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Effect of Heat Generation and Chemical Reaction on Jeffery Fluid with Suction/Injection

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ABSTRACT

The effect of heat generation and chemical reaction on Jeffery fluid with suction/injection is studied. The governing equations are namely: momentum, energy and mass transfer equations. The partial differential equations (PDEs) were converted to sets of ordinary differential equations (ODEs) and solved analytically by regular perturbation method. Expressions for velocity, temperature and concentration of the fluid as well as coefficients for the skin friction, Nusselt and Sherwood numbers were obtained. The effects of controlling physical parameters on velocity, temperature and concentration of the fluid were depicted and analyzed. It is found that the velocity of the fluid rises as the Jeffery parameter is increased and a reverse trend is seen on the temperature as heat generation becomes significant.

Keywords: Jeffery fluids, chemical reaction, Heat Generation.

Nomenclatures

M	Hartman number
S	Heat Generation Parameter
K	Permeability parameter
S_h	Sherwood Number
N_u	Nusselt Number
P_r	Prandtl number
G_c	Thermal Grashof Number
G_r	Solutal Grashof Number
S_C	Schmidt Number
ϕ	Suction/ Injection
β_1	Jeffery fluid Parameter
δ	Chemical Reaction
σ	Skin Friction
$u(y,t)$	Velocity profile
$\eta(y,t)$	Temperature Profile
$\xi(y,t)$	Concentration Profiles

1.0 INTRODUCTION

Non-Newtonian transport phenomena arise in many branches of engineering such as mechanical, chemical and materials engineering such fluids exhibit shear strain relationships which diverge significantly from the classical Newtonian (Navier-stokes) model. MostNon-Newtonian models involve some form of modification to the momentum conservation equations. These include power-law fluids, Visco-elastic fluid model, Walters-B short memory models, Oldroyd-B models, differential Reiner-Rivlin models, Bingham plastics, tangent hyperbolic models, Eyring-powell models, nano fluid models and Maxwell fluid models.

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Among the several non-Newtonian model proposed, Jeffery fluid model is one of the significant models, because Newtonian fluid model can be deduced from this as a special case by taking $\beta_1 = 0$. Further, it is speculated that the physiological fluid such as blood exhibit Newtonian and non-Newtonianbehaviours during circulation in a living body. As with a number of rheological models developed, the Jeffery(s) models have proved quite successful (Raju*et al*., 2018).

The influence of a first-order homogeneous chemical permeability in the presence of oscillatory suction. The influence of a first-order homogenous chemical reaction, heat source and sore effects are analyzed.

Jeffery fluid flows are problems are useful in nuclear engineering in connection with cooling of reactors, in the case of the effect of heat generation and chemical reaction under action transverses magnetic field and the presence of suction. The Effect of Chemical reaction depend whether the reaction is homogeneous or heterogeneous, this depends on whether they occur at an interface or a single phase volume reaction. In well-mixed systemsthe reactions heterogeneous,it takes place at an interface and homogeneous, ifit takes place in solution. In most cases of Chemical reactions, the reaction rate depends on the concentration of the species itself Humane *et al.,* (2021).

The boundary condition for suction injection is that the standard component of the velocity at the wall equals a specified value, which can be positive or negative. The suction or injection parameter affects the velocity and temperature profiles of the fluid, as well as the skin friction and heat transfer coefficients. The suction or injection can also prevent or delay the boundary layer separation Iranian *et al.,* (2023).

Jeffery fluids are first proposed by William Jeffery in 1992, and they are a type of Viscoelastic fluid. Viscoelastic fluids have both elastic and viscous properties, and their behaviour depend on the rate of deformation. In a Jeffery fluid, the stress-strain relation is a linear combination of Newtonian fluid and a generalized Maxwell fluid. The properties of a Jeffery fluid depend on the relaxation time, which is the time it takes for the fluid to recover from a deformation. A common model for heat generation is the Arrhenius model, which describe the heat generation rate as a function of temperature. In the Arrhenius model, the heat generation rate is directly proportional to the exponential of the temperature. This means that the heat generation rate increases exponentially with the temperature.

Unsteady MHD convective Jeffery flow of a viscous, electrically conducting and incompressible fluid was studied by (Omokhuale and Dange 2023). The Effects of MHD Slip Flow on Heat and Mass Transfer by Radiation, Chemical Reaction, and Suction/Injection Over a Shrinking Sheet in a Porous Medium Using the Keller Box Method was studied and examine by (Prashanth and Srinivasa 2025).

The magnetohydrodynamic (MHD) squeezing flow of Jeffrey fluid between two parallel plates in a porous medium with the presence of thermal radiation, heat generation/absorption and chemical reaction studied by Noor *et al.,* (2020).

Unsteady and hydromagnetic Jeffrey fluid flowing through an insulated, permeable system comprising two vertical parallel channels was examine by (Shabiha and Tamizharasi 2025), The analysis

incorporates the effects of uniform injection/suction, natural convection, and viscous dissipation and also the key innovation of the research is the inclusion of an external electric load, which acts as a circuit connecting the parallel channels to facilitate energy and current transfer.

Sachin *et al*., (2025) studies jeffrey fluid flow with heat and mass transfer. In advances in computational fluid dynamics it was examine in the study that the impact of a heat source and Schmidt number on Jeffrey fluid movement over an expanding surface is crucial in controlling heat and mass transfer in industrial and engineering applications. Heat sources influence temperature distribution, enhancing or reducing thermal efficiency, while the Schmidt number determines mass diffusion rates.

(Reddy and Pallavarapu, 2022) investigate the heat and mass transfer of magnetohydrodynamics (MHD) Williamson nanofluid in a porous medium with Cattaneo-Christov double diffusion on a stretching surface and Also studies the influence of radiation, chemical reaction, heat generation, and suction/injection effects.).

Vigneshwari *et al*., (2025) studies the numerical exploration of magneto-convection and diffusion in gravity-influenced jeffrey fluid flow with suction/injection over a stretching sheet. The effect of induced magnetic field and chemical reaction with linear / non-linear vertical stretching sheet of mixed convection Jeffrey fluid near a stagnation point flow through porous medium in the presence of thermal radiation and slip flow regime is analyzed by (Kathyayani 2021). Thermal radiation and magnetic dipole on the movement and conveyance of heat in Jeffery fluid over a stretching surface that is linear studied by (Iyoko, and Olajuwo 2023).

Abbas *et al*., (2021) examine the chemical reaction and magnetohydrodynamic on the peristaltic transport of a non-Newtonian Jeffrey fluid through a porous channel.

A modelling of bioconvective flow existing with tiny particles and quartic autocatalysis reaction across stratified upper horizontal surface of a paraboloid of revolution was studied by Shah *et al* .,(2023). The flow and heat transfer of thermal radiation on the Jeffery fluid flow within a microchannel for the effects of the superhydrophobic surface (SHS) within suction/injection was studied by (Gopi*et al* 2023) it is been observed that in his study the effect of heat transfer of thermal radiation is very high due to the influence of high rate in heat generation parameter .The impact of heat absorption on unsteady MHD convective Jeffery flow of a viscous, electrically conducting and incompressible fluid studied by (Omokhuale and Dange 2023). Agarwal *et al* (2023) examine Two-dimensional Jeffery fluid flow and heat transfer with radiation and heat source effects past linearly stretched sheet under suction/injection conditions.

Channappa*, et al (*2023) examine the significance of Hall and ion slip effect on the entropy generation and flow of Jeffrey nanofluid in an upstanding porous channel with the impact of suction/injection

2.0 FORMULATION OF THE RESEARCH PROBLEM

Under the usual Bossineq's and the boundary layer the governing equation for the problem can be written as:

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Continuity Equation:

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

Momentum Equation:

$$\frac{\partial u'}{\partial t'} + v'\frac{\partial u'}{\partial y'} = g\beta(T' - T'_\infty) + g\beta'(C' - C'_\infty) + \frac{v}{1+\beta_1}\frac{\partial^2 u'}{\partial y^{2'}} - \frac{\sigma\beta_0 u'}{\rho} - \frac{v}{K'}u' \tag{2}$$

Energy Equation:

$$\frac{\partial T'}{\partial t'} + v'\frac{\partial T'}{\partial y'} = \frac{k}{\rho C_P}\frac{\partial^2 T'}{\partial y^{2'}} + \frac{1}{\rho C_p}[Q_0(T' - T'_\infty)] \tag{3}$$

Concentration:

$$\frac{\partial C'}{\partial t'} + v'\frac{\partial C'}{\partial y'} = D_C\frac{\partial^2 C'}{\partial y^{2'}} - K_c(C' - C'_\infty) \tag{4}$$

The corresponding boundary conditions are given by:

$$\left.\begin{array}{l} \xi_0 = 1,\ \xi_1 = 1, \eta_0 = 1,\ \eta_1 = 1,\ u_0 = 0, u_1 = 0\ at\ y = 0 \\ \xi_0 \to 0,\ \ \xi_1 \to 0, \eta_0 \to 0, \eta_1 \to 0, u_0 \to 0, u_1 \to 0\ as\ y \to \infty \end{array}\right\} \tag{5}$$

From (1) it is clear that the suction/injection velocity is a function of time only. Assuming that it takes the following form:

$$v' = \pm V_0 \tag{6}$$

In order to write the governing equations in dimensionless form, the following non dimensional quantities are introduced:

$$y = \frac{y' u_0}{v},\quad t = \frac{t' u_0^2}{v},\quad u = \frac{u'}{u_0}, \eta = \frac{T' - T'_\infty}{T'_w - T'_\infty},\ \xi = \frac{C' - C'_\infty}{C_w - C'_\infty} \tag{7}$$

In view of equation (7) and (6), equation (4) to (2) are reduced to the following dimensional form.

$$\frac{\partial \xi}{\partial t} + \phi\frac{\partial \xi}{\partial y} = \frac{1}{S_c}\frac{\partial^2 \xi}{\partial y^2} - \delta\xi \tag{8}$$

$$\frac{\partial \eta}{\partial t} + \phi\frac{\partial \eta}{\partial y} = \frac{1}{P_r}\frac{\partial^2 \eta}{\partial y^2} + S\eta \tag{9}$$

$$\frac{\partial u}{\partial t} + \phi\frac{\partial u}{\partial y} = (G_r)\eta + (G_c)\xi + \frac{1}{1+\beta_1}\frac{\partial^2 u}{\partial y^2} - Mu - \frac{1}{K}u \tag{10}$$

3.0 METHOD OF SOLUTION

The set of equations (10), (9) and (8) are partial differential equations which cannot be solved in closed form. However, these can be solved by reducing them into set of ordinary differential equations using the following perturbation technique. We now represent the

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velocity, temperature and concentration distribution in term of harmonic and non-harmonic functions as

$$\xi = \xi_0 + \varepsilon\xi_1 e^{nt} \quad (11)$$

$$\eta = \eta_0 + \varepsilon\eta_1 e^{nt} \quad (12)$$

$$u = u_0 + \varepsilon u_1 e^{nt} \quad (13)$$

Substituting equations (13) to (11) into equations (10) to (8), assuming the small amplitude oscillations ($\epsilon << 1$), and equating the harmonic and non-harmonic terms and neglecting the higher order of ε, we obtain the following pairs of equations of order zero and order one we get

$$\frac{d^2\xi_0}{dy^2} + \phi S_c \frac{d\xi_0}{dy} - S_c\delta\xi_0 = 0 \quad (14)$$

$$\frac{d^2\xi_1}{dy^2} + \phi S_c \frac{d\xi_1}{dy} - S_c(\delta + n)\xi_1 = 0 \quad (15)$$

$$\frac{d^2\eta_0}{dy^2} + \phi P_r \frac{d\eta_0}{dy} + SP_r\eta_0 = 0 \quad (16)$$

$$\frac{d^2\eta_1}{dy^2} + \phi P_r \frac{d\eta_1}{dy} + P_r(S - n)\eta_1 = 0 \quad (17)$$

$$\frac{d^2u_0}{dy^2} - \phi(1+\beta_1)\frac{du_0}{dy} - (1+\beta_1)\left(M + \frac{1}{K}\right)u_0 = -(1+\beta_1)G_r\eta_0 - (1+\beta_1)G_c\xi_0 \quad (18)$$

$$\frac{d^2u_1}{dy^2} - \phi(1+\beta_1)\frac{du_1}{dy} - (1+\beta_1)\left(M + \frac{1}{K} + n\right)u_1 = -(1+\beta_1)G_r\eta_1 - (1+\beta_1)G_c\xi_1 \quad (19)$$

Solving the above ODEs and applying the boundary condition we have:

$$\xi_0 = e^{-n_2 y} \quad (20)$$

$$\xi_1 = e^{-n_4 y} \quad (21)$$

$$\eta_0 = e^{-n_6 y} \quad (22)$$

$$\eta_1 = e^{-n_8 y} \quad (23)$$

$$u_0 = B_{10}e^{-n_{10}y} + B_{11}e^{-n_6 y} + B_{12}e^{-n_2 y} \quad (24)$$

$$u_1 = B_{14}e^{-n_{12}y} + B_{15}e^{-n_8 y} + B_{16}e^{-n_4 y} \quad (25)$$

$$u(y,t) = B_{10}e^{-n_{10}y} + B_{11}e^{-n_6 y} + B_{12}e^{-n_2 y} + \varepsilon[B_{14}e^{-n_{12}y} + B_{15}e^{-n_8 y} + B_{16}e^{-n_4 y}]e^{nt}$$

$$\left(\frac{du}{dy}\right)_{y=0} = -n_{10}B_{10}e^{-n_{10}y} - n_6 B_{11}e^{-n_6 y} - n_2 B_{12}e^{-n_2 y} - \varepsilon[n_{12}B_{14}e^{-n_{12}y} + n_8 B_{15}e^{-n_8 y} +$$

$$n_4 B_{16}e^{-n_4 y}]e^{nt}$$

$$\sigma = -n_{10}B_{10} - n_6 B_{11} - n_2 B_{12} - \varepsilon e^{nt}[n_{12}B_{14} + n_8 B_{15} + n_4 B_{16}]$$

The Sherwood number is:

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$$\xi(y,t) = e^{-n_2 y} + \varepsilon e^{-n_4 y}.e^{nt}$$

$$\left(\frac{d\xi}{dy}\right)_{y=0} = -n_2 e^{-n_2 y} - n_4\, \varepsilon e^{-n_4 y}.e^{nt}$$

$$S_h = -n_2 - n_4 \varepsilon e^{nt}$$

The Nusselt number is:

$$\eta(y,t) = e^{-n_6 y} + \varepsilon e^{-n_8 y}.e^{nt}$$

$$\left(\frac{d\eta}{dy}\right)_{y=0} = -n_6 e^{-n_6 y} - n_8\, \varepsilon e^{-n_8 y}.e^{nt}$$

$$N_u = -n_6 - n_8 \varepsilon e^{nt}$$

4.0 RESULT AND DISCUSSIONS

the effect of heat generation and chemical reaction on Jeffery fluid with suction/injection is investigated. Regular perturbation technique is employed in solving non-linear-coupled partial differential equations. The results shows the effect of various pertaining parameter such as Grashof number of heat transfer (G_r), Grashof number for mass transfer (G_C), Magnetic Field parameter (M), permeability parameter (k), prandtl number (Pr), Schmidt number (S_c), Heat absorption parameter (S), Chemical reaction(δ) and Jeffery fluid parameter (β_1) on the velocity, temperature and concentration profiles have been analysed.

In the present study following default parameter values are adapted for computations:
$P_r = 0.71, M = 0.5 \beta_1 = 1, K = 0.5, S_c = 1.00, \delta = 1, n = 0.1, G_c = 1, \varepsilon = 0.002, nt = \frac{\pi}{2} S = 2.00$ All graphs therefore correspond to these values unless specifically indicated on the appropriate graph.

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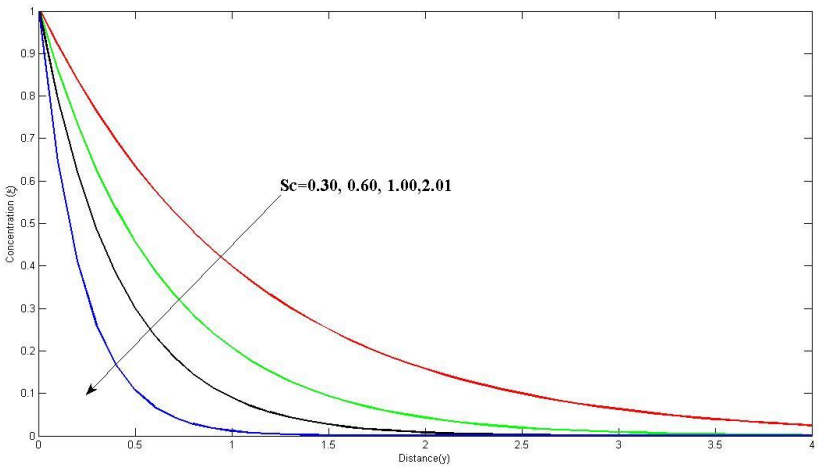

Figure 4.1: Effects of Schmidt number on concentration profiles.

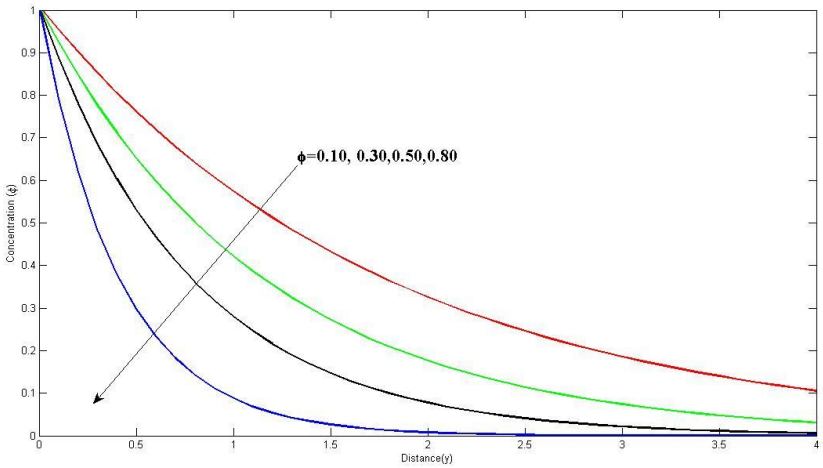

Figure 4.2: Effect of suction on concentration profiles.

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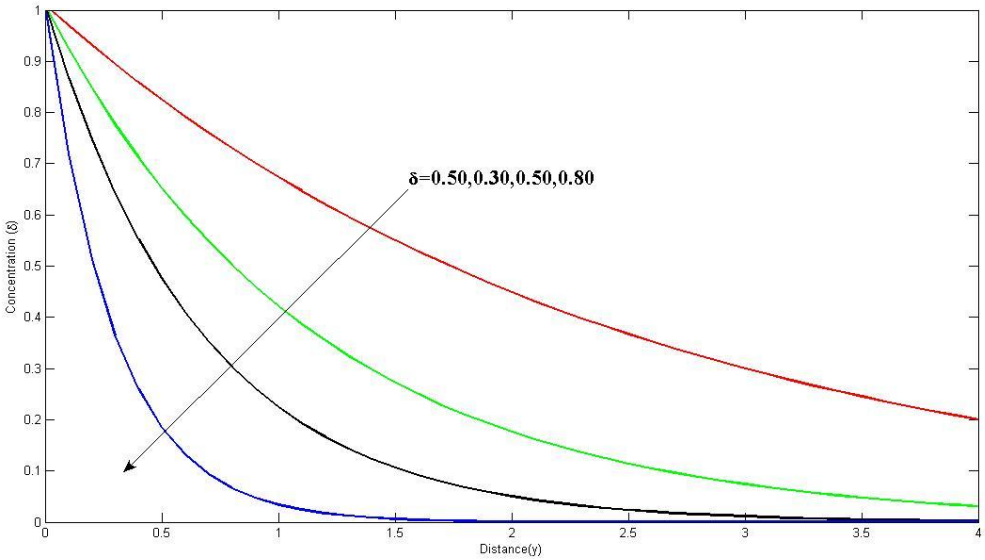

Figure 4.3: Effects of chemical reaction parameter on concentration profiles

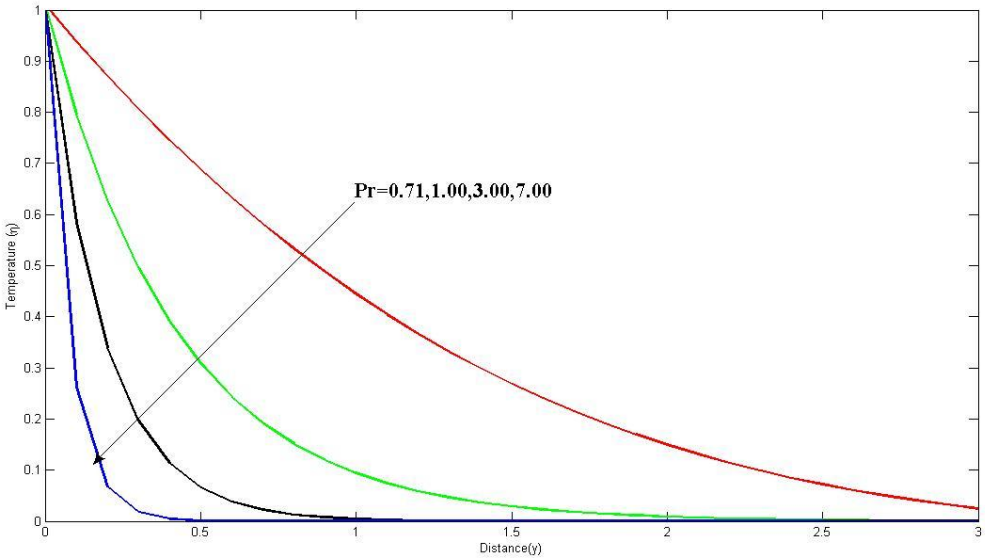

Figure 4.4: Effects of prandtl parameter on Temperature profiles

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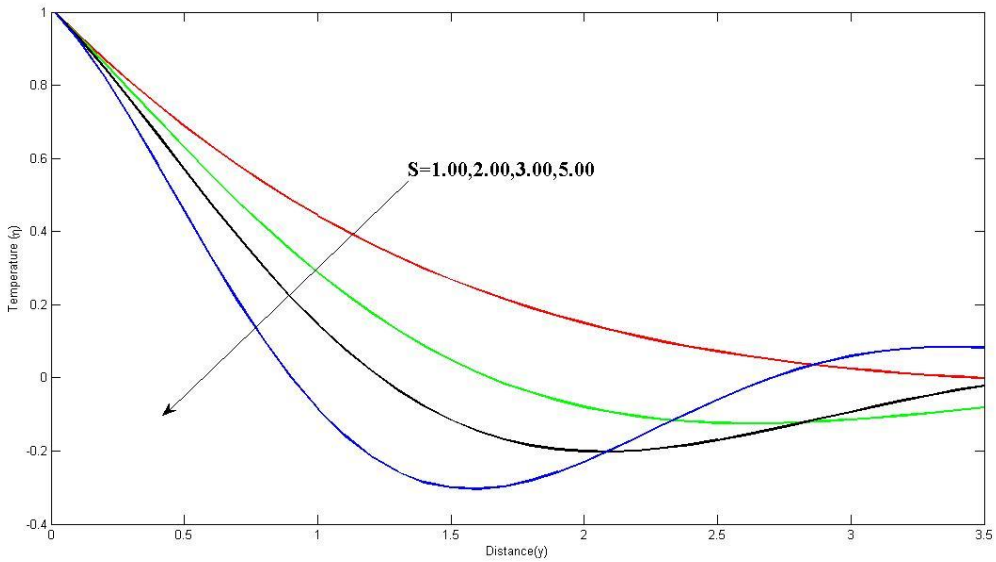

Figure 4.5: Effects of heat generation parameter on Temperature profiles

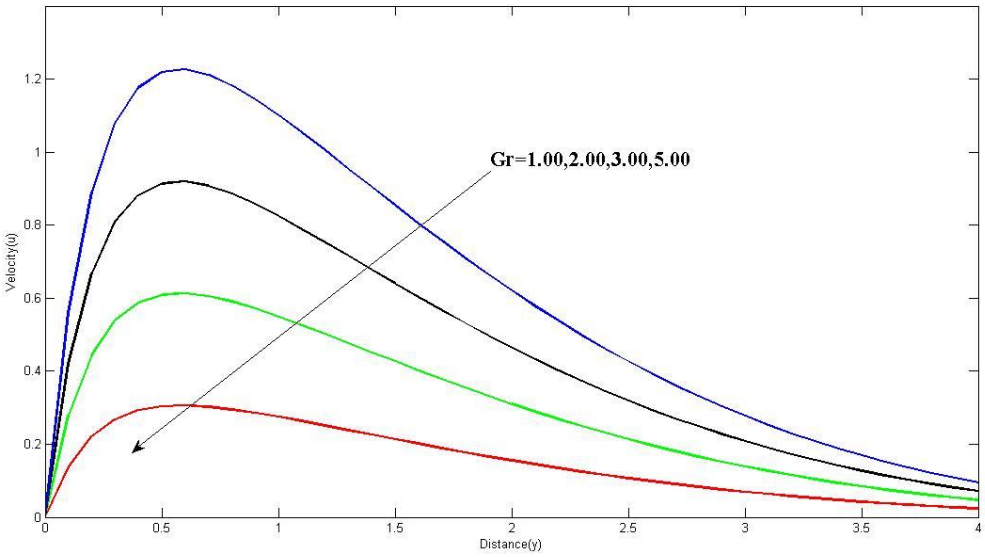

Figure 4.6: Effects of Grashof number of on velocity profiles

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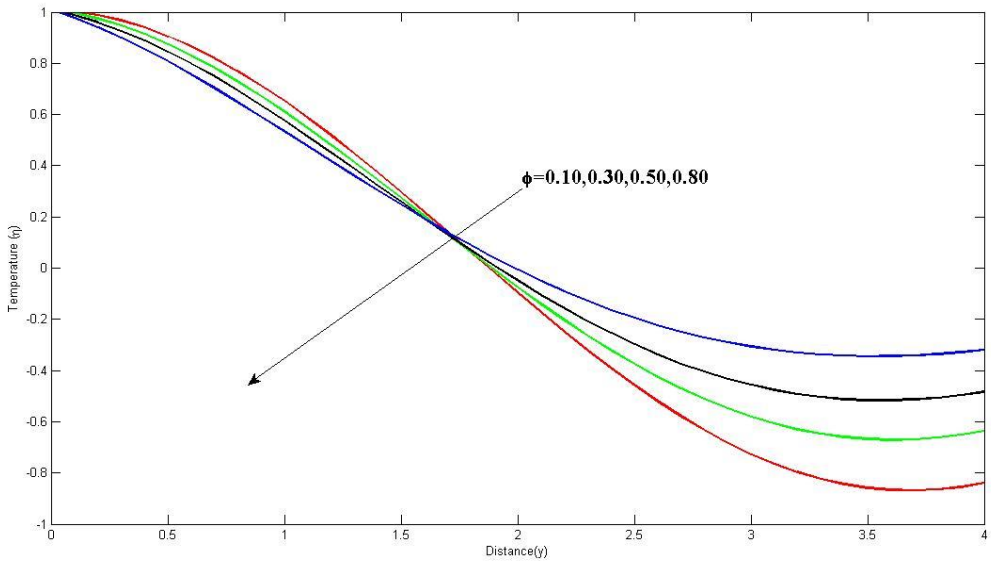

Figure 4.7: Effects of suction on Temperature profiles

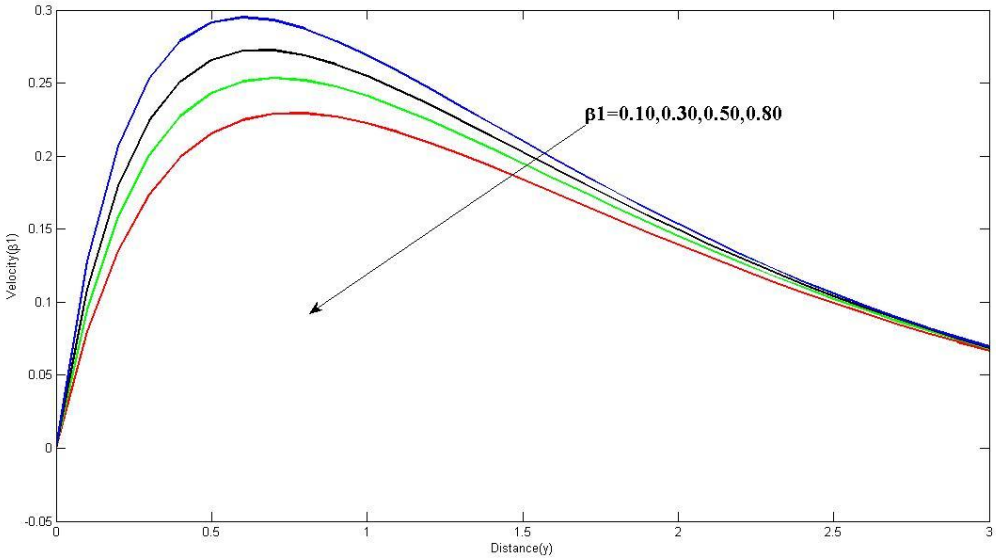

Figure 4.8: Effects of Jeffery fluid parameter on velocity profiles

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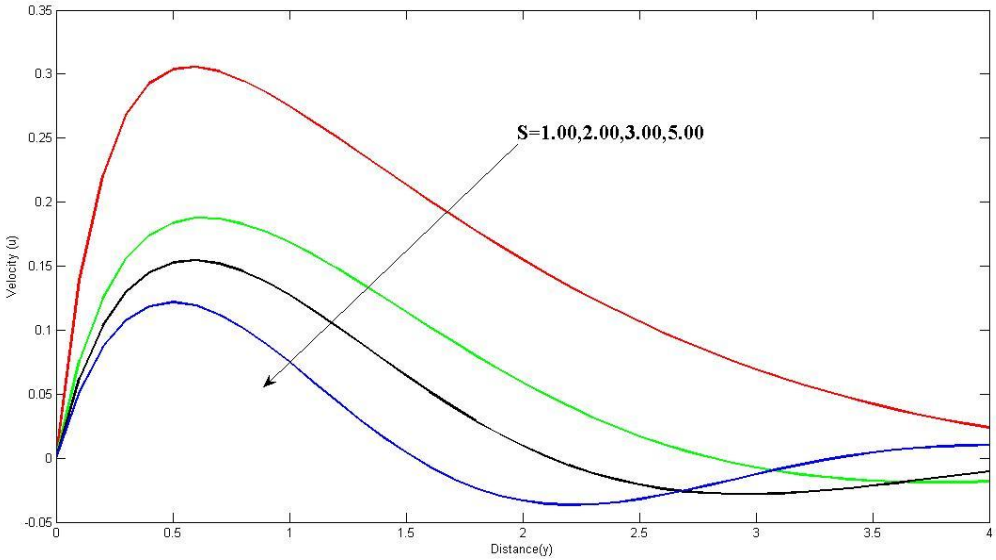

Figure 4.9: Effects of heat generation on velocity profiles

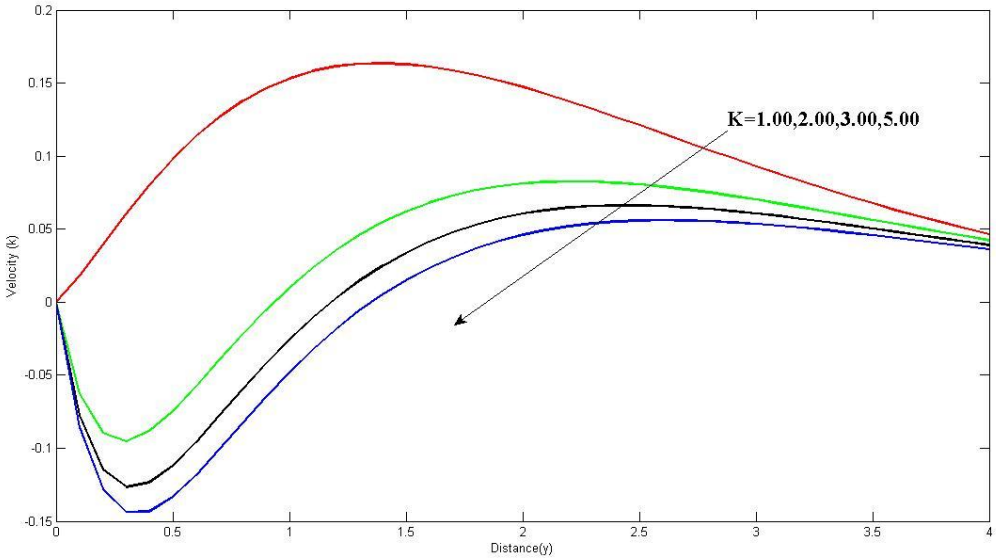

Figure 4.10: Effects of permeability parameter on velocity profiles

Figure 4.1 shows increases in the concentration due to Schmidt number. It is seen that the concentration reduces as Schmidt number increases, this cause the concentration buoyancy effects to decrease yielding a reduction in the fluid velocity. The reductions in the concentration profile are accompanied by simultaneous reduction in the boundary layer. Figure 4.2 displays the effects of suction (ϕ) parameter on the fluid concentration, it is seen in the figure that the concentration

decreases as the number of suction increase. Figure 4.3 illustrate the impact of chemical reaction (δ) on the concentration equation, it is found that in the graph it shows that the concentration reduces as the chemical reaction parameter increases,

From Figure 4.4, it is observed that the increase in the prandtl number (P_r) and hence retards the thermal boundary thickness.

Figure 4.5 represents the effect of heat sink on the temperature. It is depicted that the temperature increase with increase in heat generation.

Figure 4.6 depicts the effect of Grashof number on the temperature, it is observed that the temperature increases as the Grashof number increases. Figure 4.7 gives the effect of suction (ϕ) parameter on the temperature, it is seen in the graph that the graph of the temperature is decreasing as the suction increases. Figure 4.8 describes the effects of Jeffery parameter (β_1) on the velocity distribution. As we observed that the velocity decreases with an increase inβ_1. it is observed that the physical nature of the fluid flow if we increase the Jeffery parameter then the viscosity of the fluid is enhanced and the velocity of the fluid will decrease automatically. Figure 4.9 displays the effects of heat generation on velocity profiles it is observed that the velocity decreases as the heat generation increases. Figures 4.10 illustrates the permeability parameter, it is seen that the velocity decreases as the permeability parameter increases.

5.0 CONCLUSION

Effects of heat generation and chemical reaction on Jeffery fluid with suction/inject has been analyzed. The fundamental coupled partial differential equations are solved by perturbation technique. Results were obtained and compared with previously reported cases available in the literature and they were found to be in good agreement. Graphical results for various parametric conditions were presented and discussed for different values. From the present study, the following conclusions were drawn:

1. Velocity increases significantly with increasing values of modified Grashof number, the velocity become higher as heat generation parameter is increased while chemical reaction parameter increase lead to the decrease in concentration of the fluid.
2. An increase in Prandtl number leads to a decrease of both velocity and temperature profiles.
3. Both the velocity and temperature profiles decrease with an increase in the heat absorption.
4. Schmidt number increases and the concentration decreases for destructive chemical reactions have opposite effect on Schmidt number and concentration.
5. Velocity profiles increases with an increase in Jeffery fluid parameter.

REFERENCES

Abbas, Z., Rafiq, M. Y., Hasnain, J., &Umer, H. (2021). Impacts of lorentz force and chemical reaction on peristaltic transport of Jeffrey fluid in a penetrable channel with injection/suction at walls. *Alexandria Engineering Journal*, *60*(1), 1113-1122.

Agarwal, K., Parmar, A., &Baghel, R. S. (2023). Jeffery Fluıd Flow and Heat Transfer wıth Magnetıc Dıpole Effect Over a Porous Stretchıng Sheet.

Channappa, S. K., Linganna, K., &Basavaraj, P. M. (2023, June). Mixed

convection of Jeffrey nanofluid in a vertical porous channel with the significance of hall and ion slip effect, suction/injection and variable thermal conductivity: Entropy analysis. In *AIP Conference Proceedings* (Vol. 2649, No. 1).

Gopi Krishna, G., Ramanuja, M., Mishra, S., Ramanjini, V., Sudhakar, A., &Kavitha, J. (2023). Exploration of radiative heat on the Jeffery fluid flow in a microchannel for the impact of suction/injection. *Heat Transfer*, *52*(2), 1097-1117.

Humane, P. P., Patil, V. S., &Patil, A. B. (2021). Chemical reaction and thermal radiation effects on magnetohydrodynamics flow of Casson–Williamson nanofluid over a porous stretching surface. *Proceedings of the Institution of Mechanical Engineers, Part E: Journal of Process Mechanical Engineering*, *235*(6), 2008-2018.

Iranian, D., Sudarmozhi, K., Khan, I., & Mohamed, A. (2023). Significance of heat generation and impact of suction/injection on Maxwell fluid over a horizontal plate by the influence of radiation. *International Journal of Thermofluids*, *20*, 100396.

Iyoko, M., & Olajuwon, B. I. (2023). Study on impact of magnetic dipole and thermal Sradiation on flow/heat transfer of Jeffery fluid over stretching sheet with suction/injection. *Journal of Advanced Research in Fluid Mechanics and Thermal Sciences*, *104*(1), 65-83.

Kathyayani, G., & Devi, R. L. (2019). Numerical study on the effect of linear/non-linearly stretching sheet with suction or injection of MHD mixed convection Jeffrey fluid flow in a vertical stagnation–point of a porous medium in the presence of thermal radiation and chemical reaction.

Kathyayani, G. (2021). MHD Mixed Convection Jeffrey Fluid Near a Stagnation-Point Flow of Induced Magnetic Field and Linear/Non-Linear Vertical Stretching Sheet with Chemical Reaction in The Presence of Thermal Radiation and Suction or Injection. *Turkish Journal of Computer and Mathematics Education (TURCOMAT)*, *12*(13), 2453-2464.

Naz, S., & Tamizharasi, R. (2025). Influence of induced magnetic field, electric load and viscous dissipation on electro-hydromagnetic Jeffrey fluid flowing in an insulated vertical channel: An application of electric power generation. Results in Engineering, 104963.

Noor, N. A. M., Shafie, S., &Admon, M. A. (2020). Unsteady MHD squeezing flow of Jeffrey fluid in a porous medium with thermal radiation, heat generation/absorption and chemical reaction. *PhysicaScripta*, *95*(10), 105213.

Omokhuale, E., & Dange, M. S. (2023). Heat absorption effect on magnetohydrodynamic (MHD) flow of Jeffery fluid in an infinite vertical plate. *FUDMA JOURNAL OF SCIENCES*, *7*(2), 45-51.

Raju, K., Parandhama, A., Raju, M. C., & Ramesh Babu, K. (2018). Unsteady MHD free convection Jeffery fluid flow of radiating and reacting past a vertical porous plate in Slip-flow regime with heat source. *Frontiers in Heat and Mass Transfer (FHMT)*, *10*.

Reddy, M. V., &Pallavarapu, L. (2022). MHD radiative flow of Williamson nanofluid with Cattaneo-Christov model over a stretching sheet through a porous medium in the presence of chemical reaction and suction/injection. *Journal of Porous Media*, *25*(12).

Sachhin, S. M., Sachin, G. M., Mahabaleshwar, U. S., Anand, A., Murugesh, T. S., & Souayeh, B. (2025). Jeffrey Fluid Flow with Heat and Mass Transfer. In Advances in Computational Fluid Dynamics (pp. 66-78). CRC Press.

Shah, N. A., Popoola, A. O., Oreyeni, T., Omokhuale, E., & Altine, M. M. (2023). A modelling of bioconvective flow existing with tiny particles and quartic autocatalysis reaction across stratified upper horizontal surface of a paraboloid of revolution. Mathematical Modelling and Numerical Simulation with Applications, 3(1), 74-100.

Vigneshwari, S., Reddappa, B., Reddy, B. P., & Öztop, H. F. (2025). Numerical Exploration of Magneto-Convection and Diffusion in Gravity-Influenced Jeffrey Fluid Flow With Suction/Injection Over a Stretching Sheet. Engineering Reports, 7(9), e70411.