Abstract

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Heat Transfer Analysis of Nanocolloids Based on Zinc Oxide Nanoparticles Dispersed in PEG 400

Cooling and heating are extremely important in many industrial applications, while the thermal performance of these processes generally depends on many factors, such as fluid flow rate, inlet temperature, and many more. Hence, tremendous efforts are dedicated to the investigation of several parameters to reach an efficient cooling heating process. The interest in adding nanoparticles in regular heat transfer fluids delivered new fluids to the market, the nanofluids. In this paper, a new nanoparticle-enhanced fluid based on polyethylene glycol with ZnO nanoparticles is considered and its hydrothermal performance is investigated for HVAC applications. The thermophysical properties of PEG 400—ZnO and their variation with temperature at different nanoparticle loading are previously determined on experimental bases and here implemented in a numerical application. The numerical results are completed at Reynolds number from 200 to 2000, while the nanoparticle concentration varies from 0.5 to 5%. Results are discussed in terms of Nusselt number, friction factor, and dimensionless pressure ratio at different temperatures and ZnO loading in the PEG 400 base fluid. Additionally, the evaluation performance criteria (EC) are calculated and discussed. Concluding, the newly developed fluid enhances the heat transfer up to 16% with a 13% pressure penalty, while the performance evaluation criteria are enhanced. Plus, several correlations are developed for both Nusselt number and friction factor as a function of relevant operating conditions.