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EFFECTS OF SLIP PARAMETERS ON MAGNETOPOLAR FREE CONVECTION FLOW

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Abstract : This paper is concerned with steady free convection flow of an electrically conducting viscous incompressible magneto polar fluid through a porous medium, over a semi-infinite vertical porous plate under slip boundary conditions for velocity and temperature. Using perturbation technique expressions for velocity field, temperature field, skin friction and rate of heat transfer have been obtained. Effects of Grashof number (G), permeability parameter (K), magnetic parameter (M), rarefaction parameters (h_1 and r_1) and rotational parameters (α and λ) are discussed in detail and also shown graphically.

1. Introduction

It is a known fact that the fluid in geothermal region is electrically conducting. Flow through a porous medium is of great interest to geophysicists and fluid dynamicists. Brinkman [2], Yamamoto [12], Raptis et al. [8,9] have studied flow through a porous medium considering generalized Darcy's law. In all above research papers generalized Darcy's law is derived without taking into account the angular velocity of the fluid particles. Aero et al. [1], D'ep [3] derived flow equations with angular velocity. Such fluids are known as polar fluids in the literature. Raptis [7], Jain and Taneja [5], Taneja and Jain [11] have considered magnetic effects on a polar fluid through a porous medium.

In geothermal region situation may arise when slip at the boundary may take place. In such a situation of slip flow, ordinary continuum approach fails to yield satsifactory results. Many authors including Mittal et al. [6], Singh [10] solved problems taking slip conditions at the boundary. Results agreeing with the observed physical phenomena, can be obtained by solving usual equations of motion together with modified boundary conditions.

In the present paper an attempt has been made to study the effects of rotational and slip parameters (Eckert and Drake [4]) on free convection flow of