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Analysis of hydromagnetic natural convection radiative flow of a viscoelastic nanofluid over a stretching sheet with Soret and Dufour effects

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Abstract
Purpose: The purpose of this paper is to assess steady, two-dimensional natural convection flow of a viscoelastic, incompressible, electrically conducting and optically thick heat-radiating nanofluid over a linearly stretching sheet in the presence of uniform transverse magnetic field taking Dufour and Soret effects into account. Design/methodology/approach: The governing boundary layer equations are transformed into a set of highly non-linear ordinary differential equations using suitable similarity transforms. Finite element method is used to solve this boundary value problem. Effects of pertinent flow parameters on the velocity, temperature, solutal concentration and nanoparticle concentration are described graphically. Also, effects of pertinent flow parameters on the shear stress, rate of heat transfer, rate of solutal concentration and rate of nanoparticle concentration at the sheet are discussed with the help of numerical values presented in graphical form. All numerical results for mono-diffusive nanofluid are compared with those of double-diffusive nanofluid. Findings: Numerical results obtained in this paper are compared with earlier published results and are found to be in excellent agreement. Viscoelasticity, magnetic field and nanoparticle buoyancy parameter tend to enhance the wall velocity gradient, whereas thermal buoyancy force has a reverse effect on it. Radiation, Brownian and thermophoretic diffusions tend to reduce wall temperature gradient, whereas viscoelasticity has a reverse effect on it. Nanofluid Lewis number tends to enhance wall nanoparticle concentration gradient. Originality/value: Study of this problem may find applications in engineering and biomedical sciences, e.g. in cooling and process industries and in cancer therapy. © Emerald Publishing Limited.

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