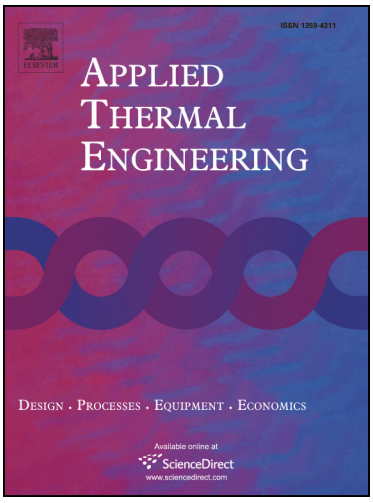

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Numerical investigation on Al_2O_3/water nanofluid flow through twisted-serpentine tube with empirical validation

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Abstract

Laminar flow and heat transfer of Al_2O_3/water nanofluid in the twisted-serpentine tube (TST) are investigated numerically. The numerical results are validated with data obtained from the empirical part of the study. The influences of three specific design factors, including serpentine pitch (s_p = 0.01, 0.02, and 0.03 m), straight length (s_l = 0.05, 0.010, and 0.15 m), and twisted pitch (t_p = 0.025, 0.050, and 0.075 m), are tested and discussed. The obtained results show that the straight length has the highest impacts on the performance of TST, followed by the twisted pitch and the serpentine pitch. It is also found that the Nusselt number of TST enhances as the volume fraction of Al_2O_3 nanoparticles increases. However, the effect of volume fraction on the friction factor is not noticeable. The overall analysis shows when a twisted-straight tube is bended and changed to the TST, its hydrothermal performance factor enhances by a factor between 1.74 and 2.77. It is detected that the performance factor can be enhanced up to 3.73 when the Al_2O_3/water nanofluid is applied as working fluid. Finally, correlations are developed