FORCED CONVECTION IN NANOFLUIDS OVER A FLAT PLATE

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ABSTRACT

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. 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.