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Hall effect on unsteady MHD flow along vertical plate with variable temperature and mass diffusion in the presence of porous medium and chemical reaction

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Abstract. *The effects of chemical reaction and Hall current on the unsteady magneto hydrodynamic flow along a vertical plate with variable temperature and mass diffusion in the presence of a porous medium is studied hare. The fluid flow model of this paper contains governing partial differential equations of the motion, energy, and diffusion equation. To simplify the analysis, the governing equations are transformed into dimensionless form using non-dimensional variables. The Laplace-transform technique is employed to obtain an exact solution for the flow equations of the MHD model. The results of the analysis are presented using graphical representations of the velocity profiles. With the help of graphs, we discussed the behavior of fluid velocities with different parameters, including the chemical reaction parameter, Hall currents parameter, accelerated parameter, magnetic field parameter, and permeability parameter, and the numerical values of Sherwood number have been tabulated. We found that the values obtained for velocity, concentration and temperature are in concurrence with the actual flow of the fluid.*

Keywords: *MHD flow, chemical reaction, Hall current*

1. Introduction

The influence of chemical reaction and Hall current on magneto hydrodynamic (MHD) flow has been extensively studied in various scientific and technological fields, including chemical engineering, mechanical engineering, biological science, and petroleum engineering. Researchers have investigated different aspects of MHD flow problems associated with these factors, focusing on diverse scenarios and phenomena. Raptis and Kafousias [4] examined MHD free convection flow and mass transfer through a porous medium bounded by an infinite vertical porous plate with a constant heat flux. They aimed to understand the behavior of the flow and its interaction with the porous medium in the presence of MHD effects, chemical reactions, and heat transfer. Abo-Eldahab et al. [1] explored the impact of Hall current on MHD free-convection flow past a semi-infinite vertical plate with mass transfer. Their investigation sought to comprehend how the Hall current influenced the convective flow patterns and the transfer of mass between the fluid and the plate. Youn [10] focused on the heat and mass transfer in MHD micro polar flow over a vertical moving porous plate in a porous medium. Attia [2] analyzed the ion slip effect on unsteady Coquette flow with heat transfer under an exponential decaying pressure gradient. The investigation aimed to understand how the ion slip phenomenon influenced the flow behavior, heat transfer, and the overall fluid dynamics. The influence of chemical reaction and Hall current on MHD flow was also explored by Ibrahim and Makinde [3], they investigated the chemically reacting MHD boundary layer flow of heat and mass transfer over a moving vertical plate with suction. The study aimed to uncover the effects of these factors on the boundary layer flow, heat transfer, and mass transfer processes. Sahin and Chamkha [8] studied the effects of chemical reaction, heat and mass transfer, and radiation on MHD flow along a vertical porous wall in the presence of an induced magnetic field. Their investigation aimed to comprehend the combined impact of these factors on the flow characteristics, heat transfer, and mass transfer mechanisms occurring within the porous medium. Rajput and Kumar [6] focused on unsteady MHD flow past an impulsively started inclined plate with variable temperature and mass diffusion in the presence of Hall currents. By considering the effects of unsteadiness, variable temperature, mass diffusion, and Hall currents, they aimed to analyze the complex interactions and their influence on the flow behavior and heat and mass transfer. Further, they [5] have worked on chemical reaction effect on unsteady MHD flow past an impulsively started oscillating inclined plate with variable temperature and mass diffusion in the presence of Hall current. Sharma et al. [9] studied Influence of chemical reaction and radiation on unsteady MHD free convection flow and mass transfer through viscous incompressible fluid past a heated vertical plate immersed in porous medium in the presence of heat source. The study aimed to understand how the chemical reaction, radiation, and MHD effects influenced the convective flow patterns, heat transfer, and mass transfer in the presence of a porous medium. Rajput and Kumar [7] examined the effects of radiation and chemical reaction on MHD flow past a vertical plate with variable temperature and mass diffusion. Their investigation aimed to analyze the combined influence of radiation, chemical reaction, and MHD effects on the flow behavior, heat transfer, and mass transfer occurring near the vertical plate.

In this paper, we have investigate the influence of chemical reaction and Hall current on unsteady MHD flow along a vertical plate with variable temperature and mass diffusion in the presence of a porous medium. The present study provides insights into how these factors affect the flow characteristics, heat transfer, and mass transfer processes. The results of their investigation are presented using graphical representations and tabulated data, which help visualize and summarize the findings.

2. Mathematical Analysis.

In this paper, consider unsteady MHD flow past on vertical plate with no electrical conductivity. The plate's x axis and z normal are taken along the flow of fluid. Fluid flow has a primary velocity u along the plate, while fluid has a secondary velocity v along the z-axis. The uniform strength magnetic field B_0 is applied perpendicular to the surface at angled φ. The plate and the fluid were first assumed to be at the same temperature T_∞. It is assumed that C is the species concentration in the fluid. The temperature of the plate is increased to T_w at time $t > 0$ when the plate suddenly starts to rise vertically upward in its own plane in the positive x-direction with a velocity of u_0 f(t). The concentration C near the plate is raised linearly with respect to time. The induced magnetic field can be ignored because the fluid has a relatively low Reynolds number value. So, under above assumptions, the flow model is as under.

Momentum equations

$$\frac{\partial u}{\partial t} = \upsilon\frac{\partial^2 u}{\partial z^2} + g\beta(T - T_\infty) + g\beta^*(C - C_\infty) - \frac{\sigma B_0^2 Cos^2\varphi(u + mvCos\varphi)}{\rho(1 + m^2 Cos^2\varphi)} - \frac{\upsilon u}{K}, \quad (1)$$

$$\frac{\partial v}{\partial t} = \upsilon\frac{\partial^2 v}{\partial z^2} + \frac{\sigma B_0^2 Cos^2\varphi(muCos\varphi - v)}{\rho(1 + m^2 Cos^2\varphi)} - \frac{\upsilon v}{K}, \quad (2)$$

Diffusion equation

$$\frac{\partial C}{\partial t} = D\frac{\partial^2 C}{\partial z^2} - K_C(C - C_\infty), \quad (3)$$

Energy equation

$$\rho C_p\frac{\partial T}{\partial t} = k\frac{\partial^2 T}{\partial z^2} \quad (4)$$

Following are the initial and boundary conditions:

$$\left.\begin{aligned} & t \le 0: u = 0,\ v = 0,\ T = T_\infty,\ C = C_\infty, \text{ for every } z, \\ & t > 0: u = u_0 f(t),\ v = 0, T = T_\infty + (T_w - T_\infty)\frac{u_0^2 t}{\upsilon}, C = C_\infty + (C_w - C_\infty)\frac{u_0^2 t}{\upsilon}, \text{ at } z=0, \\ & u \to 0,\ v \to 0,\ T \to T_\infty,\ C \to C_\infty \text{ as } z \to \infty. \end{aligned}\right\} \quad (5)$$

Here u and v are the primary and the secondary velocities along x and z respectively, ν- the kinematic viscosity, ρ- the density, C_p- the specific heat at constant pressure, k- thermal conductivity of the fluid, D- the mass diffusion coefficient, g- gravitational acceleration, β- volumetric coefficient of thermal expansion, t- time, m- the Hall current parameter, T- temperature of the fluid, β^* - volumetric coefficient of concentration expansion, C- species concentration in the fluid, T_w- temperature of the plate, C_w- species concentration, ϕ - Angle of inclination, B_0 - the uniform magnetic field, σ - electrical conductivity.

To convert equations (1), (2), (3), and (4) into dimensionless form, the following non-dimensional quantities are introduced:

$$\left.\begin{aligned} &\bar{z} = \frac{zu_0}{\upsilon},\ \bar{u} = \frac{u}{u_0},\ \bar{v} = \frac{v}{u_0}, S_c = \frac{\upsilon}{D},\ \mu = \rho\upsilon,\ M = \frac{\sigma B_0^2 \upsilon}{\rho u_0^2}, \\ &K_0 = \frac{\upsilon K_C}{u_0^2}, P_r = \frac{\mu C_p}{k}, G_r = \frac{g\beta\upsilon(T_w - T_\infty)}{u_0^{\ 3}}, \theta = \frac{(T - T_\infty)}{(T_w - T_\infty)}, \\ &G_m = \frac{g\beta^*\upsilon(C_w - C_\infty)}{u_0^{\ 3}},\ \overline{C} = \frac{(C - C_\infty)}{(C_w - C_\infty)}, \bar{t} = \frac{tu_0^2}{\upsilon}, \end{aligned}\right\} \tag{6}$$

The symbols in dimensionless form are as under:

b- Acceleration parameter, θ - the temperature, $\overline{C}$ - the concentration, G_r - thermal Grashof number, $\bar{u}$ - the primary velocity, $\bar{v}$ - the secondary velocity, μ- the coefficient of viscosity, P_r- the Prandtl number, S_c- the Schmidt number, $\bar{t}$ - time, G_r- mass Grashof number, K_0 - The chemical reaction parameter, $\overline{K}$ - permeability parameter of the medium, Ha- the magnetic parameter.

As a result, the model is:

$$\frac{\partial \bar{u}}{\partial \bar{t}} = \frac{\partial^2 \bar{u}}{\partial \bar{z}^2} + G_r\theta + G_m\overline{C} - \frac{(Ha)^2 Cos^2\varphi(\bar{u} + m\bar{v}Cos\varphi)}{(1 + m^2 Cos^2\varphi)} - \frac{1}{\overline{K}}\bar{u}, \tag{7}$$

$$\frac{\partial \bar{v}}{\partial \bar{t}} = \frac{\partial^2 \bar{u}}{\partial \bar{z}^2} + \frac{(Ha)^2 Cos^2\varphi(m\bar{u}Cos\varphi - \bar{v})}{(1 + m^2 Cos^2\varphi)} - \frac{1}{\overline{K}}\bar{v}, \tag{8}$$

$$\frac{\partial \overline{C}}{\partial \bar{t}} = \frac{1}{S_c}\frac{\partial^2 \overline{C}}{\partial \bar{z}^2} - K_0\overline{C}, \tag{9}$$

$$\frac{\partial \theta}{\partial \bar{t}} = \frac{1}{P_r}\frac{\partial^2 \theta}{\partial \bar{z}^2}. \tag{10}$$

with the aforementioned boundary constraints:

$$\left.\begin{array}{l}\bar{t} \le 0 : \bar{u} = 0,\ \bar{v} = 0,\ \theta = 0,\ \bar{C} = 0, \text{ for every } \bar{z}, \\ \bar{t} > 0 : \bar{u} = f(\bar{t}),\ \bar{v} = 0,\ \theta = \bar{t},\ \bar{C} = \bar{t}, \text{ at } \bar{z} = 0. \\ \bar{u} \to 0,\ \bar{v} \to 0,\ \theta \to 0,\ \bar{C} \to 0, \text{ as } \bar{z} \to \infty. \end{array}\right\} \tag{11}$$

When we drop bars from the equations above, we obtain:

$$\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial z^2} + G_r\,\theta + G_m C - \frac{(Ha)^2 Cos^2\varphi(u + mvCos^2\varphi)}{(1 + m^2 Cos^2\varphi)} - \frac{1}{K}u, \tag{12}$$

$$\frac{\partial v}{\partial t} = \frac{\partial^2 v}{\partial z^2} + \frac{(Ha)^2 Cos^2\varphi(muCos\varphi - v)}{(1 + m^2 Cos^2\varphi)} - \frac{1}{K}v, \tag{13}$$

$$\frac{\partial C}{\partial t} = \frac{1}{S_c}\frac{\partial^2 C}{\partial z^2} - K_0 C, \tag{14}$$

$$\frac{\partial \theta}{\partial t} = \frac{1}{P_r}\frac{\partial^2 \theta}{\partial z^2}. \tag{15}$$

with the boundary conditions:

$$\left.\begin{array}{l} t \le 0 : u = 0,\ v = 0,\ \theta = 0,\ C = 0, \text{ for every } z, \\ t > 0 : u = f(t),\ v = 0,\ \theta = t,\ C = t, \text{ at } z = 0, \\ u \to 0,\ v \to 0,\ \theta \to 0,\ C \to 0, \text{ as } z \to \infty. \end{array}\right\} \tag{16}$$

Combining equations (12) and (13) in the following form:

$$\frac{\partial q}{\partial t} = \frac{\partial^2 q}{\partial z^2} + G_r\,\theta + G_m\,C - \frac{(Ha)^2 Cos^2\varphi(1 - imCos\varphi)q}{1 + m^2 Cos^2\varphi} - \frac{q}{K}, \tag{17}$$

$$\frac{\partial C}{\partial t} = \frac{1}{S_c}\frac{\partial^2 C}{\partial z^2} - K_0 C, \tag{18}$$

$$\frac{\partial \theta}{\partial t} = \frac{1}{P_r}\frac{\partial^2 \theta}{\partial z^2}. \tag{19}$$

the boundary conditions:

$$\left.\begin{array}{l} t \le 0: q = 0, \theta = 0, C = 0, \text{ for every } z, \\ t > 0: q = f(t), \theta = t, C = t, \text{ at } z=0, \\ q \to 0,\ \theta \to 0,\ C \to 0, \text{ as } z \to \infty. \end{array}\right\} \tag{20}$$

The standard Laplace-transform method is used to solve the dimensionless governing equations (17) to (19), subject to the boundary conditions (20). The found solutions are as follows:

$$C = \frac{1}{4\sqrt{K_0}} \exp(-z\sqrt{S_c K_0})\{erfc[\frac{1}{2\sqrt{t}}(z\sqrt{S_c} - 2t\sqrt{K_0})](-z\sqrt{S_c}$$

$$+ 2t\sqrt{K_0}) + \exp(2z\sqrt{S_c K_0}) erfc[\frac{1}{2\sqrt{t}}(z\sqrt{S_c} + 2t\sqrt{K_0})](z\sqrt{S_c}$$

$$+ 2t\sqrt{K_0})\}.$$

$$\theta = t\{(1 + \frac{z^2 P_r}{2t}) erfc[\frac{z\sqrt{P_r}}{2\sqrt{t}}] - \frac{z\sqrt{P_r}}{\sqrt{\pi}\sqrt{t}} \exp(-\frac{z^2}{4t}) P_r\}.$$

Case 1: In this case, we considered the motion of the surface with uniform velocity, and the velocity is

$$q = \frac{e^{-\sqrt{a}z}}{2}\left(1 + erf[\frac{2\sqrt{a}t - z}{2\sqrt{t}}] + e^{2\sqrt{a}z} erfc[\frac{2\sqrt{a}t + z}{2\sqrt{t}}]\right) + \frac{1}{4a^2} G_r \{z\chi_{11}$$

$$+ 2\exp(-\sqrt{a}z)\chi_2 P_r + 2\chi_{14}\chi_4(1 - P_r)\} + \frac{G_m}{4(a - K_0 S_c)^2}\{z\chi_{11} + 2\chi_{13}\chi_5$$

$$(1 - S_c) + 2\exp(-\sqrt{a}z)\chi_2 S_c(1 - tK_0) - \frac{1}{\sqrt{a}} z\exp(-\sqrt{a}z)\chi_3 K_0 S_c\}$$

$$- \frac{1}{2a^2\sqrt{\pi}} G_r\{2za\exp(\frac{-z^2 P_r}{4t})\sqrt{tP_r} + \sqrt{\pi}\chi_{14}(\chi_6 + \chi_7 P_r) + \sqrt{\pi}\chi_{12}$$

$$(az^2 P_r - 2 + 2at + 2P_r)\} + \frac{G_m\sqrt{S_c}}{2\sqrt{\pi}(a - K_0 S_c)^2}\{\frac{1}{2\sqrt{K_0}}\exp(-z\sqrt{K_0 S_c})$$

$$\chi_9\sqrt{\pi S_c}(S_c K_0 - az) + \chi_{13}\sqrt{\pi} A_{10}(S_c - 1) + \exp(-z\sqrt{K_0 S_c})\sqrt{\pi}\chi_8(1$$

$$- at - S_c + tK_0 S_c)\}$$

Case 2: In this case, we studied the motion of the surface with exponentially accelerating, after which the fluid's velocity is

$$q=\frac{1}{2}\exp(bt-\sqrt{a+bz})(1+erf[\frac{2\sqrt{a+bt}-z}{2\sqrt{t}}]+\exp(2\sqrt{a+bz})$$

$$erfc[\frac{2\sqrt{a+bt}+z}{2\sqrt{t}}])+\frac{1}{4a^2}G_r\{z\chi_{11}+2\exp(-\sqrt{a}z)\chi_2 P_r+2\chi_{14}\chi_4$$

$$(1-P_r)\}+\frac{G_m}{4(a-K_0S_c)^2}\{z\chi_{11}+2\chi_{13}\chi_5(1-S_c)+2\exp(-\sqrt{a}z)\chi_2$$

$$S_c(1-tK_0)-\frac{1}{\sqrt{a}}z\exp(-\sqrt{a}z)\chi_3K_0S_c\}-\frac{1}{2a^2\sqrt{\pi}}G_r\{2za\exp(\frac{-z^2P_r}{4t})$$

$$\sqrt{tP_r}+\sqrt{\pi}\chi_{14}(\chi_6+\chi_7P_r)+\sqrt{\pi}\chi_{12}(az^2P_r-2+2at+2P_r)\}$$

$$+\frac{G_m\sqrt{S_c}}{2\sqrt{\pi}(a-K_0S_c)^2}\{\frac{1}{2\sqrt{K_0}}\exp(-z\sqrt{K_0S_c})\chi_9\sqrt{\pi\, S_c}(S_cK_0-az)$$

$$+\chi_{13}\sqrt{\pi}A_{10}(S_c-1)+\exp(-z\sqrt{K_0S_c})\sqrt{\pi}\chi_8(1-at-S_c+tK_0S_c)\}$$

where,

$$q=u+iv,\ a=\frac{(Ha)^2Cos^2\varphi(1-imCos\varphi)}{1+m^2Cos^2\varphi}+\frac{1}{K}.$$

$$\chi_1=1+\chi_{16}+\exp(2\sqrt{a}z)(1-\chi_{17}),\ \chi_2+\chi_1=0,$$

$$\chi_3+\exp(2z\sqrt{a})(1-\chi_{17})=1+\chi_{16},\quad \chi_4+1=\chi_{22}+\chi_{18}(\chi_{23}-1),$$

$$\chi_5+1=\chi_{24}+\chi_{19}(\chi_{25}-1),\qquad \chi_6+\chi_{26}+1=\chi_{18}(\chi_{27}-1),$$

$$\chi_7+\chi_6=0,\ \chi_8+\chi_{20}+1=\chi_{30}(\chi_{21}-1),$$

$$\chi_9=1+\chi_{20}+\chi_{30}(\chi_{21}-1),\ \chi_{10}+\chi_{28}+1=\chi_{19}(\chi_{29}-1),$$

$$z\chi_{11}=\exp(-\sqrt{az})(2\chi_1+2at\chi_2+\sqrt{a}\chi_3),\ \chi_{12}+1=erf[\frac{z\sqrt{P_r}}{2\sqrt{t}}],$$

$$\chi_{13}=\exp(\frac{at-tK_0S_c}{S_c-1}-z\chi_{31}\sqrt{S_c}),\ \chi_{14}=\exp((\chi_{32})^2t-z\chi_{32}\sqrt{P_r}),$$

$$\chi_{15}=1,\ \chi_{16}=erf[\frac{2\sqrt{a}t-z}{2\sqrt{t}}]\ \chi_{17}=erf[\frac{2\sqrt{a}t+z}{2\sqrt{t}}],$$

$$\chi_{18} = \exp(-2z\chi_{32}\sqrt{P_r})\,,\ \chi_{19} = \exp(-2z\chi_{31}\sqrt{S_c}),$$

$$\chi_{20} = erf[\sqrt{tK_0} - \frac{z\sqrt{S_c}}{2\sqrt{t}}],\ \chi_{21} = erf[\sqrt{tK_0} + \frac{z\sqrt{S_c}}{2\sqrt{t}}],$$

$$\chi_{22} = erf[\frac{1}{2t}(z - 2t\chi_{32}\sqrt{P_r})],\ \chi_{23} = erf[\frac{1}{2t}(z + 2t\chi_{32}\sqrt{P_r})],$$

$$\chi_{24} = erf[\frac{1}{2t}(z - 2t\chi_{31}\sqrt{S_c})],\ \chi_{25} = erf[\frac{1}{2t}(z + 2t\chi_{31}\sqrt{S_c})],$$

$$\chi_{26} = erf[\frac{1}{2\sqrt{t}}(2t\chi_{32} - z\sqrt{P_r})],\ \chi_{27} = erf[\frac{1}{2\sqrt{t}}(2t\chi_{32} + z\sqrt{P_r})],$$

$$\chi_{28} = erf[\sqrt{t}\chi_{31} - \frac{zS_c}{2\sqrt{t}}],\ \chi_{29} = erf[\sqrt{t}\chi_{31} + \frac{zS_c}{2\sqrt{t}}],$$

$$\chi_{30} = \exp(2z\sqrt{K_0\sqrt{S_c}}),\ (\chi_{31})^2 = \frac{(a-K_0)}{S_c-1},\ (\chi_{32})^2 = \frac{a}{P_r - 1}$$

2.1. Sherwood Number

The dimensionless Sherwood number is given by

$$S_h = \left(\frac{\partial C}{\partial z}\right)_{z=0} = erfc[-\sqrt{tK_0}](-\frac{1}{4\sqrt{K_0}}\sqrt{S_c} - \frac{t\sqrt{S_cK_0}}{2}) + \sqrt{S_c}erfc[\sqrt{tK_0}](\frac{1}{4\sqrt{K_0}} + t\sqrt{K_0}) - \frac{e^{-tK_0}\sqrt{tS_cK_0}}{\sqrt{\pi K_0}},$$

The numerical values of S_h are given in table-1 for different parameters.

3. Results and Discussion

In this paper, graphical representations of the analytical solution obtained for the MHD fluid velocity, which has two components-primary velocity u and secondary velocity v in the transverse direction and along the direction of motion of the surface, are shown in figures 1 to 14. Here, two cases are discussed thought graph: Figures 1 to 6 show the velocity profile for the first case's various parameters, such as the magnetic field parameter (*Ha*), Hall parameter (*m*), chemical reaction parameter (K_0), acceleration parameter (b), and permeability parameter (K), while additional figures are shown for the second case of the solution. It is observed that in both situations, primary velocity and secondary velocity each reach an extreme value in the area close to the plate before gradually decreasing to reach free stream value. Figures 1 and 7 show that as the angle of inclination φ increases, the primary fluid velocity rises and the secondary fluid velocity falls. From figures 2 and 10, it can be concluded that as permeability parameter K increases, then rise the velocities. This is because a decrease in the resistance of the porous medium, as indicated by an increase in the permeability parameter K, tends to accelerate primary and secondary velocities in the boundary layer region. It seems that the velocities decrease as the chemical reaction parameter K_0 increases (Figures 3, 4, and 11, 12). It can be seen from figures 5 and 13 that speeds rise as the Hall current parameter m is raised. Additionally, figures 6 and 14 show that increasing values of the parameter Ha have the opposite effect on u and v. Figures 8 and 9 show that when velocities increase, the acceleration parameter b also increases.

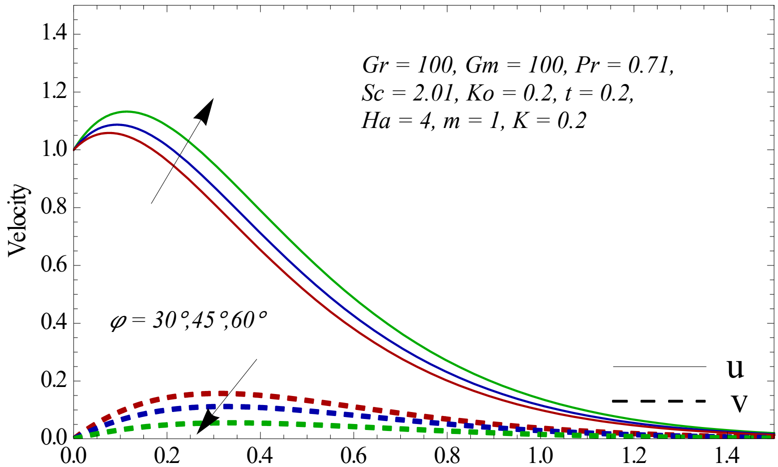

Figure 1. Velocity u and v for different values of φ

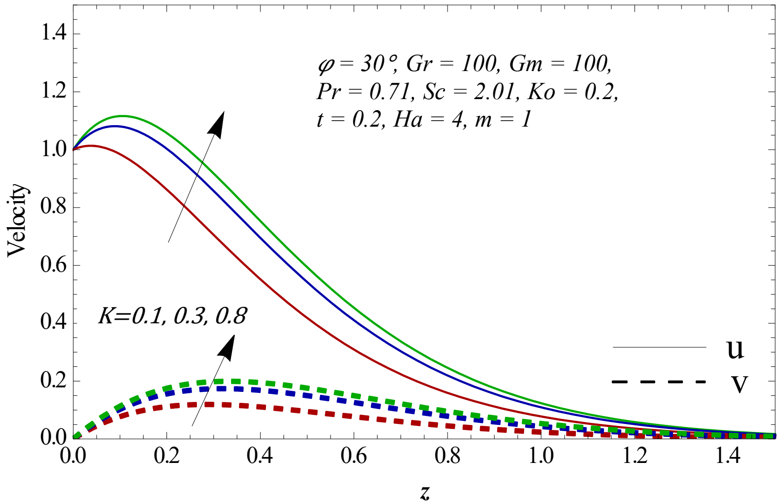

Figure 2. Velocity u and v for different values of *K*

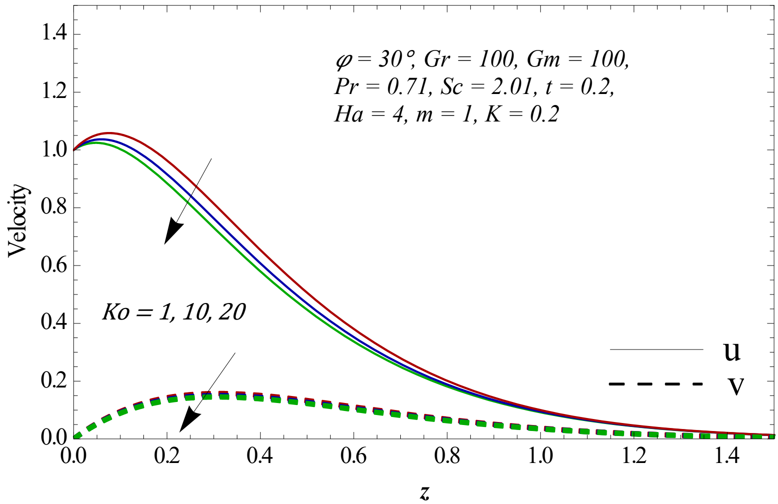

Figure 3. Velocity u and v for different values of *Ko*

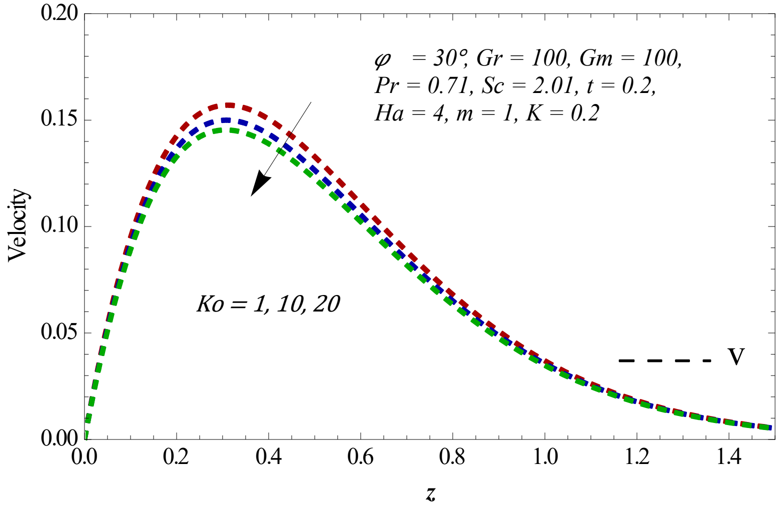

Figure 4. Velocity v for different values of *Ko*

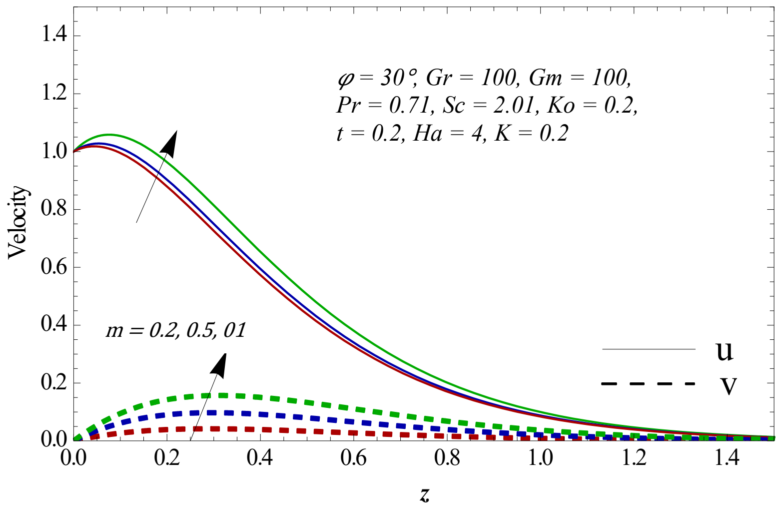

Figure 5. Velocity u and v for different values of *m*

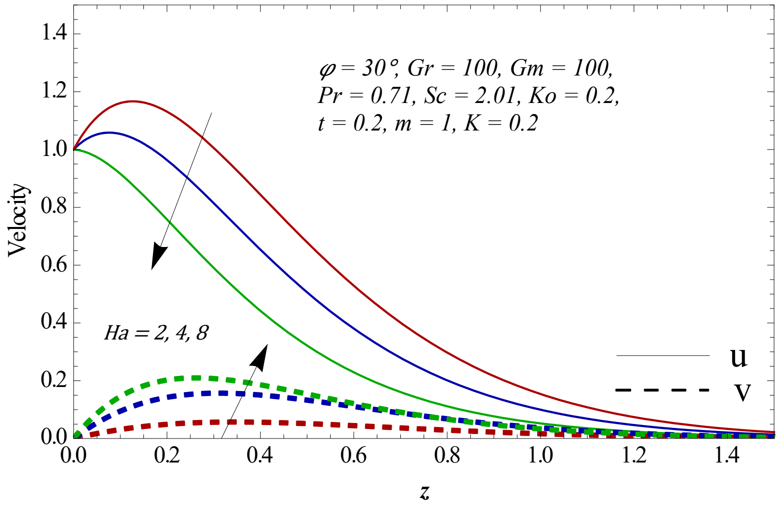

Figure 6. Velocity u and v for different values of *Ha*

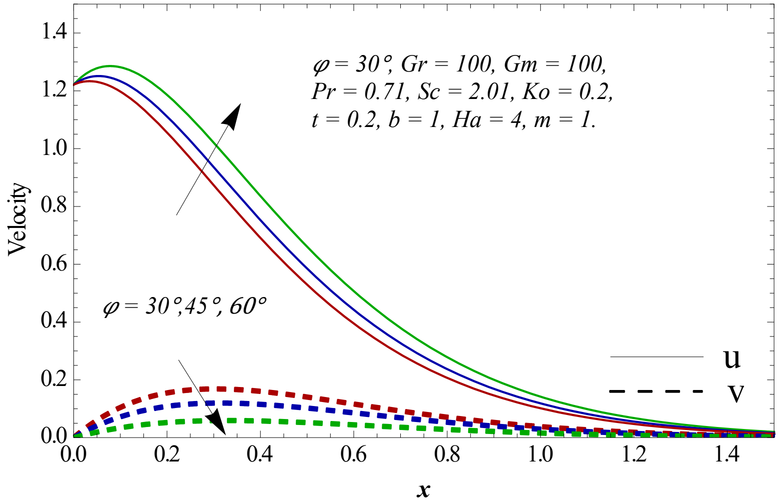

Figure 7. Velocity u and v for different values of φ

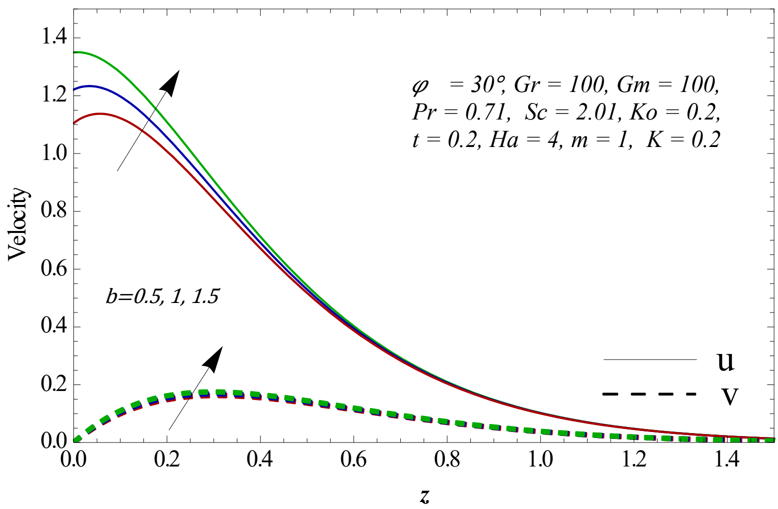

Figure 8. Velocity u and v for different values of *b*

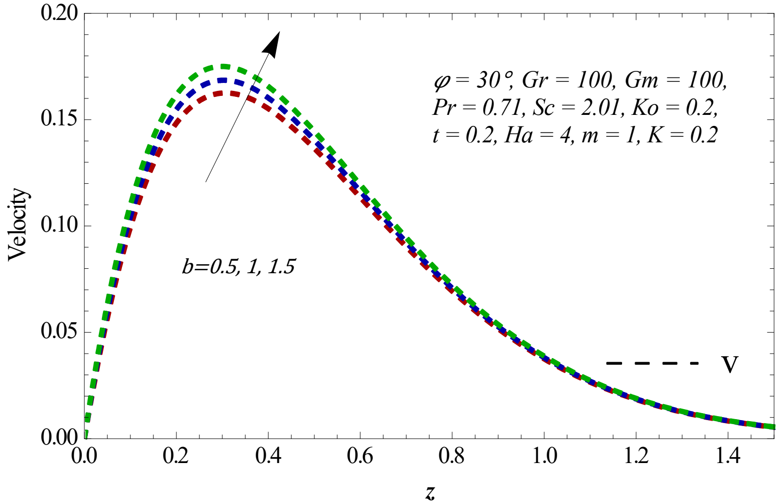

Figure 9. Velocity v for different values of *b*

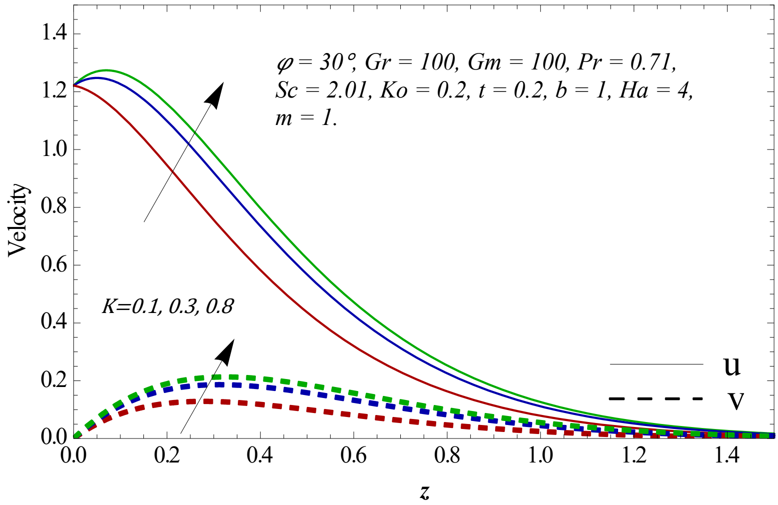

Figure 10. Velocity u and v for different values of *K*

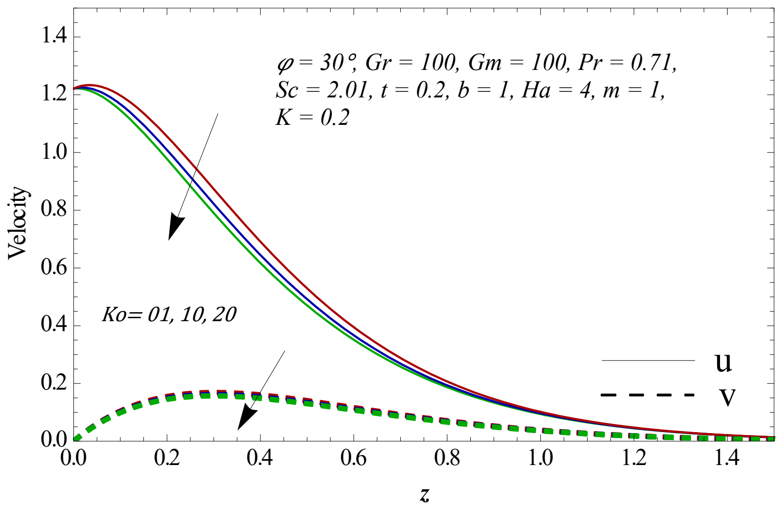

Figure 11. Velocity u and v for different values of *Ko*

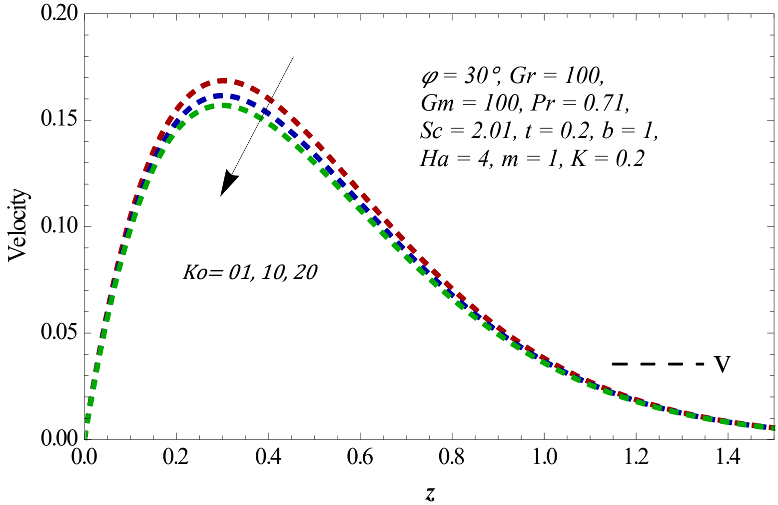

Figure 12. Velocity v for different values of *Ko*

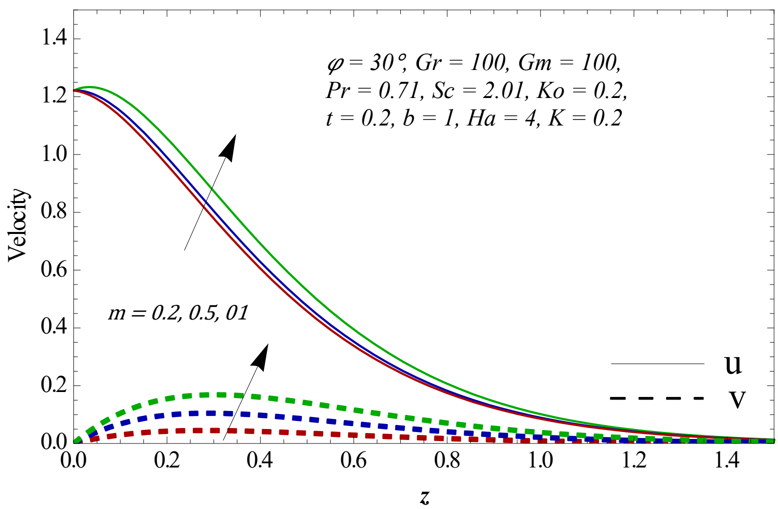

Figure 13. Velocity u and v for different values of *m*

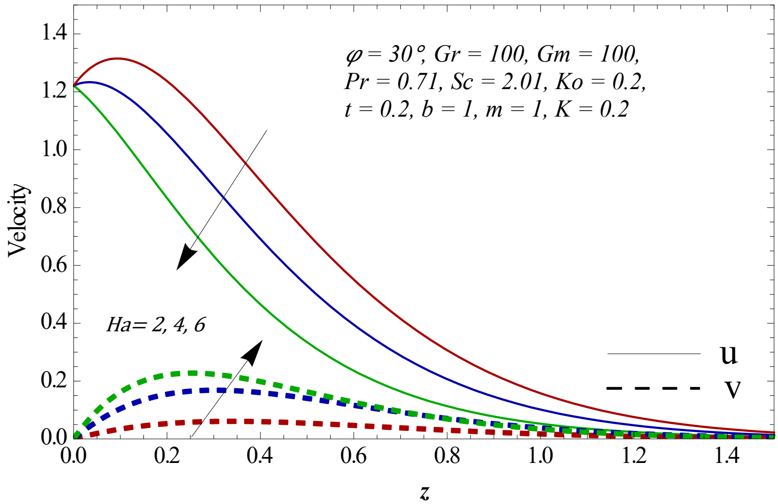

Figure 14. Velocity u and v for different values of *Ha*

Table 1. Sherwood number for different Parameters

K_0	Sc	t	S_h
01	2.01	0.2	-0.7622
10	2.01	0.2	-1.1182
20	2.01	0.2	-1.4264
05	3.00	0.2	-1.1399
05	4.00	0.2	-1.3162
05	2.01	0.3	-1.2602
05	2.01	0.4	-1.5814

4. Conclusion

An analytical investigation has been conducted for the MHD fluid flow model under the consideration by converting the governing linear partial differential equations into non dimensional form. It has been observed that raising the chemical reaction parameter causes a decrease in boundary layer velocity. The velocity of fluid close to the surface increase as the acceleration parameter increases. It has been noted that Hall current tends to slow secondary fluid flow velocity while accelerating primary flow of the velocity. We observed that the values obtained for velocity, concentration and temperature are in concurrence with the actual flow of the MHD fluid.

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