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Abdullah, A., Ibrahim, F., Chamkha, A.

Nonsimilar solution of unsteady mixed convection flow near the stagnation point of a heated vertical plate in a porous medium saturated with a nanofluid
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Abstract
This article studies the effects of Brownian motion and thermophoresis on unsteady mixed convection flow near the stagnation-point region of a heated vertical plate embedded in a porous medium saturated by a nanofluid. The plate is maintained at a variable wall temperature and nanoparticle volume fraction. The presence of a solid matrix, which exerts first and second resistance parameters, is considered in this study. A suitable coordinate transformation is introduced and the resulting governing equations are transformed and then solved numerically using the local nonsimilarity method and the Runge-Kutta shooting quadrature. The effects of various governing parameters on the flow and heat and mass transfer on the dimensionless velocity, temperature, and nanoparticle volume fraction profiles as well as the skin-friction coefficient, Nusselt number, and the Sherwood number are displayed graphically and discussed to illustrate interesting features of the solutions. The results indicate that as the values of the thermophoresis and Brownian motion parameters increase, the local skin-friction coefficient increases whereas the Nusselt number decreases. Moreover, the Sherwood number increases as the thermophoresis parameter increases, and decreases as the Brownian motion parameter increases. On the other hand, the unsteadiness parameter and the resistance parameters enhance the local skin-friction coefficient, local Nusselt number, and the local Sherwood number. © 2018 by Begell House, Inc.

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