Magnetohydrodynamic Flow In Porous Media Over A Stretching Surface In A Rotating System With Heat And Mass Transfer

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ABSTRACT

The unsteady laminar boundary layer hydromagnetic flow of an incompressible, viscous, and electrically conducting Newtonian fluid over a stretching sheet embedded in a porous medium in a rotating system has been investigated. The fluid is subjected to a transverse magnetic field that cuts perpendicularly across the flow in the positive direction of the z-axis. The flow takes place between two parallel flat sheets that are made of an electrically non-conducting material. The stretching sheet has a permeable surface, while the surface of the other sheet is impermeable. Each of the sheets has an isothermal surface, and both sheets are kept at different temperatures of T_W and T_∞ such that the temperature differences within the flow are sufficiently small. The small magnitude of the temperature difference allows expression of the Taylor series expansion about the freestream temperature T_∞ as a linear function of temperature at any interior point within the flow region. The unsteady boundary layer flow over a permeable sheet that stretches with a linear velocity has been investigated. The effect of varying various parameters on the velocity, temperature and concentration profiles has been discussed. These parameters include the Reynolds number Re, Prandtl number Pr, Eckert Number Ec, Magnetic parameter M, the Suction parameter w_o, Joule heating parameter N, Radiation parameter R, Permeability constant Xi, Rotational parameter Ro, local temperature Grashof number Gr_θ, the local mass Grashof number Gr_c, Schmidt number Sc, Soret number Sr and time t. The coupled non-linear partial differential equations governing the flow field have been solved numerically using the finite difference method. The results that are obtained are then presented on graphs and the observations are discussed. Later the method of Least Squares is used to study the effect of changing some of these parameters on the skin-friction coefficients, rate of mass transfer and local wall heat flux. A change in the parameters is observed to either increase, decrease or to

have no effect on the velocity, temperature, and concentration profiles respectively. The results that are obtained are presented in tables and then discussed. A change in the various parameters is observed to alter the velocity profiles, the concentration profiles, the temperature profiles, the rate of skin friction, the rates of heat and mass transfer on the surface of the stretching sheet.