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Study of Heat Transfer on Elliptic Parts in One and Two Row Arrays of Plate Fin and Tube Heat Exchangers, a CFD Approach

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Abstract

The geometrical parameters have considerable effects on heat transfer and pressure drop on the performance of plate fin and tube heat exchangers. Previous investigators have only studied the effects of geometrical parameters on one row tube of these types of heat exchangers. Therefore, it is the aim of this study to develop the findings of the previous work and extend it to both one and two row tubes in cross flow direction using computational fluid dynamics (CFD). For one row tube heat exchangers, the effect of distance between the fins was investigated. The findings of this work revealed that this parameter has a considerable effect on pressure drop across the heat exchanger. It was also observed that increasing ellipticity of the fin tube would have a positive heat transfer effect. Furthermore, the effects of transverse and longitudinal pitch between the tubes on heat transfer and pressure drop characteristics in two rows have also been investigated. It was found that the transverse pitch has a remarkable effect on pressure drop. On the other hand, an increase in the longitudinal direction enhances the heat transfer characteristics. The finding of the present study also reveals that there is a good agreement with both experimental and numerical studies. It is also worth noting that although the present study has been carried out for one and two row tube heat exchangers, the results could be extended to heat exchangers with more rows tube. Finally, the results of this study could be utilized in designing plate fin and tube heat exchangers.

Keywords: Plate Fin, Heat Exchanger; Heat Transfer; Pressure Drop; Two Row Tubes.

1. Introduction

Extended surfaces are usually added to a structure to increase the rate of heat removal. The extended surface in effect provides a greater area through which energy could flow. In industry, fins are used in numerous applications, such as in electrical equipment, to help dissipate unwanted or potentially harmful heat. These types of heat exchangers are utilized when high yield of 98 percent or above is targeted. These heat exchangers are divided into two categories: plate-fin and tube-fin heat exchangers. The tubes in an exchanger are usually arranged in an equilateral triangular, square, or rotated square pattern. The triangular and