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FEM Simulation of Triple Diffusive Magnetohydrodynamics Effect of Nanofluid Flow over a Nonlinear Stretching Sheet

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Abstract : The triple diffusive boundary layer flow of nanofluid under the action of constant magnetic field over a non-linear stretching sheet has been investigated numerically. The model includes the effect of Brownian motion, thermophoresis, and cross-diffusion; slip mechanisms which are primarily responsible for the enhancement of the convective features of nanofluid. The governing partial differential equations are transformed into a system of ordinary differential equations (by using group theory transformations) and solved numerically by using variational finite element method. The effects of various controlling parameters, such as the magnetic influence number, thermophoresis parameter, Brownian motion parameter, modified Dufour parameter, and Dufour solutal Lewis number, on the fluid flow as well as on heat and mass transfer coefficients (both of solute and nanofluid) are presented graphically and discussed quantitatively. The present study has industrial applications in aerodynamic extrusion of plastic sheets, coating and suspensions, melt spinning, hot rolling, wire drawing, glass-fibre production, and manufacture of polymer and rubber sheets, where the quality of the desired product depends on the stretching rate as well as external field including magnetic effects.

Keywords : FEM, thermophoresis, diffusiophoresis, Brownian motion
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