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Numerical Investigation of the Effect of Geometrical Shape of Plate Heat Exchangers on Heat Transfer Efficiency

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Abstract : Optimizations of Plate Heat Exchangers (PHS) have received great attention in the past decade. In this study, heat transfer and pressure drop coefficients are compared for rectangular and circular PHS employing numerical simulations. Plates are designed to have equivalent areas. Simulations were implemented to investigate the efficiency of PHSs considering heat transfer, friction factor and pressure drop. Amount of heat transfer and pressure drop was obtained for different range of Reynolds numbers. These two parameters were compared with aim of F "weighting factor correlation". In this comparison, the minimum amount of F indicates higher efficiency. Results reveal that the F value for rectangular shape is less than circular plate, and hence using rectangular shape of PHS is more efficient than circular one. It was observed that, the amount of friction factor is correlated to the Reynolds numbers, such that friction factor decreased in both rectangular and circular plates with an increase in Reynolds number. Furthermore, such simulations revealed that the amount of heat transfer in rectangular plate is more than circular plate for different range of Reynolds numbers. The difference is more distinct for higher Reynolds number. However, amount of pressure drop in circular plate is less than rectangular plate for the same range of Reynolds numbers which is considered as a negative point for rectangular plate efficiency. It can be concluded that, while rectangular PHSs occupy more space than circular plate, the efficiency of rectangular plate is higher.

Keywords : Chevron corrugated plate heat exchanger, heat transfer, friction factor, Reynolds numbers
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