Idowu, A. S.; Falodun, B. O.
Variable thermal conductivity and viscosity effects on non-Newtonian fluids flow through a vertical porous plate under Soret-Dufour influence. (English) Zbl 07318106

Summary: The purpose of this paper is to consider heat and mass transfer processes on two non-Newtonian fluids (Walters-B viscoelastic and Casson fluid) situated in a hot environment. This study considered concentrated fruit juice and tomato sauce as the type of Casson fluid and polymethyl methacrylate, chromatography, and ceramic processing as the type of Walters-B viscoelastic fluids. The model is governed by systems of partial differential equations. These equations were simplified with the help of appropriate similarity variables to obtain nonlinear couple fourth-order ordinary differential equations. The transformed equations were solved numerically using the spectral homotopy analysis method (SHAM). SHAM is efficient and converges faster than HAM. This paper is unique because it explored variable viscosity and thermal conductivity in the presence of flow parameters such as Soret, Dufour, radiation, viscous dissipation, magnetic field, and so on. The applied magnetic field serves as an opposition to the flow and thereby slows down the motion of an electrically conducting fluid. The influence of pertinent flow parameters is extensively discussed and presented graphically. The permeability parameter is noticed to decrease the velocity profile and increase the temperature profile. The present results were found to be in good agreement with existing works in literature.

MSC:
80Axx Thermodynamics and heat transfer
76Sxx Flows in porous media; filtration; seepage
35Qxx Partial differential equations of mathematical physics and other areas of application

Keywords:
Soret-Dufour; free convection; spectral homotopy analysis; magnetohydrodynamics (MHD); chemical reaction

Software:
Matlab

Full Text: DOI

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