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Combined heat and mass transfer in MHD free convection from a vertical surface with ohmic heating and viscous dissipation. (English) Zbl 1211.76141

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Summary: The problem of combined heat and mass transfer of an electrically conducting fluid in MHD natural convection adjacent to a vertical surface is analyzed, taking into account the effects of Ohmic heating and viscous dissipation. The resulting governing equations are transformed using suitable transformations and then solved numerically by an implicit finite-difference technique. The solution is found to be dependent on the governing parameters including the magnetic field parameter, the buoyancy ratio between species and thermal diffusion, the Eckert number, the Prandtl number, and the Schmidt number. Effects of these major parameters on the transport behaviors are investigated methodically and typical results are illustrated to reveal the tendency of the solutions. Representative results are presented for the velocity, temperature, and concentration distributions, as well as the local skin-friction coefficient, local Nusselt number, and the local Sherwood number.

MSC:

76W05 Magnetohydrodynamics and electrohydrodynamics
80A20 Heat and mass transfer, heat flow (MSC2010)
76M20 Finite difference methods applied to problems in fluid mechanics

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