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Numerical study on turbulent forced convective heat transfer using nanofluids TiO₂ in an automotive cooling system



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ABSTRACT

The limited thermal properties of liquids have led to the addition of solid nanoparticles to liquids in many industrial applications. In this paper, the friction factor and forced convection heat transfer of TiO₂ nanoparticles dispersed in water in a car radiator was numerically determined. Four different nanofluid volume concentrations (1%, 2%, 3% and 4%) were used, and the resulting thermal properties were evaluated. The Reynolds number and inlet temperature ranged from 10000 to 100000 and from 60 to 90 °C, respectively. The results showed that the friction factor decreases as the Reynolds number increases and increases as the volume concentration increases. Additionally, the Nusselt number increases as the Reynolds number and volume concentration of the nanofluid increases. The TiO₂ nanofluid at low concentrations can enhance the heat transfer efficiency up to 20% compared with that of pure water. There was good agreement among the CFD analysis and experimental data available in the literature.