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MHD natural convection of a micropolar nanofluid flowing inside a radiative porous medium under LTNE condition with an elliptical heat source

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Abstract

The present study deals with MHD (Magnetohydrodynamic) natural convection associated to a micropolar nanofluid flowing in a radiative porous medium. An elliptical heat source is placed in the porous medium. The Darcy model and local thermal non-equilibrium condition are acceptable to simulate the porous medium. *KKL* model is employed to simulate the nanofluid flow. This model associates the viscosity and thermal conductivity with the temperature and considers the effects of Brownian motions on these two thermos-physical properties. The Galerkin finite element approach is utilized to dissolve the equations. The impacts of governing key parameters are investigated on the streamlines, isotherms of fluid and solid phases, and isolines of micro-rotation as well as the rates of heat transfer. The range of these parameters are Rayleigh number $Ra=10-1000$, Hartman number $Ha=0-50$, nanoparticles volume fraction $\phi=0-0.04$, interface heat transfer coefficient $H=1-1000$, porosity $\varepsilon=0.1-0.9$, modified thermal conductivity ratio $K_r=0.1-10$, vortex viscosity parameter $\Delta=0-2$ and radiation parameter $R_d=0-2$. The results illustrate that the strength of the particles' micro-rotations slightly increases when R_d grows. The increment of porosity increases and decreases the strength of the flow and micro-rotations of the particles, respectively.

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