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Energy saving with using of elliptic pillows in turbulent flow of two-phase water-silver nanofluid in a spiral heat exchanger
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Abstract
Purpose: Increasing heat transfer rate in spiral heat exchangers is possible by using conventional methods such as increasing number of fluid passes and counter flowing. In addition, newer ideas such as using pillows as baffles in the path of cold and hot fluids and using nanofluids can increase heat transfer rate. The purpose of this study is to simulate turbulent flow and heat transfer of two-phase water-silver nanofluid with 0-6 Vol.% nanoparticle concentration in a 180° path of spiral heat exchanger with elliptic pillows. Design/methodology/approach: In this simulation, the finite volume method and two-phase mixture model are used. The walls are subjected to constant heat flux of q″ = 150,000 Wm −2 . The inlet fluid enters curves path of spiral heat exchanger with uniform temperature T in = 300 K. After flowing past the pillows and traversing the curved route, the working fluid exchanges heat with hot walls and then exits from the section. In this study, the effect of radiation is disregarded because of low temperature range. Also, temperature jump and velocity slipping are disregarded. The effects of thermophoresis and turbulent diffusion on nanofluid heat transfer are disregarded. By using finite volume method and two-phase mixture model, simulations are performed. Findings: The results show that the flow and heat transfer characteristics are dependent on the height of pillows, nanoparticle concentration and Reynolds number. Increasing Reynolds number, nanoparticle concentration and pillow height causes an increase in Nusselt number, pressure drop and pumping power. Originality/value: Turbulent flow and heat transfer of two-phase water-silver nanofluid of 0-6 per cent volume fraction in a 180° path of spiral heat exchanger with elliptic pillows is simulated. © 2019, Emerald Publishing Limited.

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