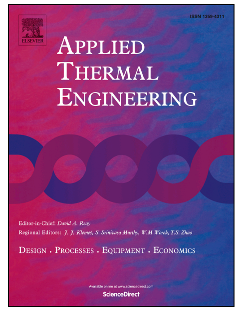

Experimental and numerical study on the optimal fin numbering in an external extended finned tube heat exchanger

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Experimental and numerical study on the optimal fin numbering in an external extended finned tube heat exchanger

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Abstract

Optimization of fin numbers in an external extended finned tube heat exchanger is the main subject of this work. For this purpose an experimental apparatus was constructed and available data such as temperature distribution along the heat exchanger surface at fixed Reynolds and different Rayleigh numbers were recorded and used as a verification tool for corresponding numerical results. Numerical results which are responsible for heat transfer rate, average fin Nusselt number and temperature distribution were reported. According to numerical results optimized fin numbers for maximum heat transfer were obtained for a given conditions. Also to estimate the average fin Nusselt number, characteristic length scale *S* is introduced and used in new obtained correlation for current heat exchanger.

1. Introduction

Broad application of finned tube heat exchangers causes the vast scientific attempts to reach optimized and applicable ones [1-4]. Besides the low heat coefficient of the natural convection, using the heat exchangers with natural convection are of the great interest in wide engineering applications such as heat recovery processes, air conditioning and refrigeration systems, chemical reactors, food and dairy processes. Any attempt to increase the heat transfer surface leads to more heat transfer rate and this is the origin of finned-tube heat exchanger development. Park et al. [5] conducted an experimental investigation on the natural convection around the vertical cylinder with branched plate fins. They proposed a correlation for evaluating the Nusselt number considering the Rayleigh number, branch angle, and fin numbers. The same investigation has been done by An et al. [6] in order to estimate the Nusselt number for a vertical cylinder with vertically oriented plate fins. They obtain a correlation using various fin numbers, fin heights, and base temperatures. Al-arabi and Khamis [7] presented an investigation for an inclined-cylinder cooling system. Their experimental data were corresponded for the effect of diameter and inclination on the natural convection from the outside surface of isothermal cylinders to the air in both laminar and turbulent regimes. They found that for the same cylinder length and inclination, heat transfer rate will decrease by diameter increasing and for the same cylinder length and diameter, the average heat transfer coefficient varies with angle of inclination. In addition to the mentioned literature, it would be worthwhile to address [8-9] which

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