

ABSTRACT

Unsteady MHD heat and mass transfer over an infinite flat plate with convective surface boundary condition problems have received little attention yet they are of great importance in many scientific and engineering fields. Past studies by various researchers in the field of MHD fluid flows seems to have ignored the effects of ion-slip and Hall currents on velocity, temperature and concentration profiles of fluid flow. In this research, unsteady MHD heat and mass transfer of an electrically conducting fluid over an infinite flat porous plate with convective surface boundary conditions is studied and more specifically to investigate the contribution of the combined effects of ion-slip and Hall currents on the velocity, temperature and concentration of the fluid subject to cooling and heating of the plate by free convective currents and constant heat flux. The objective of this study was to formulate and solve the coupled partial differential equations of momentum, energy and concentration of species describing the flow. The flow equations were non-dimensionalized, transformed then programmed into a mathematica code and results generated in graphs. The effects of physical parameters on velocity, temperature and concentration fields are analyzed from graphs. Our analysis of the graphical results obtained shows that velocity and thermal boundary layer thickness increase with increase in ion-slip and Hall parameters for the cooling of the plate by free convection in the presence of constant heat flux. The concentration of the fluid increases with increase in time or decrease in mass diffusion parameter or withdrawal of suction velocity. The results can serve as prototype for practical propulsion type of problems, for example, generation of propulsion force in moving ship.