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Soret effect on Magneto Hydro Dynamic convective immiscible Fluid flow in a Horizontal Channel

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ABSTRACT

Unsteady Magneto Hydro Dynamic immiscible fluid flow with Heat and mass transfer have been analyzed in this paper. The impact of Soret is also considered here. The equations are solved under the given boundary conditions for each fluid and the solutions have been studied analytically. The governing equations of the flow were converted into an ordinary differential equations by a perturbation method and the expression for the velocity, temperature and concentration for each fluid flow were obtained. The impacts of different parameters like Grash of numbers for Heat and mass exchange, Prandtl number, Viscosity proportion, conductivity proportion, radiative parameter, Soret number and so on the maximum speed, temperature and focus fields have been introduced graphically .

KEYWORDS: MHD, Heat transfer, Mass transfer, Immiscible fluid, Soret Effect.

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INTRODUCTION

Magneto Hydro Dynamic is the study of electrically conducting fluids using its the magnetic properties . An electrical engineer Hannes Alfven in 1942 found the properties of MHD through fluids. Also several motions of these electrically conducting fluids were discussed by Shercliff , Sparrow and Cess , Singhand Ram , Abdulla , Singh from early 1950 to 1990.

MHD flows have applications in solar system based physics, cosmic fluid dynamics. All the problem relevant to the Industry of petroleum, Plasma physics, magnetic field effect in fluid dynamics etc involved in various fluid flow situations. The immiscible fluid flow through a porous medium and heat transfer is significant in the problem of petroleum extraction and transport. Examining the wide range of applications of such flow, some authors and scholars have made their contribution. Soret effects and its importance for the fluids with very light molecular weights have been investigated and reported by many researchers in this field and the results for these flows were presented here. Anand Rao.s , Shivaiah and S.KNuslin [1] discussed about the Radiation effect on an unsteady MHD free convective flow past a vertical porous plate in presence of soret. Chamka [2] in the discussed about the presence of heat in MHD in non porous channel and the effect of magnetic field with buoyancy under the porous region of two immiscible fluids. Also he studied about the unsteady flow. Kurnar et el [4] discussed about heat transfer effect of the unsteady MHD and immiscible fluid through a porous medium in an inclined channel. Malashetty and Umavathi [5] studied two phase MHD flow and heat transfer in an inclined channel. P.S.Reddy[7] analyzed the mass transfer and radiation effect in an unsteady Free flow under the vertical heated porous plate with viscous dissipation.

B.K.Sharma and Kailash Yadav [8] discussed about soret effects on free convective mass transfer in a porous medium under the chemical reaction and radiation effect. Simon [9] also studied about the same concept of immiscible fluid flow under heat transfer in a porous medium along an inclined channel with pressure gradient.

In the above investigations the effect of soret is neglected in most of the studies on multiple phase flows. This present study hereby investigates the impact of soret on unsteady MHD Free convective immiscible fluid flow through an inclined channel with Heat and Mass Transfer. The momentum equations, energy equations and diffusion equations and continuity equations , which governs the flow regions are solved by perturbation method. Using MATLAB results and discussion are derived graphically .

Problem Formation:

The two immiscible liquids having heat with constant pressure Cp in a non-porous lower channel and porous upper channel bounded by two infinite horizontal parallel plates extending in the X and Z directions with the Y-direction normal to the plates. The regions $0 \le y \le h$ and $-h \le y \le 0$ are denoted as Region-I and Region-II respectively. The fluid flowing through Region-I is having density ρ_1, dynamic viscosity μ_1, thermal conductivity k_1, thermal diffusivity D_1. Similarly the fluid flowing through Region-II is having density ρ_2, dynamic viscosity μ_2, thermal conductivity k_2, thermal diffusivity D_2.

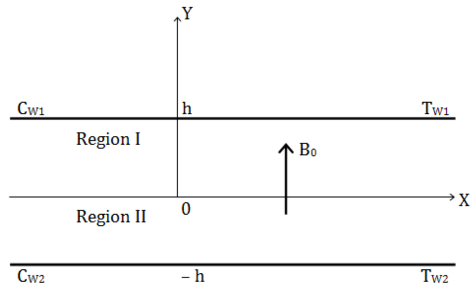


Figure 1-Flow Configuration

All the variables are functions of y' and t' only, due to the bounding surface being infinitely long along the x' axis. The flow is assumed to be fully developed and that all fluid properties are constants. The magnetic field Reynolds number is assumed very small. Hence the governing equations of the fluid flow for the two different regions are

REGION I : Porous Region

$$\frac{\partial V_1'}{\partial y'} = 0 \tag{1}$$

$$\rho_1\left(\frac{\partial U_1'}{\partial t'} + V_1'\frac{\partial U_1'}{\partial y'}\right) = \mu_1\frac{\partial^2 U_1'}{\partial y'^2} - \frac{\partial P'}{\partial x'} - \sigma B_0^2 U_1' + \rho_1 g\beta_{f1}\left(T_1' - T_{w1}'\right) + \rho_1 g\beta_{c1}^*\left(C_1' - C_{w1}'\right) \tag{2}$$

$$\rho_1 c_p\left(\frac{\partial T_1'}{\partial t'} + V_1'\frac{\partial T_1'}{\partial y'}\right) = k_1\frac{\partial^2 T_1'}{\partial y'^2} - \frac{\partial q_r}{\partial y} \tag{3}$$

$$\frac{\partial C_1'}{\partial t'} + V_1'\frac{\partial C_1'}{\partial y'} = D_1\frac{\partial^2 C_1'}{\partial y'^2} - \frac{D_{Kt}}{T_m}\frac{\partial^2 T_1'}{\partial y'^2} \tag{4}$$

REGION –II: Clear Region

$$\frac{\partial V_2'}{\partial y'} = 0 \tag{5}$$

$$\rho_2\left(\frac{\partial U_2'}{\partial t'} + V_2'\frac{\partial U_2'}{\partial y'}\right) = \mu_2\frac{\partial^2 U_2'}{\partial y'^2} - \frac{\partial P'}{\partial x'} - \sigma B_0^2 U_2' + \frac{\mu_2}{k'}U_2' + \rho_2 g\beta_{f2}\left(T_2' - T_{w2}'\right) + \rho_2 g\beta_{c2}^*\left(C_2' - C_{w2}'\right) \tag{6}$$

$$\rho_2 c_p \left(\frac{\partial T_2'}{\partial t'} + V_2' \frac{\partial T_2'}{\partial y'}\right) = k_2 \frac{\partial^2 T_2'}{\partial y'^2} - \frac{\partial qr}{\partial y} \quad (7)$$

$$\frac{\partial C_2'}{\partial t'} + V_2' \frac{\partial C_2'}{\partial y'} = D_2 \frac{\partial^2 C_2'}{\partial y'^2} - \frac{D_{Kt}}{Ttm} \frac{\partial^2 T_2'}{\partial y'^2} \quad (8)$$

Assuming that the boundary and interface conditions on velocity are no slip, given that at the boundary and interface, the fluid particles are at rest, x component of the velocity vanish at the wall. The interface and the boundary conditions for the velocity for both fluids are:

$$U_1'(h) = 0,\ U_2'(-h) = 0,\ U_1'(h) = U_2'(h), \quad \mu_1 \frac{\partial U_1'}{\partial y'} = \mu_2 \frac{\partial U_2'}{\partial y'}\ at\ y' = 0 \quad (9)$$

The conditions for the temperature field for both fluids are

$$T_1'(h) = T_{w1}', T_2'(-h) = T_{w2}', T_1'(0) = T_2'(0),\ k_1 \frac{\partial T_1'}{\partial y'} = k_2 \frac{\partial T_2'}{\partial y'}\ at\ y' = 0 \quad (10)$$

Similarly the boundary and interface conditions for the concentration fields are:

$$C_1'(h) = C_{w1}', C_2'(-h) = C_{w2}', C_1'(0) = C_2'(0), D_1 \frac{\partial C_1'}{\partial y'} = D_2 \frac{\partial C_2'}{\partial y'} \text{ when } y'=0 \quad (11)$$

The equations (1) and (5) implies that V_1' and V_2' are independent of y', they are functions of time alone.

Hence $V' = V_0(1+\epsilon A e^{i\omega t})$ (12)

Assuming that $V_1' = V_2' = V'$. Where $\varepsilon A \leq 1$. By assuming the following dimensionless quantities:

$U_i = \frac{U_i'}{u}$, $y = \frac{y'}{h}$, $t = \frac{t'\vartheta 1}{h^2}$, $V = \frac{h}{\vartheta_1}$, $V_1' = \frac{V}{V_0}$, $Pr = \frac{\mu_1 C_p}{k_1}$, $\alpha_1 = \frac{\mu_2}{\mu_1}$, $\beta_1 = \frac{k_2}{k_1}$, $\tau_1 = \frac{\rho_2}{\rho_1}$, $\gamma_1 = \frac{D_2}{D_1}$, $m_1 = \frac{\beta_{f2}}{\beta_{f1}}$, $\eta_1 = \frac{\beta_{c2}^*}{\beta_{c1}^*}$, $k^2 = \frac{h^2}{K'}$, $sc = \frac{\vartheta_1}{D_1}$, $M^2 = \frac{\sigma h^2 B_0^2}{\mu 1}$, $F = \frac{4I''h_1^2}{k_1}$, $\frac{\partial q_r}{\partial y} = 4(T_i' - T_{w1}')\,I'$, $\xi_1 = \frac{1}{\tau_1} = \frac{\rho_1}{\rho_2}$, $Gr = \frac{g(T_{w2}' - T_{w1}')\beta_{f1} h^2 \rho_1}{\mu_1 \mu}$, $Gc = \frac{g(C_{w2}' - C_{w1}')\beta *_{c1} h^2 \rho_1}{\mu_1 \mu}$, $P = \frac{-h^2}{\mu_1 \mu}\left(\frac{\partial P'}{\partial x'}\right)$, $\theta_i = \frac{(T_i' - T_{w1}')}{(T_{w2}' - T_{w1}')}$, $C_i = \frac{(C_i' - C_{w1}')}{(C_{w2}' - C_{w1}')}$

$S_r = \frac{D_{KT}(C_w - C_\infty)}{C_s T_m (T_w - T_\infty)}$, i= 1, 2…….Equations (2), (3), (4), (6), (7)and (8) becomes

REGION – I :

$$\frac{\partial U_1}{\partial t} + (1 + \epsilon e^{i\omega t}) \frac{\partial U_1}{\partial y} = \frac{\partial^2 U_1}{\partial y^2} + P - M^2 U_1 + Gr\theta_1 + GcC_1 \quad (13)$$

$$\frac{\partial \theta_1}{\partial t} + (1 + \epsilon e^{i\omega t}) \frac{\partial \theta_1}{\partial y} = \frac{1}{Pr} \frac{\partial^2 \theta_1}{\partial y^2} - \frac{F\theta_1}{Pr} \quad (14)$$

$$\frac{\partial C_1}{\partial t} + (1 + \epsilon e^{i\omega t}) \frac{\partial C_1}{\partial y} = \frac{1}{Sc} \frac{\partial^2 C_1}{\partial y^2} + \frac{S_r}{Sc} \frac{\partial\ \ \theta_1}{\partial y^2} \quad (15)$$

REGION-II :

$$\frac{\partial U_2}{\partial t} + \left(1 + \epsilon e^{i\omega t}\right)\frac{\partial U_2}{\partial y} = \alpha_1 \xi_1 \frac{\partial^2 U_2}{\partial y^2} + \xi_1 P - \xi_1 M^2 U_2 - \alpha_1 \xi_1 K^2 U_2 + Grm_1 \theta_2 + Gc\eta_1 C_2 \quad (16)$$

$$\frac{\partial \theta_2}{\partial t} + \left(1 + \epsilon e^{i\omega t}\right)\frac{\partial \theta_2}{\partial y} = \frac{\beta_1 \xi_1}{Pr}\frac{\partial^2 \theta_2}{\partial y^2} - \frac{F\xi_1 \theta_2}{Pr} \quad (17)$$

$$\frac{\partial C_2}{\partial t} + \left(1 + \epsilon e^{i\omega t}\right)\frac{\partial C_2}{\partial y} = \frac{\gamma_1}{Sc}\frac{\partial^2 C_2}{\partial y^2} + \frac{S_r}{Sc}\frac{\partial^2 \theta_1}{\partial y^2} \quad (18)$$

The interface conditions with boundary conditions in dimensionless form are given as follows

$$U_1(1) = 0,\ U_2(-1) = 0,\ U_1(0) = U_2(0),\ \frac{\partial U_1}{\partial y} = \alpha_1 \frac{\partial U_2}{\partial y}\ at\ y = 0 \quad (19)$$

$$\theta_1(1) = 1,\ \theta_2(-1) = 0,\ \theta_1(0) = \theta_2(0),\ \frac{\partial \theta_1}{\partial y} = \beta_1 \frac{\partial \theta_2}{\partial y}\ at\ y = 0 \quad (20)$$

$$C_1(1) = 1,\ C_2(-1) = 0,\ C_1(0) = C_2(0),\ \frac{\partial C_1}{\partial y} = \gamma_1 \frac{\partial C_2}{\partial y}\ \text{when } y = 0 \quad (21)$$

PROCEDURE OF THE SOLUTION

To solve the equations (13) to (18) under the interface and boundary conditions (19) to (21), we have to expand $U_1(y,t)$, $\Theta_1(y,t)$, $C_1(y,t)$, $U_2(y,t)$, $\Theta_2(y,t)$, $C_2(y,t)$, as a power series on the parameter ϵ. Here, let $\epsilon \leq 1$.Thus

$$U_1(y,t) = U_{10}(y) + \epsilon e^{i\omega t} U_{11}(y)$$
$$\Theta_1(y,t) = \Theta_{10}(y), + \epsilon e^{i\omega t} \Theta_{11}(y)$$
$$C_1(y,t) = C_{10}(y), + \epsilon e^{i\omega t} C_{11}(y)$$
$$U_2(y,t) = U_{20}(y) + \epsilon e^{i\omega t} U_{21}(y)$$
$$\Theta_2(y,t) = \Theta_{20}(y), + \epsilon e^{i\omega t} \Theta_{21}(y)$$
$$C_2(y,t) = C_{20}(y), + \epsilon e^{i\omega t} C_{21}(y)$$

Substitute the above equations in (13) to (18) and equate the non-periodic and periodic terms, and neglect the terms containing ϵ^2. we will get the following set of differential equations:

REGION-I :Non Periodic Terms:

$$\frac{\partial^2 U_{10}}{\partial y^2} + \frac{\partial U_{10}}{\partial y} - M^2 U_{10} = -P - Gr\theta_{10} + GcC_{10} \quad (22)$$

$$\frac{\partial^2 \theta_{10}}{\partial y^2} - Pr\frac{\partial \theta_{10}}{\partial y} - F\,\theta_{10} = 0 \quad (23)$$

$$\frac{\partial^2 C_{10}}{\partial y^2} - Sc\frac{\partial C_{10}}{\partial y} = Sr\,\frac{\partial^2 \theta_{10}}{\partial y^2} \quad (24)$$

Periodic Terms:

$$\frac{\partial^2 U_{11}}{\partial y^2} + \frac{\partial U_{11}}{\partial y} - (M^2 + i\omega)U_{11} = \frac{\partial U_{10}}{\partial y} - Gr\theta_{11} - GcC_{11} \quad (25)$$

$$\frac{\partial^2 \theta_{11}}{\partial y^2} - Pr\frac{\partial \theta_{11}}{\partial y} - (F + i\omega Pr)\,\theta_{11} = Pr\frac{\partial \theta_{10}}{\partial y} \quad (26)$$

$$\frac{\partial^2 C_{11}}{\partial y^2} - S\,\frac{\partial C_{11}}{\partial y} - i\omega ScC_{11} = Sc\,\frac{\partial C_{10}}{\partial y} - Sr\,\frac{\partial^2 \theta_{11}}{\partial y^2} \quad (27)$$

REGION-II Non periodic Terms:

$$\frac{\partial^2 U_{20}}{\partial y^2} - \frac{1}{\alpha_1\xi_1}\,\frac{\partial U_{20}}{\partial y} - \frac{(\xi_1 M^2 + \alpha_1\xi_1 K^2)}{\alpha_1\xi_1}U_{20} = -\frac{P}{\alpha_1} - \frac{Grm_1}{\alpha_1\xi_1}\,\theta_{20} - \frac{Gc\,\eta_1}{\alpha_1\xi_1}\,C_{10} \quad (28)$$

$$\frac{\partial^2 \theta_{20}}{\partial y^2} - \frac{Pr}{\beta_1\xi_1}\,\frac{\partial \theta_{20}}{\partial y} - \frac{F}{\beta_1}\,\theta_{20} = 0 \quad (29)$$

$$\frac{\partial^2 C_{20}}{\partial y^2} - \frac{Sc}{\gamma_1}\,\frac{\partial C_{20}}{\partial y} - \frac{Sr}{\gamma_1}\frac{\partial^2 \theta_{20}}{\partial y^2} = 0 \quad (30)$$

Periodic Terms:

$$\frac{\partial^2 U_{21}}{\partial y^2} - \frac{1}{\alpha_1\xi_1}\,\frac{\partial U_{21}}{\partial y} - \frac{(\xi_1 M^2 + \alpha_1\xi_1 K^2 + i\omega)}{\alpha_1\xi_1}U_{21} = \frac{1}{\alpha_1\xi_1}\,\frac{\partial U_{20}}{\partial y} - \frac{Grm1}{\alpha_1\xi_1}\theta_{21} - \frac{Gc\,\eta_1}{\alpha_1\xi_1}\,C_{21} \quad (31)$$

$$\frac{\partial^2 \theta_{21}}{\partial y^2} - \frac{Pr}{\beta_1\xi_1}\,\frac{\partial \theta_{21}}{\partial y} - \frac{F\xi_1 + i\omega Pr}{\beta_1\xi_1}\theta_{21} = \frac{Pr}{\beta_1\xi_1}\frac{\partial \theta_{20}}{\partial y} \quad (32)$$

$$\frac{\partial^2 C_{21}}{\partial y^2} - \frac{Sc}{\gamma_1}\,\frac{\partial C_{21}}{\partial y} - \frac{i\omega Sc}{\gamma_1}\,C_{21} + \frac{Sr}{\gamma_1}\frac{\partial^2 \theta_{21}}{\partial y^2} = 0 \quad (33)$$

The above equations are second order differential equations with constant coefficients and the corresponding boundary and interface conditions are :

Non Periodic Terms

$$U_{10}(1) = 0\,,\ U_{20}(-1) = 0\,,\ U_{10}(0) = U_{20}(0)\,,\ \frac{\partial U_{10}}{\partial y} = \alpha_1\frac{\partial U_{20}}{\partial y}\ at\ y = 0 \quad (34)$$

$$\theta_{10}(1) = 1\,,\ \theta_{20}(-1) = 0\,,\ \theta_{10}(0) = \theta_{20}(0)\,,\ \frac{\partial \theta_{10}}{\partial y} = \beta_1\frac{\partial \theta_{20}}{\partial y}\ at\ y = 0 \quad (35)$$

$$C_{10}(1) = 1\,,\ C_{20}(-1) = 0\,,\ C_{10}(0) = C_{20}(0),\ \frac{\partial C_{10}}{\partial y} = \gamma_1\frac{\partial C_{20}}{\partial y}\ at\ y = 0 \quad (36)$$

Periodic Terms:

$$U_{11}(1) = 0\ , U_{21}(-1) = 0\ , U_{11}(0) = U_{21}(0)\ , \frac{\partial U_{11}}{\partial y} = \alpha_1 \frac{\partial U_{21}}{\partial y}\ at\ y = 0 \qquad (37)$$

$$\theta_{11}(1) = 0\ ,\ \theta_{21}(-1) = 0\ , \Theta_{11}(0) = \theta_{21}(0)\ , \frac{\partial \theta_{11}}{\partial y} = \beta_1 \frac{\partial \theta_{21}}{\partial y}\ at\ y = 0 \qquad (38)$$

$$C_{11}(1) = 1\ , C_{21}(-1) = 0\ , C_{11}(0) = C_{21}(0)\ , \frac{\partial C_{11}}{\partial y} = \gamma_1 \frac{\partial C_{21}}{\partial y}\ at\ y = 0 \qquad (39)$$

The solutions of the differential equations (22) to (33) using the above boundary conditions (34) to (39) are

$$U_{10}(y) = C_5 e^{m5} y + C_6 e^{m6} y + K_1 + K_2 e^{m1} y + K_3 e^{m2} y + K_4 e^{m3} y + K_5 e^{m4} y \qquad (40)$$

$$U_{20}(y) = C_{17} e^{m17} y + C_{18} e^{m18} y + K_{20} + K_{21} e^{m13} y + K_{22} e^{m14} y + K_{23} e^{m15} y + K_{24} e^{m16} y \qquad (41)$$

$$\theta_{10}(y) = C_1 e^{m1} y + C_2 e^{m2} y \qquad (42)$$

$$\theta_{20}(y) = C_{13} e^{m13} y + C_{14} e^{m14} y \qquad (43)$$

$$C_{10}(y) = C_3 e^{m3} y + C_4 e^{m4} y + K_{39} e^{m1} y + K_{40} e^{m2} y \qquad (44)$$

$$C_{20}(y) = C_{15} e^{m15} y + C_{16} e^{m16} y + K_{47} e^{m13} y + K_{48} e^{m14} y \qquad (45)$$

$$U_{11}(y) = C_{11} e^{m11} y + C_{12} e^{m12} y + K_{10} e^{m1} y + K_{11} e^{m2} y + K_{12} e^{m3} y + K_{13} e^{m4} y + K_{14} e^{m5} y + K_{15} e^{m6} y + K_{16} e^{m7} y + K_{17} e^{m8} y + K_{18} e^{m9} y + K_{19} e^{m10} y \qquad (46)$$

$$U_{21}(y) = C_{23} e^{m23} y + C_{24} e^{m24} y + K_{29} e^{m13} y + K_{30} e^{m14} y + K_{31} e^{m15} y + K_{32} e^{m16} + K_{33} e^{m17} y + K_{34} e^{m18} y + K_{35} e^{m19} y + K_{36} e^{m20} y + K_{37} e^{m21} y + K_{38} e^{m22} y \qquad (47)$$

$$\theta_{11}(y) = C_7 e^{m7} y + C_8 e^{m8} y + K_6 e^{m1} y + K_7 e^{m2} y \qquad (48)$$

$$\theta_{21}(y) = C_{19} e^{m19} y + C_{20} e^{m20} y + K_{25} e^{m13} y + K_{26} e^{m14} y \qquad (49)$$

$$C_{11}(y) = C_9 e^{m9} y + C_{10} e^{m10} y + K_8 e^{m3} y + K_9 e^{m4} y + K_{41} e^{m1} y + K_{42} e^{m2} y + K_{43} e^{m7} y + K_{44} e^{m8} y + K_{45} e^{m1} y + K_{46} e^{m2} y \qquad (50)$$

$$C_{21}(y) = C_{21} e^{m21} y + C_{22} e^{m22} y + K_{27} e^{m15} y + K_{28} e^{m16} y + K_{49} e^{m19} y + K_{50} e^{m20} y + K_{51} e^{m13} y + K_{52} e^{m14} y \qquad (51)$$

RESULTS AND DISCUSSION:

The Numerical evaluations of the Analytical results reported in the previous section was performed and the set of results is reported graphically in fig 1 to 7 for the Unsteady Free Convective Two Immiscible Fluid Flow in a Horizontal channel on the upper porous channel and non-porous lower channel bounded by two infinite horizontal parallel plates under the influence of magnetic field and soret effect by assigning different numerical values such as Gr=5 , Gc=5, Pr=1, Sc=.78, F=3, K=1, M=1, α_1= 1, β_1=1, γ_1=1,ω=1, ξ_1=1, φ_1=1, η_1=1, P=1, ωt=3, using MATLAB.Further the values of ϵ is .0007and the frequency parameter ω = 30 are fixed for all the graphs .

The influence of heat absorption parameter H1 and Soret effect sr are displayed through the velocity profiles in figure 1 to 5 respectively.

From these figures it is seen that an increase in either of the Heat absorption parameter or the soret effect leads to a delay in the velocity field while it enhances with an increase in the value of the soret number.

Figure2 and Figure3 displays the effect of the Grashof number Gr and Gc for Heat and Mass transfer respectively on the velocity field. It is clearly seen that an increases in the Region I and slightly shows the differences of decrement in the lower nonporous region II channel for various points .The characteristics of the velocity u for fluids is observed to the channel length for Gr is measured . It is clear that whenever Gr increasing , u diminishes towards to the opposite downward direction of the channel. Also it is clear that the Grashof number under Heat transfer increases the velocity of the fluid more than for Mass transfer.

Figure4 describes the effect of Permiability parameter on the velocity(u_1)in region I and suppress the velocity(u_2)in region-II. The velocity is low for a less than 1 Permiability Parameter further increase above unity reports causes an increase in the velocity .

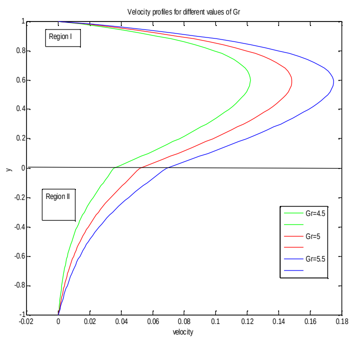
Figure 5 exhibit velocity profile for various values of soret number. It is observed that the velocity decreases with larger velocity boundary layer in Region II as compared to region I to the end of the boundary layer. This observation concludes with the fact that increase in the thickness of a fluid reduces the velocity field of that fluid.

In Figure 6, the momentum diffusivity gradually dominates the thermal diffusivity, the velocity of the flow is decreasing with slight modification from its position in the porous region and the variation of the velocity is not that much significant even if the Prandtl number is increasing for region II.

Figure 7 shows the variation of temperature profile for different values of the Prandtl number . As the value of m increases, the temperature of the fluid increases in the both regions . one can easily see that the temperature of the fluid in the region I is lesser than the temperature of the fluid in the region II.

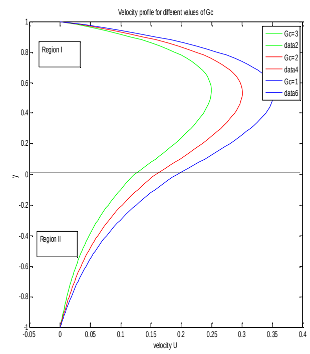
Figure 8 represents the effects of Soret number on the concentration profile. As the Soret number increases, the concentration profile of the flow is having a slight change in the Region I and in the upper part of the clear Region II one can see the difference of various parameters . It also shows us that the increase in the value of the concentration of the fluid increases in the boundary layer region but no effect is observed from onwards in the figures.

Figure 2



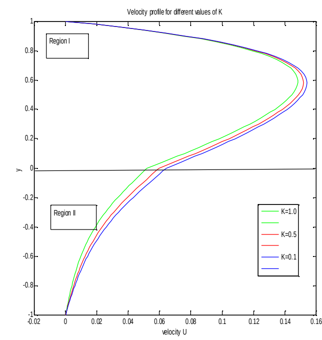
Effect of Gr in Velocity Profile

Figure 3



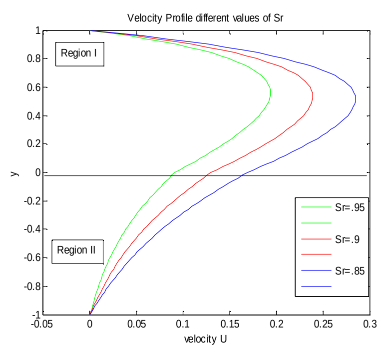
Effect of Gc in Velocity Profile

Figure 4



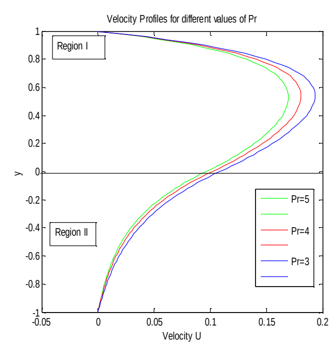
Effect of in K Velocity Profil

Figure 5



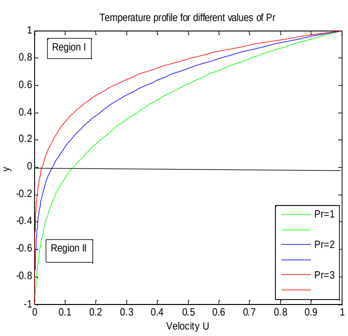
Effect of in Sr Velocity Profile

Figure 6



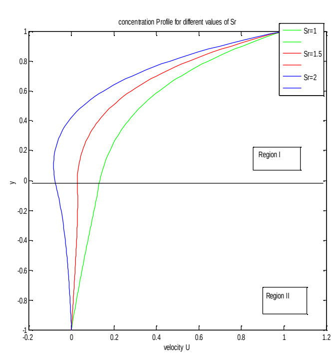
Effect of in Pr Velocity Profile

Figures 7



Effect of in Pr in Temperature

Figure 8



Effect of in Sr in Concentration

CONCLUSIONS

In this paper, the effect of soret is mainly studied by using various parameters under unsteady mixed convective flow of an immiscible fluid through a Horizontal channel in a porous and non-porous channels . The fluid is electrically conducting through a porous medium in the presence of uniform magnetic field. Soret Effect is added by its mathematical form. The governing equations o are are solved analytically. The analytical results are derived for the flow field , heat transfer , mass transfer , by using the perturbation technique. The features of the flow characteristics are analyzed by plotting graphs and discussed in detail. The velocity profiles increases the value of Grashof number, Prandtl Number , Permeability parameter but they are decreasing based on the values of heat source parameter, radiation parameter Also an increase in Soret number increases the velocity profiles, concentration and temperature profile. The effect of porous decreases the flow in both regions.

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