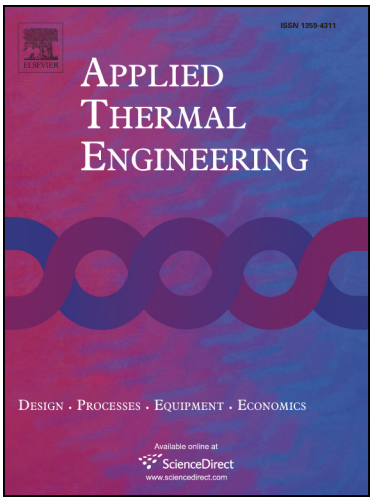


Research Paper

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# Assessment and optimization of hydrothermal characteristics for a non-Newtonian nanofluid flow within miniaturized concentric-tube heat exchanger considering designer's viewpoint

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## Abstract

Flow and convective heat transfer of a non-Newtonian nanofluid containing Cu nanoparticles in the annuli are investigated. The base fluid is solution of 0.4 wt% Carboxymethyl Cellulose (CMC) in water, having pseudo-plastic behavior. Increasing the concentration and reducing the particle size enhance the pressure drop of the nanofluid flow, and also the convective heat transfer coefficient on both inner and outer walls of the annulus. Meanwhile by narrowing the annulus, the pressure drop intensifies and the convective heat transfer coefficient of the outer wall improves, while that of the inner wall decreases. The influence of the concentration changing on the pressure drop is more significant than the effects of radius ratio and particle size. Using the data obtained from the numerical simulations, an Artificial Neural Network (ANN) model is developed to predict the convective heat transfer coefficients in both wall, and the pressure drop in terms of radius ratio, volume concentration, and particle size. In addition, the Genetic Algorithm (GA) coupled with compromise programming technique is employed for optimization in order to find the optimal cases with maximum heat transfer and minimum