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CHEMICAL REACTION AND DIFFUSION THERMO EFFECTS ON MHD FLOW OF A DUSTY VISCOELASTIC FLUID IN AN IRREGULAR CHANNEL

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ABSTRACT

The purpose of the present problem is to study the combined effects of free convective heat and mass transfer on an unsteady MHD Dusty visco elastic (Walters liquid model B) fluid flow between a vertical long wavy wall and a parallel flat wall saturated with porous medium subject to the convective boundary condition. The governing equations are solved by a regular perturbation technique. The velocity of dusty fluid and dust particles and skin friction, nusselt number and Sherwood number are discussed with the help of tables and graphs.

Key words: *MHD, Dusty visco elastic fluid, chemical reaction.*

INTRODUCTION

The concept of heat transfer of a dusty fluid has a wide range of applications in air conditioning, refrigeration, pumps, accelerators, nuclear reactors space heating, power generation, chemical processing, filtration and geothermal systems etc. The good example of heat transfer is the radiator in a car, in which the hot radiator fluid is cooled by the flow of air over the radiator surface. Keeping above facts many authors attracted in this field of study of heat and mass transfer through dusty fluids. Dusty viscous and visco-elastic fluids have been discussed by Saffman [10], Micheal and Norey [5], Raptis and Perdikis [9]. Many investigations on the flow of dusty viscous fluids in presence of various physical parameters have been carried out. Thermal diffusion and diffusion-thermo effects have been found to appreciably influence the flow field in free convection boundary layer over a vertical isothermal surface embedded in a porous medium was discussed by Postelnicu [8].Eckert and Drakes [3] work several investigators have analyzed the effects of Soret and Dufour effects in various types of heat and mass transfer problems. Kafoussias and Williams [4] examined the boundary layer flows in the presence of Soret and Dufour effects associated with the thermal-diffusion and diffusion-thermo for the mixed-forced-natural convection. The main aspects occurring in the modeling of a chemical reaction in a porous medium are discussed by Nield and Bejan [7]. The effect of chemical reaction on free convection and heat transfer past an oscillating infinite vertical plate has been studied by Muthucumaraswamy and Meenakshisundaram [6].Anjalidevi and Kandasamy [1] have analyzed the effect of chemical reaction on MHD flow with heat and mass transfer past a semi-infinite plate. Anurag Dubey and Singh [2] discussed effect of dusty viscous fluid on unsteady laminar free convective flow through porous media with thermal diffusion.

In this paper we have analysed the problem of unsteady flow of dusty visco-elastic fluid (Walters liquid, Model B') through a porous medium in presence of diffusion thermo and chemical reaction.

MATHEMATICAL FORMULATION

We consider a two –dimensional, unsteady flow and free convection heat and mass transfer of an electrically conducting, incompressible viscoelastic (Walters liquid-B) fluid between a vertical long wavy wall and a parallel flat wall saturated with porous medium placed in the plane Y=0 of a coordinate system as shown in Fig. The X-axis is taken in the direction along the channel which is set in motion and the Y-axis is taken perpendicular to it. The flow field is exposed to the influence of an external transversely applied uniform magnetic field of strength B_0, thermal and mass buoyancy effects, heat absorption, thermal radiation, radiation absorption and first order chemically reactive species in the presence of dufour effect. The wavy wall $(Y = \varepsilon^* \cos(K_2 X))$ maintains a temperature T_{w1} which represents the

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convective boundary condition $-k\frac{\partial T}{\partial Y} = h_f\left(T_1 - T + (T_2 - T_1)\varepsilon e^{-n^*t^*}\right)$ and concentration $C_{w1} = C_1 + (C_2 - C_1)\varepsilon e^{-n^*t^*}$, respectively. The flat wall (Y=d) maintains a temperature T_{w2} which represents the convective boundary condition $-k\frac{\partial T}{\partial Y} = h_f\left(T_2 - T + (T_2 - T_1)\varepsilon e^{-n^*t^*}\right)$ and concentration $C_{w2} = C_2 + (C_2 - C_1)\varepsilon e^{-n^*t^*}$, respectively. It is assumed that the convective heat exchange with the wall temperatures at the channel surface follows Newton's law of cooling. Rest of properties of the fluid are assumed to be constant. Taking into consideration of these assumptions, the equations that describe the physical situation can be written in Cartesian frame of references, as follows

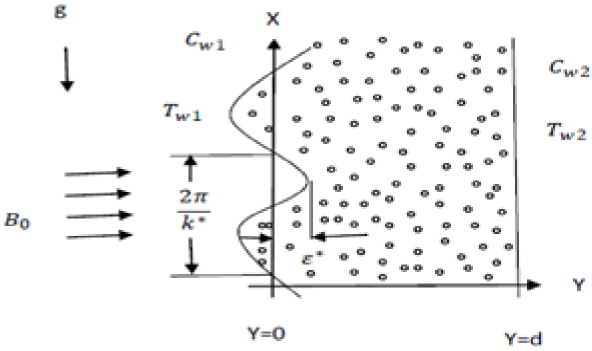
$$\frac{\partial v'}{\partial y'} = 0 \tag{1}$$

$$\frac{\partial U'}{\partial t'} = v'(1-k_0)\frac{\partial^2 U'}{\partial Y'^2} + \frac{K_1 N_0}{\rho}(V-U) - \frac{\vartheta}{k'}U' - \frac{\sigma_e {B_0}^2}{\rho}U' + g\beta_T\left(T' - {T_1}'\right) + g\beta_C\left(C' - {C_1}'\right) \tag{2}$$

$$m\frac{\partial V'}{\partial t'} = K_1(U' - V') \tag{3}$$

$$\frac{\partial T'}{\partial t'} = \frac{k}{\rho C_p}\frac{\partial^2 T'}{\partial Y'^2} - \frac{Q_T}{\rho C_p}\left(T' - {T_1}'\right) - \frac{1}{\rho C_p}\frac{\partial {q_r}'}{\partial Y'} + \frac{Q_C}{\rho C_p}\left(C' - {C_1}'\right) + \frac{D_m K_T}{C_S C_P}\frac{\partial^2 C'}{\partial Y'^2} \tag{4}$$

$$\frac{\partial C'}{\partial t'} = D\frac{\partial^2 C'}{\partial Y'^2} - {K_R}'\left(C' - {C_1}'\right) \tag{5}$$



The intial and boundary conditions of the problem are

$$t' = 0, U = 0 = V, T = T_1, C = C_1 \;\; for \;\; Y\epsilon\,(\varepsilon'\cos(K_2 \mathrm{X}), \mathrm{d}) \tag{6}$$

$$t' > 0, U = 0 = V, -k\frac{\partial T}{\partial Y} = h_f\left(T_2 - T + (T_2 - T_1)\varepsilon e^{-n't'}\right)$$

$$C = C_1 + (C_2 - C_1)\varepsilon e^{-n't'} at \;\; Y = \varepsilon'\cos(K_2 \mathrm{X}) \tag{7}$$

$$U = 0 = V, -k\frac{\partial T}{\partial Y} = h_f\left(T_1 - T + (T_2 - T_1)\varepsilon e^{-n't'}\right),$$

$$C = C_2 + (C_2 - C_1)\varepsilon e^{-n't'} \; at \;\; Y = d \tag{8}$$

The radiative heat flux is given by

$$\frac{\partial {q_r}'}{\partial Y'} = 4(T - T_1)I', \;\; I' = \int_0^\infty K_{\lambda_1 w}\frac{\partial e_{b\lambda_1}}{\partial T}d\lambda_1 \tag{9}$$

Introducing the following non dimensional quantities

$$x = \frac{X'}{d}, y = \frac{Y'}{d}, u = \frac{U'}{U_0}, v = \frac{V'}{U_0}, \theta = \frac{T' - {T_1}'}{{T_2}' - {T_1}'}, \emptyset = \frac{C' - {C_1}'}{{C_2}' - {C_1}'}, t = \frac{\vartheta t'}{d^2}, n = \frac{d^2 n'}{\vartheta}, E = \frac{K_0\vartheta}{d^2},$$

$$\delta = \frac{mN_0}{\rho}, w = \frac{m\vartheta}{K_1 d^2}, M^2 = \frac{\sigma {B_0}^2 d^2}{\mu}, \frac{1}{K} = \frac{d^2}{K'}, Gr = \frac{g\beta_T({T_2}' - {T_1}')d^2}{\vartheta U_0}, Gm = \frac{g\beta_C({C_2}' - {C_1}')d^2}{\vartheta U_0},$$

$$Pr = \frac{\mu C_p}{k}, Sc = \frac{\vartheta}{D}, \alpha_T = \frac{Q_T d^2}{k}, F = \frac{4I' d^2}{k}, Df = \frac{D_m K_T\left({C_2}' - {C_1}'\right)}{\vartheta C_S C_P\left({T_2}' - {T_1}'\right)}, \alpha_C = \frac{Q_C\left({C_2}' - {C_1}'\right)d^2}{k({T_2}' - {T_1}')},$$

$$B_i = \frac{h_f d}{k}, K_r = \frac{K_R d^2}{\vartheta}, \lambda = K_2 d, \varepsilon = \frac{\varepsilon'}{d}, h = \varepsilon\cos(\lambda x) \tag{10}$$

In view of equation (10), the basic field of equations (1) - (5) can be expressed in non-dimensional form as

$$\frac{\partial u}{\partial t} = \left(1 - E\frac{\partial}{\partial t}\right)\frac{\partial^2 u}{\partial y^2} + \frac{\delta}{w}(v - u) - \left(M^2 + \frac{1}{K}\right)u + Gr\theta + Gc\emptyset \tag{11}$$

$$w\frac{\partial v}{\partial t} = v - u \tag{12}$$

$$Pr\frac{\partial\theta}{\partial t} = \frac{\partial^2\theta}{\partial y^2} - (\alpha_T + F)\theta + \alpha_C\emptyset + DfPr\frac{\partial^2\emptyset}{\partial y^2} \tag{13}$$

$$Sc\frac{\partial\emptyset}{\partial t} = \frac{\partial^2\emptyset}{\partial y^2} - KrSc\emptyset \tag{14}$$

The corresponding intial and boundary conditions (6)-(8) in dimensionless form are

$$t = 0, u = 0 = v, \theta = 0, \emptyset = 0 \;\; for y\epsilon\,(h, 1) \tag{15}$$

$$t > 0, u = 0 = v, \theta' = B_i(\theta - \varepsilon e^{-nt}), \;\; \emptyset = \varepsilon\, e^{-nt} \;\; at \;\; y = h \tag{16}$$

$$u = 0 = v, \theta' = B_i(\theta - 1 - \varepsilon e^{-nt}), \emptyset = \; 1 + \varepsilon e^{-nt} at \;\; y = 1 \tag{17}$$

METHOD OF SOLUTION

Equations (11)-(14) represent a set of partial differential equations that cannot be solved in closed form. However, these equation can be solved analytically. Thus we can represent the velocity (u), temperature (θ) and concentration ($\emptyset$) in terms of power of $\varepsilon(\varepsilon \ll 1)$ as follows

$$u(y,t) = u_0(y) + \varepsilon e^{-nt} u_1(y) + \mathrm{o}(\varepsilon^2) \quad (18)$$
$$v(y,t) = v_0(y) + \varepsilon e^{-nt} v_1(y) + \mathrm{o}(\varepsilon^2) \quad (19)$$
$$\theta(\mathrm{y},\mathrm{t}) = \theta_0(y) + \varepsilon e^{-nt} \theta_1(y) + \mathrm{o}(\varepsilon^2) \quad (20)$$
$$\emptyset(y,t) = \emptyset_0(y) + \varepsilon e^{-nt} \emptyset_1(y) + \mathrm{o}(\varepsilon^2) \quad (21)$$

Substituting the above equations in equations (11)- (17), equating harmonic and non harmonic terms and neglecting the higher order terms of $\mathrm{o}(\varepsilon^2)$, we get the following set of equations.

$$u_0'' - Nu_0 + \frac{\delta}{w}(v_0 - u_0) = -(Gr\theta_0 + Gc\emptyset_0) \quad (22)$$
$$(1+nE)u_1'' - (N-n)u_1 + \frac{\delta}{w}(v_1 - u_1) = -(Gr\theta_1 + Gc\emptyset_1) \quad (23)$$
$$v_0 = u_0 \quad (24)$$
$$v_1 = \frac{1}{1-nw} u_1 \quad (25)$$
$$\theta_0'' - (\alpha_T + F)\theta_0 = -\alpha_C \emptyset_0 - DfPr\emptyset_0'' \quad (26)$$
$$\theta_1'' - (\alpha_T + F - nPr))\theta_1 = -\alpha_C \emptyset_1 - DfPr\emptyset_1'' \quad (27)$$
$$\emptyset_0'' - KrSc\emptyset_0 = 0 \quad (28)$$
$$\emptyset_1'' - (Kr - n)Sc\emptyset_1 = 0 \quad (29)$$

The appropriate boundary conditions become

$$u_0 = 0 = v_0, \theta_0' = B_i\theta_0, \emptyset_0 = 0, \qquad u_1 = 0 = v_1$$
$$\theta_1' = B_i(\theta_1 - 1),\ \emptyset_1 = 1 \quad at \quad y = h \quad (30)$$
$$u_0 = 0 = v_0, \theta_0' = B_i(\theta_0 - 1),\ \emptyset_0 = 1, u_1 = 0 = v_1$$
$$\theta_1' = B_i(\theta_1 - 1),\ \emptyset_1 = 1 \quad at \quad y = 1 \quad (31)$$

Equations (22) – (29) are solved and the solution for dusty fluid velocity, dust particles velocity, temperature and concentration are given as follows

$$u(y,t) = c_9 e^{a_9 y} + c_{10} e^{a_{10} y} - k_{13} e^{a_5 y} - k_{14} e^{a_6 y} + k_{15} e^{a_1 y} + k_{16} e^{a_2 y} + k_{17} e^{a_1 y} + k_{18} e^{a_2 y} - k_{19} e^{a_1 y} - k_{20} e^{a_2 y} + \varepsilon e^{-nt}(c_{11} e^{a_{11} y} + c_{12} e^{a_{12} y} - k_{23} e^{a_7 y} - k_{24} e^{a_8 y} + k_{25} e^{a_3 y} + k_{26} e^{a_4 y} + k_{27} e^{a_3 y} + k_{28} e^{a_4 y} - k_{29} e^{a_3 y} - k_{30} e^{a_4 y}) \quad (32)$$

$$v(y,t) = c_9 e^{a_9 y} + c_{10} e^{a_{10} y} - k_{13} e^{a_5 y} - k_{14} e^{a_6 y} + k_{15} e^{a_1 y} + k_{16} e^{a_2 y} + k_{17} e^{a_1 y} + k_{18} e^{a_2 y} - k_{19} e^{a_1 y} - k_{20} e^{a_2 y} + \frac{\varepsilon e^{-nt}}{1-nw}(c_{11} e^{a_{11} y} + c_{12} e^{a_{12} y} - k_{23} e^{a_7 y} - k_{24} e^{a_8 y} + k_{25} e^{a_3 y} + k_{26} e^{a_4 y} + k_{27} e^{a_3 y} + k_{28} e^{a_4 y} - k_{29} e^{a_3 y} - k_{30} e^{a_4 y}) \quad (33)$$

$$\theta(y,t) = c_5 e^{a_5 y} + c_6 e^{a_6 y} - k_1 e^{a_1 y} - k_2 e^{a_2 y} - k_3 e^{a_1 y} - k_4 e^{a_2 y} + \varepsilon e^{-nt}(c_7 e^{a_7 y} + c_8 e^{a_8 y} - k_7 e^{a_3 y} - k_8 e^{a_4 y} - k_9 e^{a_3 y} - k_{10} e^{a_4 y} \quad (34)$$

$$\emptyset(y,t) = c_1 e^{a_1 y} + c_2 e^{a_2 y} + \varepsilon e^{-nt}(c_3 e^{a_3 y} + c_4 e^{a_4 y}) \quad (35)$$

The skinfrictionτ, the nusselt number (Nu) and the Sherwood number (Sh) at the wavy wall y=h and the flat wall y=1 are given by

$$\tau_{f0} = -u'_{y=h} = -(c_9 a_9 e^{a_9 h} + c_{10} a_{10} e^{a_{10} h} - k_{13} a_5 e^{a_5 h} - k_{14} a_6 e^{a_6 h} + k_{15} a_1 e^{a_1 h} + k_{16} a_2 e^{a_2 h} + k_{17} a_1 e^{a_1 h} + k_{18} a_2 e^{a_2 h} - k_{19} a_1 e^{a_1 h} - k_{20} a_2 e^{a_2 h} + \varepsilon e^{-nt}(c_{11} a_{11} e^{a_{11} h} + c_{12} a_{12} e^{a_{12} h} - k_{23} a_7 e^{a_7 h} - k_{24} a_8 e^{a_8 h} + k_{25} a_3 e^{a_3 h} + k_{26} a_4 e^{a_4 h} + k_{27} a_3 e^{a_3 h} + k_{28} a_4 e^{a_4 h} - k_{29} a_3 e^{a_3 h} - k_{30} a_4 e^{a_4 h})) \quad (36)$$

$$\tau_{f1} = -u'_{y=1} = -(c_9 a_9 e^{a_9} + c_{10} a_{10} e^{a_{10}} - k_{13} a_5 e^{a_5} - k_{14} a_6 e^{a_6} + k_{15} a_1 e^{a_1} + k_{16} a_2 e^{a_2} + k_{17} a_1 e^{a_1} + k_{18} a_2 e^{a_2} - k_{19} a_1 e^{a_1} - k_{20} a_2 e^{a_2} + \varepsilon e^{-nt}(c_{11} a_{11} e^{a_{11}} + c_{12} a_{12} e^{a_{12}} - k_{23} a_7 e^{a_7} - k_{24} a_8 e^{a_8} + k_{25} a_3 e^{a_3} + k_{26} a_4 e^{a_4} + k_{27} a_3 e^{a_3} + k_{28} a_4 e^{a_4} - k_{29} a_3 e^{a_3} - k_{30} a_4 e^{a_4})) \quad (37)$$

$$\tau_{p0} = -v'_{y=h} = -(c_9 a_9 e^{a_9 h} + c_{10} a_{10} e^{a_{10} h} - k_{13} a_5 e^{a_5 h} - k_{14} a_6 e^{a_6 h} + k_{15} a_1 e^{a_1 h} + k_{16} a_2 e^{a_2 h} + k_{17} a_1 e^{a_1 h} + k_{18} a_2 e^{a_2 h} - k_{19} a_1 e^{a_1 h} - k_{20} a_2 e^{a_2 h} + \frac{\varepsilon e^{-nt}}{1-nw}(c_{11} a_{11} e^{a_{11} h} + c_{12} a_{12} e^{a_{12} h} - k_{23} a_7 e^{a_7 h} - k_{24} a_8 e^{a_8 h} + k_{25} a_3 e^{a_3 h} + k_{26} a_4 e^{a_4 h} + k_{27} a_3 e^{a_3 h} + k_{28} a_4 e^{a_4 h} - k_{29} a_3 e^{a_3 h} - k_{30} a_4 e^{a_4 h})) \quad (38)$$

$$\tau_{p1} = -v'_{y=1} = -(c_9 a_9 e^{a_9} + c_{10} a_{10} e^{a_{10}} - k_{13} a_5 e^{a_5} - k_{14} a_6 e^{a_6} + k_{15} a_1 e^{a_1} + k_{16} a_2 e^{a_2} + k a_1 e^{a_1} + k_{18} a_2 e^{a_2} - k_{19} a_1 e^{a_1} - k_{20} a_2 e^{a_2} + \frac{\varepsilon e^{-nt}}{1-nw}(c_{11} a_{11} e^{a_{11}} + c_{12} a_{12} e^{a_{12}} - k_{23} a_7 e^{a_7} - k_{24} a_8 e^{a_8} + k_{25} a_3 e^{a_3} + k_{26} a_4 e^{a_4} + k_{27} a_3 e^{a_3} + k_{28} a_4 e^{a_4} - k_{29} a_3 e^{a_3} - k_{30} a_4 e^{a_4})) \quad (39)$$

$$Nu_0 = -\theta'_{y=h} = -(c_5 a_5 e^{a_5 h} + c_6 a_6 e^{a_6 h} - k_1 a_1 e^{a_1 h} - k_2 a_2 e^{a_2 h} - k_3 a_1 e^{a_1 h} - k_4 a_2 e^{a_2 h} + \varepsilon e^{-nt}(c_7 a_7 e^{a_7 h} + c_8 a_8 e^{a_8 h} - k_7 a_3 e^{a_3 h} - k_8 a_4 e^{a_4 h} - k_9 a_3 e^{a_3 h} - k_{10} a_4 e^{a_4 h}) \quad (40)$$

$$Nu_1 = -\theta'_{y=1} = -(c_5 a_5 e^{a_5} + c_6 a_6 e^{a_6} - k_1 a_1 e^{a_1} - k_2 a_2 e^{a_2} - k_3 a_1 e^{a_1} - k_4 a_2 e^{a_2} + \varepsilon e^{-nt}(c_7 a_7 e^{a_7} + c_8 a_8 e^{a_8} - k_7 a_3 e^{a_3} - k_8 a_4 e^{a_4} - k_9 a_3 e^{a_3} - k_{10} a_4 e^{a_4})) \quad (41)$$

$$Sh_0 = -\emptyset'_{y=h} = -(c_1 a_1 e^{a_1 y} + c_2 a_2 e^{a_2 y} + \varepsilon e^{-nt}(c_3 a_3 e^{a_3 y} + c_4 a_4 e^{a_4 y})) \quad (42)$$

$$Sh_1 = -\emptyset'_{y=1} = -(c_1 a_1 e^{a_1} + c_2 a_2 e^{a_2} + \varepsilon e^{-nt}(c_3 a_3 e^{a_3} + c_4 a_4 e^{a_4})) \quad (43)$$

RESULT AND DISCUSSION

Numerical calculations are carried out for different values of dimensionless parameters and representative set of results is reported graphically in Figures 1-8.These results are obtained to illustrate the influence of the Chemical reaction parameter Kr, Dufour number Df, Magnetic field parameter M, Schmidt number Sc on the velocity, temperature and concentration profiles, while the values of the physical parameters are fixed at real constants.

Numerical calculations are carried out for different values of dimensionless parameters and representative set of results is reported graphically in Figures 1-8.These results are obtained to illustrate the influence of the Chemical reaction parameter Kr, Dufour number Df, Magnetic field parameter M, Schmidt number Sc on the velocity, temperature and concentration profiles, while the values of the physical parameters are fixed at real constants.

For various values of the Schmidt number Sc, the concentration profiles are plotted in figure 1. It can be seen that as Schmidt numberincreases, the concentration decreases. The temperature profiles for different values of Dufour number Df are shown in figure.2. This shows that the temperature increases as Dufour number increases. Figure 3 to 6 represents the effects of M, Df, Gr, Gc, on the velocity distributions of dusty fluid and dust particals, respectively. Figure 3 shows that as Magnetc field M increases, velocity decreases. From figure 4, it is shown that as dufour number increases, velocity is also increases. From figure 5, it is observed that as Gr increases, velocity increases. Figure 6 shows that velocity increases with increasing values of Gc.

Figures 7 and 8 present the variations of skinfriction coefficient againist the frequency of wavy wall and flat wall for various values of viscoelastic parameter with dust fluid and dust particles respectively. It is noticed that from figure 7 that the value of shear stress decreases for increasing the visco elastic parameter at the wavy wall for dust particles but the trend is reversed for the dusty fluid. The magnitude of skinfriction at flat wall increase with an increase of visco-elastic parameter for dust particle fluid but this trend is reversed for the dusty fluid which is plotted in figure 8.

Table illustrates the variations of skinfriction, nusselt number and Sherwood number distributions at the walls y=h and y=1 for different values of Sc, Kr, D_f, F, α_c, Pr.Nusselt number decreases with increasing values of Dufournumberand Radiation absorption parameter at y=h and y=1. As Radiation parameter increases, nusselt number increases at y=h and y=1.As Schmidt nuber and chemical reaction parameter increases, Sherwood number decreases at y=h and increases at y=1.As Dufour number, Radiation absorption parameter and Prandtlnumberincreases, skinfriction decreases for dusty fluid and dust particles at y=h and reverse trend occurred at y=1. As Radiation parameter increases, skinfriction increases for dusty fluid and dust particles at y=h and reverse trend occurred at y=1.

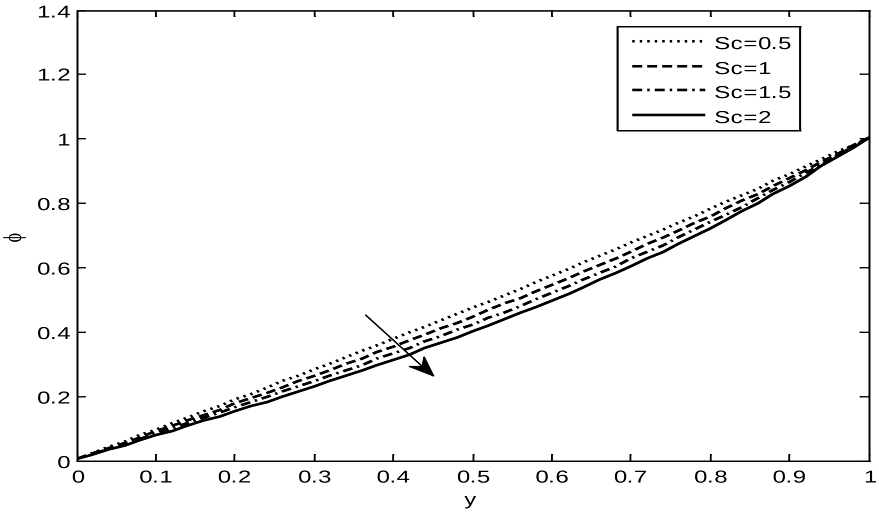


Fig.1: Concentration profiles for different value of Sc

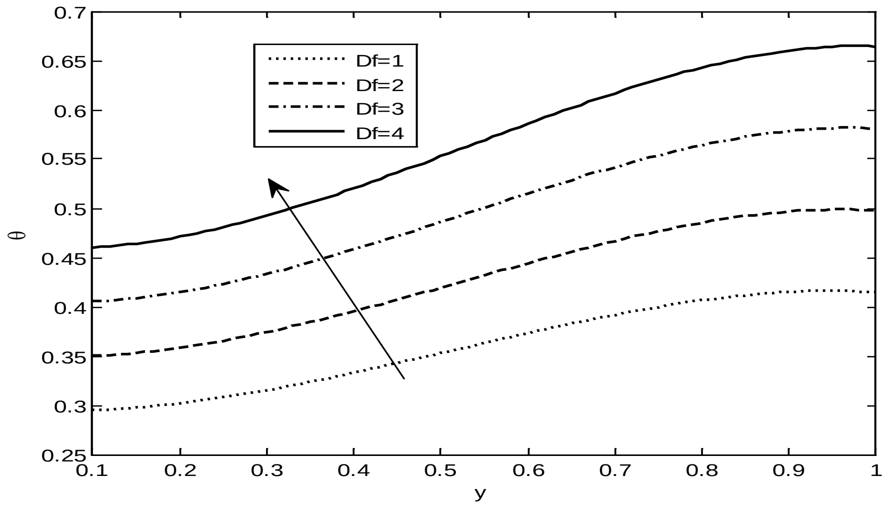


Fig.2: Temperature profiles for different value of Df

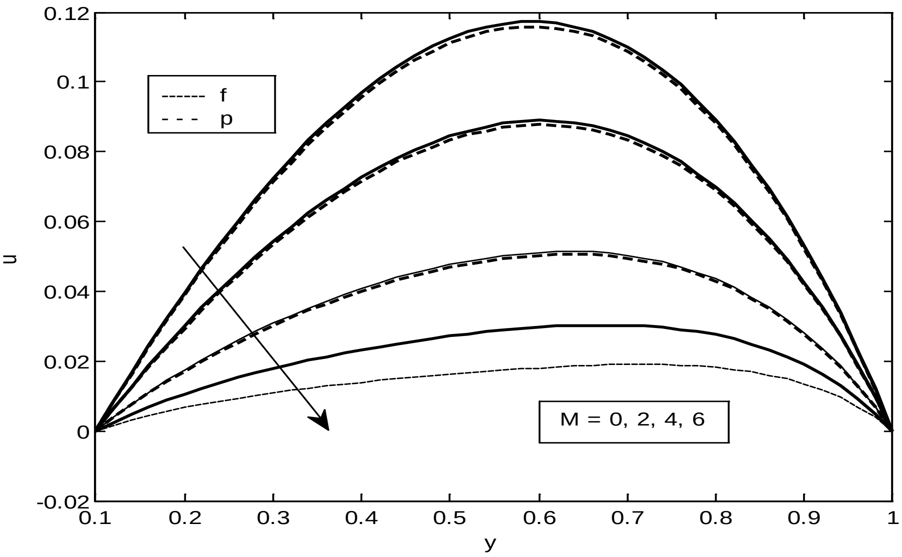


Fig.3: Velocity profiles for different value of M

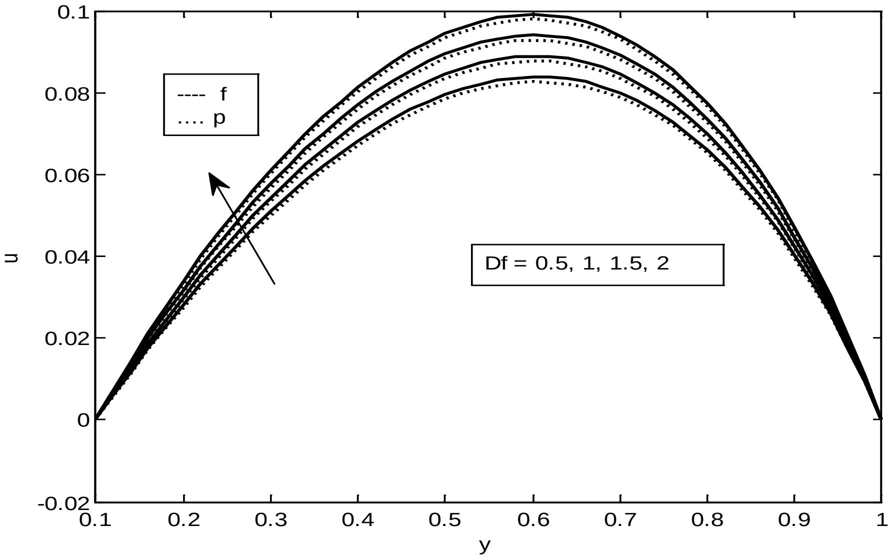


Fig.4: Velocity profiles for different value of Df

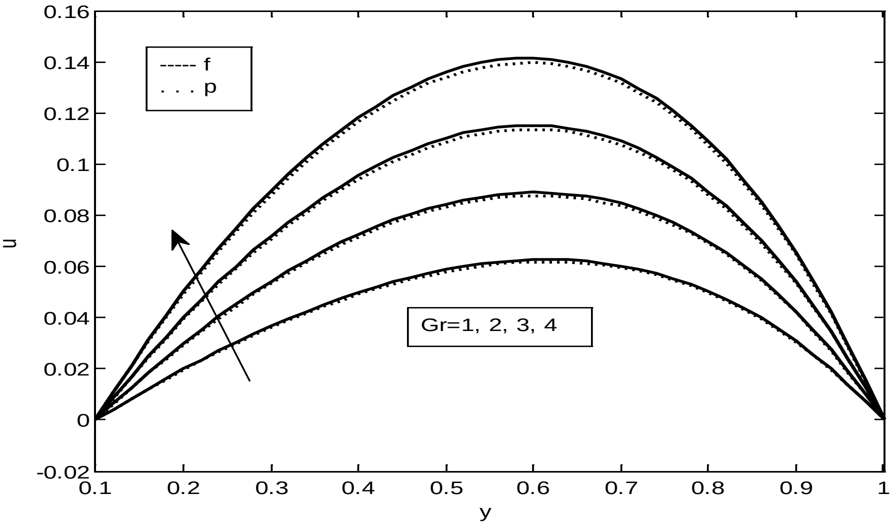


Fig.5: Velocity profiles for different value of Gr

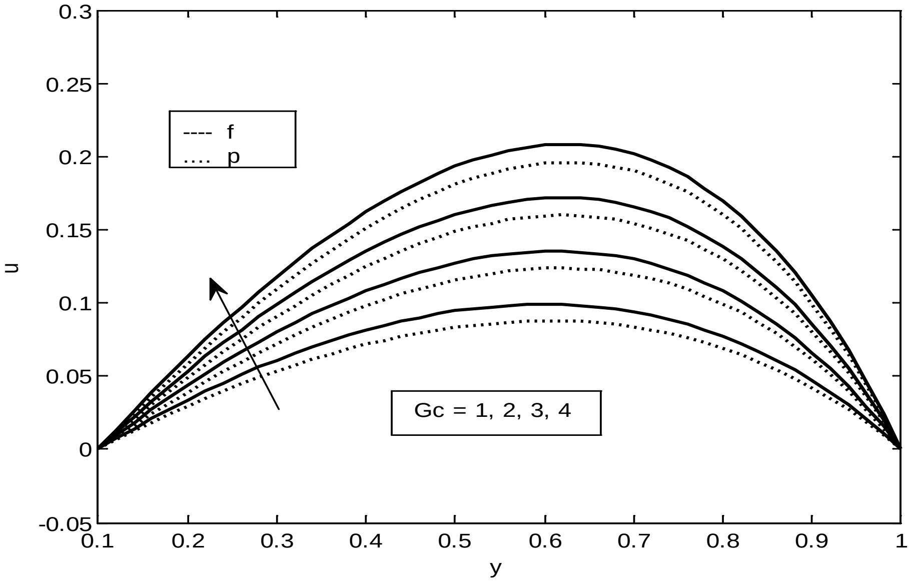


Fig.6: Velocity profiles for different value of Gc

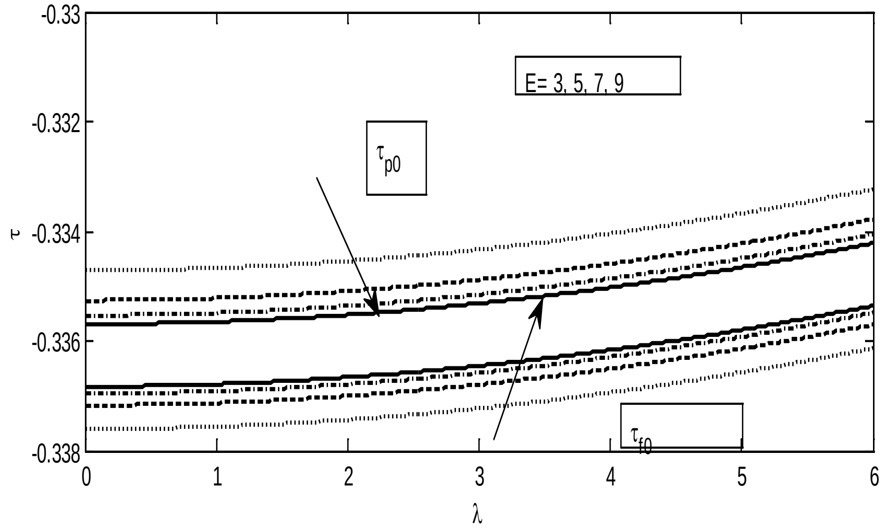


Fig.7: Skinfriction for different value of λ at wavy wall

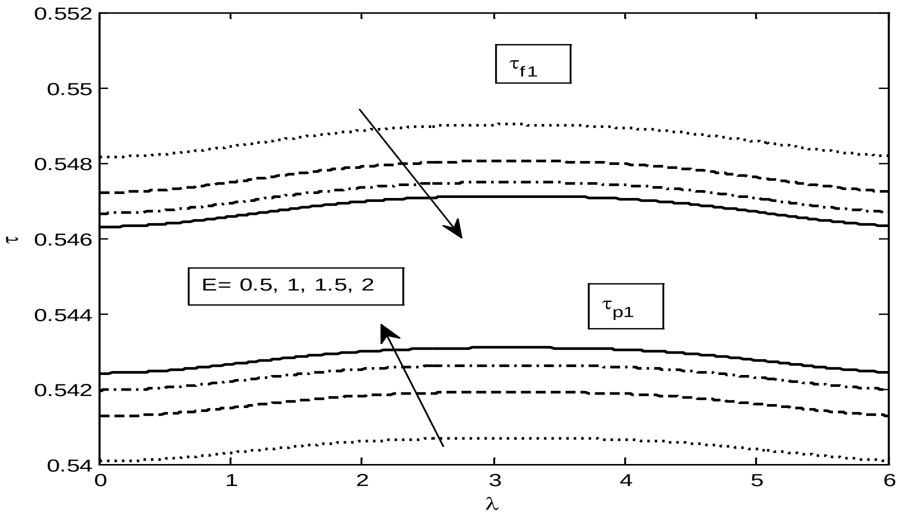


Fig.8: Skinfriction for different value of λ at the flat wall

Table-1

Sc	Kr	D_f	F	α_C	Pr	S_{h0}	S_{h1}	Nu_0	Nu_1	T_{f0}	T_{f1}	T_{p0}	T_{p1}
0.22	1	1	-	-	-	1.0475	1.1761	-	-	-	-	-	-
0.6	1	1	-	-	-	0.9488	1.2850	-	-	-	-	-	-
0.78	1	1	-	-	-	0.9065	1.3351	-	-	-	-	-	-
0.96	1	1	-	-	-	0.8667	1.3843	-	-	-	-	-	-
0.6	1	1	2	2	-	1.0265	1.2850	-0.0303	0.0535	-0.3131	0.6147	-0.3104	0.6130
0.6	1	2	2	2	-	0.9488	1.4505	-0.0387	0.0397	-0.3350	0.6411	-0.3324	0.6385
0.6	3	3	2	2	-	0.8789	1.6070	-0.0472	0.0259	-0.3569	0.6676	-0.3543	0.6650
0.6	4	4	2	2	-	0.8157	1.7554	-0.0556	0.0121	-0.3788	0.6940	-0.3763	0.6916
0.6	1	1	3	2	0.71	-	-	-0.0197	0.0678	-0.2827	0.5821	-0.2802	0.5797
0.6	1	1	4	2	0.71	-	-	-0.0149	0.0739	-0.2646	0.5624	-0.2623	0.5602
0.6	1	1	5	2	0.71	-	-	-0.0117	0.0780	-0.2527	0.5493	-0.2505	0.5471
0.6	1	1	2	3	0.71	-	-	-0.0406	0.0375	-0.3651	0.6774	-0.3619	0.6742
0.6	1	1	2	4	0.71	-	-	-0.0532	0.0172	-0.4170	0.7401	-0.4134	0.7365
0.6	1	1	2	5	0.71	-	-	-0.0659	-0.0031	-0.4690	0.8029	-0.4649	0.7987
0.6	1	1	2	2	1	-	-	-	-	-0.3223	0.6257	-0.3194	0.6228
0.6	1	1	2	2	3	-	-	-	-	-0.3823	0.6985	-0.3814	0.6977
0.6	1	1	2	2	7	-	-	-	-	-0.5068	0.8489	-0.5049	0.8471

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