

State of the art on flow and heat transfer performance of compact fin-and-tube heat exchangers

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ABSTRACT

The need for better thermal–hydraulic performance of heat exchangers remains the primary reason for further improving the design of heat exchanger. Various investigations have been carried out on the design and performance of fin-and-tube heat exchangers (HEs). Different HE designs were made available that can enhance the heat transfer and reduce the pressure drop. Recently, existing heat exchangers are either have been improved or replaced by newly emerged heat exchangers with better thermal–hydraulic performance. In this review, fin-and-tube HEs' thermal–hydraulic performance investigation methods and their detailed flow and heat transfer analyses results are summarized. This review also critically surveyed the major heat transfer enhancers and their configuration, geometry and material type effects on thermal–hydraulic performance. Furthermore, a summary of both the theoretical and experimental studies on HEs' performance is made. Also, the effects of tubes dimension, arrangement and number rows on HEs' performance have been discussed. Furthermore, different ways to optimize the geometrical and process parameters of the fin-and-tube HEs were studied, considering the heat transfer enhancement, pumping power, size of the heat exchanger, and other economic factors. Finally, future studies and perspective in the field of fin-and-tube HEs are included.

KEYWORDS

Heat transfer; Heat exchanger; Fin-and-tube; Vortex generator

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