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Numerical Investigation of Fluid Flow, Characteristics of Thermal Performance and Enhancement of Heat Transfer of Corrugated Pipes with Various Geometrical Configurations

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Abstract : In this investigation, the flow pattern, characteristics of thermal-hydraulic, and improvement of heat transfer performance are evaluated using a numerical technique in three dimensions corrugated pipe heat exchanger. The modification was made under different corrugated pipe geometrical parameters, including corrugated ring angle (CRA), distance between corrugated ring (DBCR), and corrugated diameter (CD), the range of Re number from 2000 to 12000. The numerical results are validated with available experimental data. The numerical outcomes reveal that there is an important change in flow field behaviour and a significant increase in friction factor and improvement in heat transfer performance owing to the use of the corrugated shape in the heat exchanger pipe as compared to the conventional smooth pipe. Using corrugated pipe with different configurations makes the flow more turbulence, flow separation, boundary layer distribution, flow mixing, and that leads to augmenting the performance of heat transfer. Moreover, the value of pressure drop, and the Nusselt number increases as the corrugated pipe geometrical parameters increase. Furthermore, the corrugation configuration shapes have an important influence on the thermal evaluation performance factor, and the maximum value was more than 1.3. Numerical simulation can be performed to predict the various geometrical configurations effects on fluid flow, thermal performance, and heat transfer enhancement.

Keywords : corrugated ring angle, corrugated diameter, Nusselt number, heat transfer
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