## Abstract

Heat exchangers are well-known devices that transfer heat between two fluids of different temperatures. Concentric finned double-pipe heat exchangers are widely utilized in the various engineering and practical applications.

The thermal-hydraulic characteristics of a concentric double-pipe heat exchanger equipped with longitudinal 45°-helical fins were systematically investigated through numerical and experimental approaches. Commercial ANSYS FLUENT (Version 19R1) was used for executing the numerical simulation. The inner and outer diameters of the finned double-pipe heat exchanger used in the experiment and computational simulation were 21 mm and 25 mm for the inner pipe, respectively, and 50 mm and 60 mm for the outer pipe, respectively, with a length of 200 mm. The number of 45°-helical fins that machined for the inner pipe of the double-pipe heat exchanger is 4 and 8 fins. Moreover, three different heights (H= 2.5, 3.75 and 5 mm) of fins with W= 2 mm width were numerically simulated. The cold water flows within the annular gap with the range of Reynolds numbers from 100 to 1000 whereas the hot water flows in the inner pipe of double-pipe heat exchanger.

In general, the numerical and experimental results elucidate that the averaged Nusselt numbers increase with increasing the Reynold numbers, while the friction factor decreases with increasing in Reynold numbers. In addition, an increase in the number of 45°-helical fins with a constant height leads to an increase in the Nusselt number and verse versa. The enhancement percentage of convective heat transfer for eight 45°-helical fins of the double-pipe heat exchanger with 2.5 mm height of fins shows a significant increase in heat transfer (18%) and a reasonable

increase in friction factor (7%) when compared to four 45°-helical fins of the double-pipe heat exchanger at Reynolds number equates 750. The maximum value of performance evaluation criteria is 2.4 when (8-fins, and H= 5 mm) and Reynolds number equating 750 have been used. The comparison between the numerical and experimental results was offered and it showed satisfaction between them, and the averaged deviation of friction factor and average Nusselt numbers for all cases studied are within 9.13% and 9.2%, respectively.