Public Abstract
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This work analyzes the characteristics, flow development, and heat transfer coefficient of nanofluids under laminar forced convection over a flat plate. Nanofluids are engineered colloids composed of a base fluid and nanometer sized particles. They are studied because they have been shown to possess enhanced heat transfer properties over those of the base fluid. This analysis studies alumina nanoparticles submersed in water and also alumina nanoparticles submersed in ethylene glycol. A system of equations for continuity, momentum, and energy was developed and solved using Mathematica.

Nanoparticle diameter size, nanoparticle volume fraction, nanofluid temperature, and free stream velocity were varied to observe their effects on nanofluid characteristics and the heat transfer coefficient. The nanoparticle volume fraction and nanoparticle size proved to be the most dominate parameters of those that were studied. Ethylene glycol showed greater enhancements due to adding nanoparticles than did water, which corroborates with the results from other research.

The transition to a fully developed velocity profile was observed for both types of nanofluids. Despite the fact that the density/viscosity ratio of ethylene glycol is an order of magnitude smaller than water, the velocity profile became fully developed in a shorter distance along the plate than did water. In addition, increasing the free stream velocity for both types of nanofluid caused the velocity profile to develop a farther distance down the plate.

Varying the nanoparticle volume fraction distribution showed that it is vital for the nanoparticles to stay evenly suspended throughout the fluid for there to be any enhancement in the heat transfer coefficient. When the nanoparticles were evenly distributed, the heat transfer coefficient increased anywhere from 2 to 3 times compared to nanofluids with settled nanoparticles.

As the nanoparticle size was decreased below a nanometer, there was a significant increase in the heat transfer coefficient, about a 16% increase in the heat transfer coefficient for the water based nanofluid and about a 100% increase for the ethylene glycol based nanofluid. Decreasing the nanoparticle size also dispersed the volume fraction of the nanoparticles farther away from the plate and lowered the temperature next to the plate.