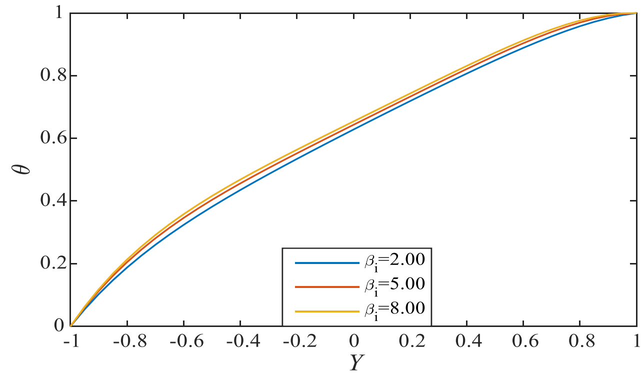
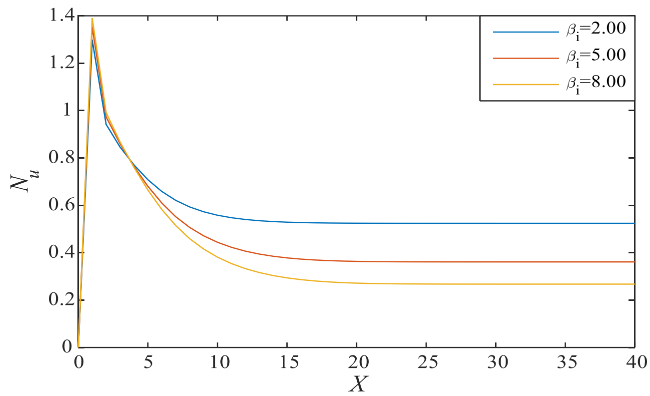


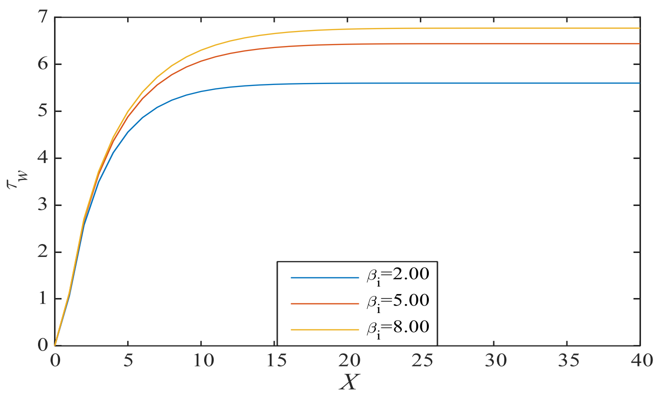
7(c)

Figure 7. Effects of Ion-slip Parameter (β_i) on (a) Primary velocity; (b) Secondary velocity and (c) Temperature distributions; where, $\beta_e = 3.00$, $H_a = 3.00$, $R_e = 3.00$, $E_c = 0.01$, $P_r = 0.30$, $k_0 = 0.50$ and $\tau_D = 0.10$ at time $\tau = 4.00$ (Steady State)

Figure 7 shows that the primary velocity and temperature profiles increases with the increase of β_i while the secondary velocity profile decreases with the increment of β_i.



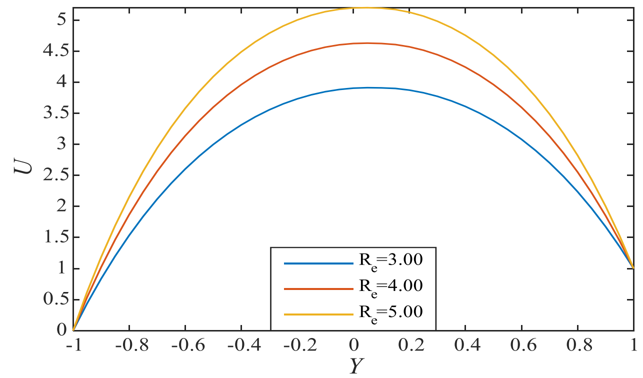
8(a)



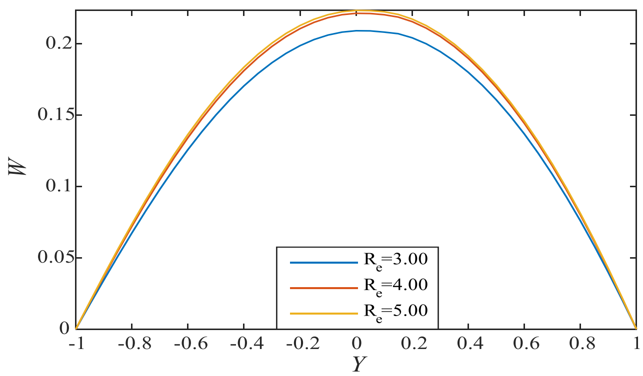
8(b)

Figure 8. Effects of Ion-slip Parameter (β_i) on (a) local Nusselt number and (b) local shear stress at moving plate; where, $\beta_e = 3.00$, $H_a = 3.00$, $R_e = 3.00$, $E_c = 0.01$, $P_r = 0.30$, $k_0 = 0.50$ and $\tau_D = 0.10$ at time $\tau = 4.00$ (Steady State)

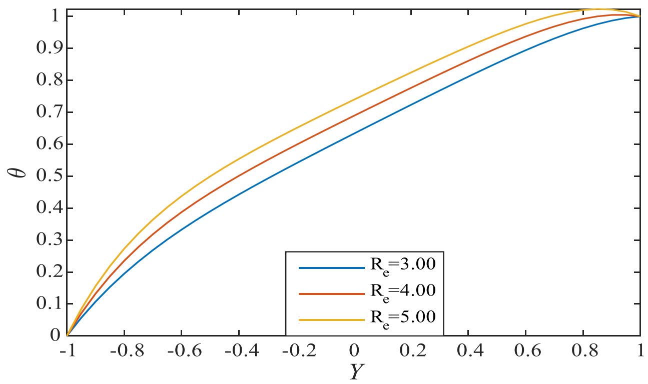
Figure 8 shows that the local Nusselt number decreases with the rise of β_i at moving plate while the local shear stress increases with the raise of β_i at moving plate.



9(a)

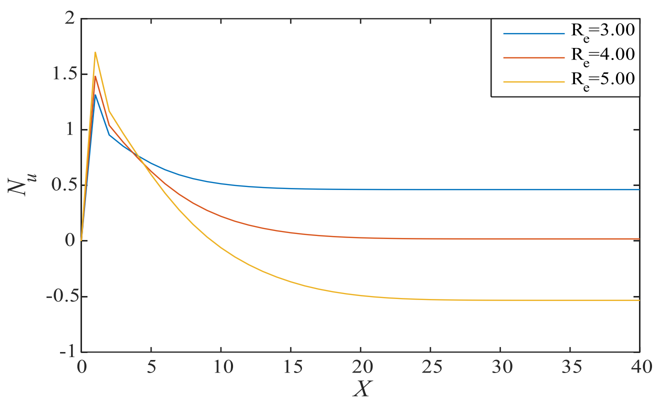


9(b)

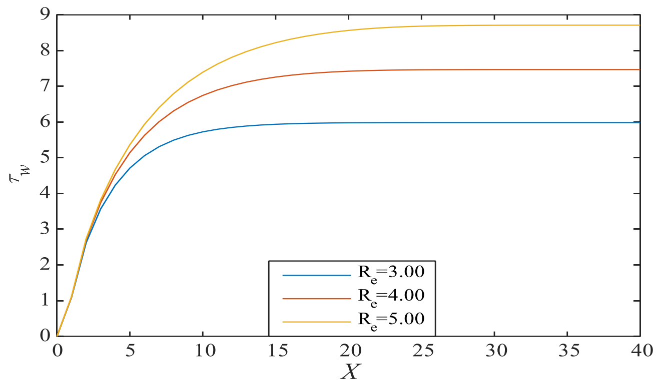


9(c)

Figure 9. Effects of Reynolds number (R_e) on (a) Primary velocity; (b) Secondary velocity and (c) Temperature distributions; where, $\beta_e = 3.00$, $H_a = 3.00$, $\beta_i = 3.00$, $E_c = 0.01$, $P_r = 0.30$, $k_0 = 0.50$ and $\tau_D = 0.10$ at time $\tau = 4.00$ (Steady State)



10(a)



10(b)

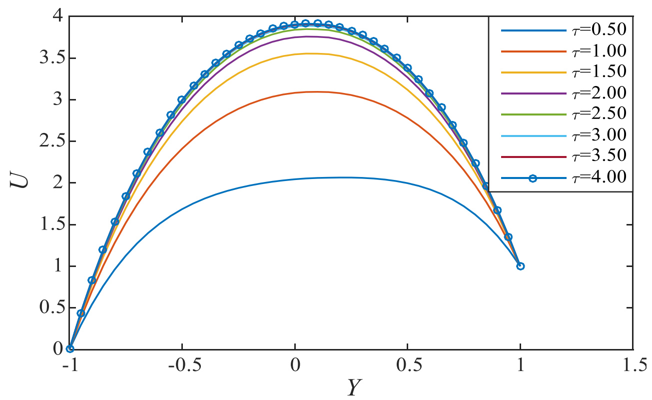
Figure 10. Effects of Reynolds number (R_e) on (a) local Nusselt number and (b) local shear stress at moving plate; where, $\beta_e = 3.00$, $H_a = 3.00$, $\beta_i = 3.00$, $E_c = 0.01$, $P_r = 0.30$, $k_0 = 0.50$ and $\tau_D = 0.10$ at time $\tau = 4.00$ (Steady State)

Figure 9 shows that the primary velocity, secondary velocity also temperature profiles increases with the increase of R_e.

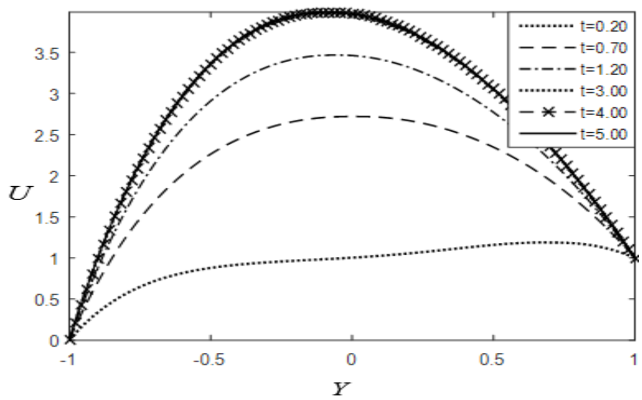
Figure 10 shows that the local Nusselt number decreases with the rise of R_e at moving plate while the local shear stress increases with the forward movement of R_e at moving plate.

4.4 Comparison

Finally, a qualitative and quantitative comparisons of the current results with the published results of Mollah et al. [14] are presented in Figures 11(a,b).



11(a) In the case of porous plate



11(b) In the case of flat plate

Figure 11. Comparison with published results

Figure 11 shows that, both the researches show qualitatively quite same results. Quantitatively, the present results are little different due to the consideration of porous plate.

5. CONCLUTIONS

The MHD generalized Couette flow and heat transfer on Bingham fluid through porous parallel plates with Ion-slip and Hall currents has been investigated numerically by explicit finite difference scheme. The mesh sensitivity and time sensitivity tests are performed for obtaining appropriate mesh size and the steady-state solution respectively. The results were discussed for some important parameters such as Hall parameter (β_e), Ion-slip parameter (β_i) and Reynolds number (R_e) and their effects on the flow behaviour. The most important outcomes of this investigation can be concluded as follows:

1. The steady-state solutions are obtained for the dimensionless time, $\tau = 4.00$.
2. The obtained appropriate mesh size is $(m,n) = (40,40)$.
3. The primary velocity and temperature profiles increases with the increment of β_e, β_i and R_e.
4. The secondary velocity increases with the increment of R_e while it decreases with the rise of β_e and β_i both.
5. The local Nusselt number decreases with the increment of β_e, β_i and R_e.
6. The local shear stress increases with the increase of β_e, β_i and R_e.

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NOMENCLATURE

$\tilde{u}, \tilde{w}$	primary and secondary velocity components
$T_1,\ T_2$	temperatures at lower and upper plates
T_m	non-dimensional mean fluid temperature
ρ	density of the fluid
B_0	Uniform magnetic field
$\tilde{\mu}$	Viscosity
σ	electric conductivity of the fluid
k'	magnetic permeability
κ	thermal conductivity
c_p	specific heat at the constant pressure
U, W	dimensionless Primary and secondary velocity components
θ	dimensionless temperature
τ	dimensionless time
τ_w	dimensionless local shear stress at moving plate
N_u	dimensionless local Nusselt number at moving plate
τ_D	Bingham number or dimensionless yield stress
β_e	Hall parameter
β_i	Ion-slip parameter
R_e	Reynolds number
P_r	Prandtl number
E_C	Eckert number
Ha	Hartmann number
k_0	permeability of porous medium