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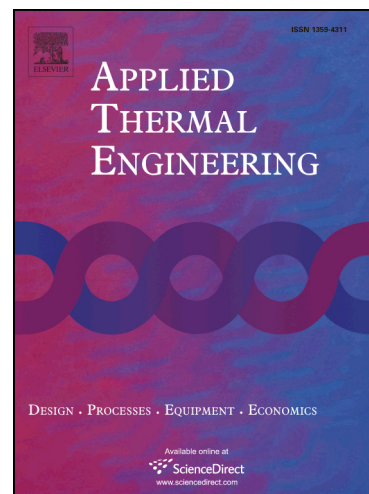
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Air side performance of finned-tube heat exchanger with combination of circular and elliptical tubes

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ABSTRACT

A three-dimensional numerical study has been conducted on finned-tube heat exchangers with multiple-rows of tubes. The effect of different combinations of circular and elliptical tubes on air-side flow and heat transfer characteristics are studied with various inlet air velocities in the range, 0.5 to 2.5 m/s. The results are presented in the form of Nusselt number, friction factor and synergy angle. The results show that at a low inlet velocity, elliptical tube followed by circular tube is a better alternative for heat exchangers with circular tube alone. Along the air flow direction, elliptical tube followed by a circular tube performs better as compared to heat exchanger with circular tube followed by an elliptical tube. On the other hand, at higher inlet air velocity the combination of elliptical and circular tubes performs better than the heat exchanger with elliptical tubes alone. Further, the heat exchanger performance is found to be improved by grouping of elliptical tubes in the upstream region and circular tubes in the downstream region as compared with an alternate arrangement of elliptical and circular tubes. At lower velocity (0.5m/s), the maximum percentage increase of 'h' of heat exchanger with grouped elliptical tubes followed by circular tubes combination as compared to heat exchanger with circular tubes alone is 3.37, 4.86 and 5.56 with corresponding decrease of Δp 8.61, 8.75 and 6.94 respectively for N=2,4 and 6. As compared to heat exchanger with elliptical tubes alone the maximum percentage increase of h with the penalty of $\Delta p = 35.53$ at $v=2.5\text{m/s}$ for N=4.

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