Unsteady Mixed Convection Flow along Symmetric Wedge with Variable Surface Temperature Embedded in a Porous Medium Saturated with a Nanofluid

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Abstract:

Laminar two-dimensional unsteady mixed-convection boundary-layer flow of a viscous incompressible fluid past asymmetric wedge with variable surface temperature embedded in a porous medium saturated with a nanofluid has been studied. The employed mathematical model for the nanofluid takes into account the effects of Brownian motion and thermophoresis. The velocity in the potential flow is assumed to vary arbitrary with time. The non-Darcy effects including convective, boundary and inertial effects will be included in the analysis. The unsteadiness is due to the time-dependent free stream velocity. The governing boundary layer equations along with the boundary conditions are converted into dimensionless form by a non-similar transformation, and then resulting system of coupled non-linear partial differential equations are solved by perturbation solutions for small dimensionless time until the second order. Numerical solutions of the governing equations are obtained employing the implicit finite-difference scheme in combination with the quasi-linearization technique. To validating the method used, we compared our results with previous results in earlier papers on special cases of the problem and are found to be in agreement. Effects of various parameters on velocity, temperature and nanoparticle volume fraction profiles are graphically presented.

Keywords:

Nanofluids, Unsteady Flow, Mixed Convection, Boundary Layer, Wedge Flow, Finite Difference, Non-Similarity Solutions, Porous Media

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