HEAT TRANSFER CHARACTERISTICS FOR MHD NANO FLUIDS UNDER NUMERICAL CONDITIONS WITH DIFFERENT PARAMETRIC CONDITIONS

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ABSTRACT:

In this paper we research the boundary-layer stream, heat, in addition to mass exchange qualities over the vertical cone loaded up with a nanofluid soaked permeable medium by the impact of attractive field, temperate radiation, and the first request compound response area under discussion to the convective limit condition. Likeness change procedure is utilized to change over non-straight incomplete differential conditions into the arrangement of complex normal, differential conditions. The computational restricted component strategy have been utilized towards deal with the stream, temperate the and mass-exchange conditions together with limit condition. The effect of different appropriate parameter lying on hydrodynamic, temperate, and solute boundary layers is researched in addition to the outcomes be shown graphically. Besides, the estimations of nearby skin-contact coefficient, the pace of temperature, and the pace of focus are additionally determined and the outcomes are introduced graphically. The examination with recently distributed work is settled on and discovered great understanding. The thickness of temperate limit layer is expanded through an increment in the estimations of Brownian pressure group parameter (Nb) and thermophoresis parameter (Nt). To get non-comparative condition, progression, force, vitality, and focus conditions have been non-dimensionalised by the common changes. The non-comparative arrangements are considered here. They got conditions have been fathomed by express limited contrast strategy with security and union examination.

Key words: Thermophoresis, function of Brownian motion, consistency, focus.

1.0 INTRODUCTION:

H.I. Andersson [1], since the slip-stream of a Newtonian liquid past a directly extend sheet, is considered. The incomplete slip is constrained by a dimensionless slip factor, which shifts between zero (absolute grip) and boundlessness (full slip). A careful scientific arrangement of the govern Navier-Stokes condition is exposed, which is officially substantial for all Reynolds numbers M. Aarti, et al., [2] have portrayed over round and hollow body has been accounted for in the characters which bargain the procedure of polymer, A. Aziz [3] induced come to a decision the temperature dissemination in the temperate limit layer for a capacity of virtues for both the slip parameter just as the liquid Prandtl number. The development in Prandtl number as well as the slip parameter diminishes the dimensionless surface temperature. The real surface temperature at any area of the turn an element of the neighbourhood Knudsen number, the close to
Reynolds number, the energy expediency coefficient, Prandtl number, other water course properties, and the applied heat motion. B.Bhattacharyya et, al., [4] have contemplated consistent that The immediate variety and backwards variety of heat motion along the sheet entirely have various impacts on the temperature appropriation. In addition, the heat move qualities within the sight of non-uniform heat motion for a few estimation of physical parameters are the same seen as charming M.Q.Brewster et, al., [5] have inspected created synthetic response parameter and Soret number on the speed, micro rotation, temperature, and fixation have been process and talk about in aspect through certain figures. So as to confirm the precision of the present outcome, we have to contrast these outcomes and the scientific activities by utilize the differential change technique (DTM) and the multi-step differential transforms strategy (MDTM). It is seen this inexact numerical arrangement is in acceptable concurrence with the explanatory solution, J.A Gbadeyan et, al., [6] have researched intrigued the velocity, temperature, and concentrated particle proles aswellas helical skin-frict particle coeftZ cent; nearby Nusselt number and t neighborhood Sherwood number delineate in the in• peace of heart the primary number; agree rodent particle to thermal lightness proportion; and the divider mass transfer coeftZ clients are introduced and examined,. K.Chand et, al., [7] explored the estimations of speed, temperature, fixation, skin rubbing coefficient, pace of warmth and mass exchange are found for various parameters associated with the definition by means of attractive, suction and slip parameters.J.A.Gbadeyan et, al., [8] illustrated heat, and mass exchange of a gooey incompressible, dim, engrossing transmitting magnetohydrodynamics (MHD) liquid o wing past a rashly begun vertical plate in a permeable medium. The overseeing conditions are diminished to two-dimensional, S. Goldstein et, al., [9] examined his work on consistent stream laminar limit layer conditions and on the tempestuous protection from turn of a plate in a liquid. Goldstein was very proficient on streamlined features and his work had a huge effect here, T., Hayat et, at., [10] examined Velocity and warm slip conditions are considered. Issue detailing is created within the sight of temperate radiation.M.A Hossian,et,al., [11] the impact of radiation on the common convection stream of an optically thick incompressible liquid along a consistently warmed vertical plate with a uniform suction. D. B Ingham, et, al., [12] have examined the Darcy stream issue with a convective limit state at the plate surface. P.M. Kishore, et, al., [13] are discussed magnetohydrodynamic stream of an electrically leading, thick, and incompressible liquid past a researched boundless vertical permeable plate within the sight of variable suction. The warm radiation and compound response impacts are expecting to exist inside the channel. Non-dimensional incomplete differential conditions of overseeing conditions of stream are comprehended numerically utilizing Crank Nicolson limited distinction strategy. The skin grinding, warmth, and mass-exchange rates just as the impacts of different parameters on speed, temperature, and focus profiles are investigated. The huge outcomes from this examination are that an expansion in the estimations of radiation parameter and synthetic response parameter causes a decrease in the velocity, temperature, and heart. B. Krishnendu, et,al., [14] have inspected the consistent two-dimensional limit layer stream and receptive mass exchange past an exponentially extending sheet in an exponentially poignant free stream, G. Murali et,al., [15] have observe that he velocity enlarge with the increase within the energy parameter and there is an enlarge in temperature through the increase in the significance of radiation parameter.
Problem statement:
During fluid mechanics, most theoretical questions are fundamentally nonlinear. Both such issues and phenomena are based on normal or incomplete calculations of deferential type. Solutions of these deferential equations are important in the evaluation of the phenomena being studied in the future. These physical processes include, to name only a handful, the passage of stars, nonlinear optics, oceanography, meteorology, missiles, fluid dynamics, and population dynamics. Most of these equations are extremely nonlinear and it is not always possible to find precise solutions. Numerical methods often provide tentative solutions for those situations where precise answers are not feasible. There are advantages and disadvantages of both numerical and analytical methods. Nanofluids are designed by suspending nanoparticles with normal sizes underneath 100 nm in conventional heat move fluids, for example, water, oil, and ethylene glycol. A modest quantity of visitor nanoparticles, when scattered consistently and suspended steadily in have fluids (base fluids), can give sensational upgrades in the warm properties of host fluids. Nanofluids (suspension of nanoparticles fluids) are the term used. The theory of magneto hydrodynamics (MHD) is about the acceleration of extremely conductive fluids in the presence of a magnetic field. The motion of the conducting fluid across the magnetic field generates electric currents that change the magnetic field, and the action of the magnetic field on these currents gives rise to mechanical forces that modify the flow of the fluid. Work in MHD flows has been driven by two problems: shielding space vehicles from aerodynamic overheating and degradation during the passage through the atmosphere's thick layers; improving the operational capacity of the constructive elements of high temperature MHD generators for direct transformation of heat energy into electric current. The first issue shows that a magnetic field's effect on ionized gases is a simple method of controlling space, heat, and hydrodynamic processes.
OBJECTIVES:
- Mathematical model for MHD boundary layer movement and nanofluid heat transfer.
- Using the Continuity Technique Law to find numerical solutions to these problems.
- Studying the transition of the Lie group to overcome nanofluid flow mathematical models.

ANALYSIS:
Consider in the nearness of a uniform curved attractive field, B0, the steady laminar boundary-layer flow of two dimensional incompressible Carreau fluid over a fixed radius an isothermal horizontal circular cylindrical body. The initiated attractive field, the hall impact, and the thick and Joule scattering terms are thought to be immaterial in this investigation, so that the cylinder Tw's surface temperature is taken above the fluid Tw's ambient temperature. (For example, a heated cylinder). The considered objective model is illustrated in the figure 1.

![Figure 1](image1.png)

**Figure(2) Magnetohydrodynamic non-Newtonian high temperature move as of a cone**

The differential conditions overseeing the present issue are given as:
\[ \nabla \cdot V = 0 \quad (1) \]
\[ \rho \left[ \frac{\partial V}{\partial t} + (V \cdot \nabla) V \right] = -\nabla P + \nabla \cdot \bar{\tau} + \rho g + \sigma (V \times B_0) \times B_0 \quad (2) \]
\[ \rho c \left[ \frac{\partial T}{\partial t} + (V \cdot \nabla) T \right] = -\nabla \cdot q \quad (3) \]

Here, V is the velocity vector, \( \bar{\tau} \) is the additional stress tensor, q is the high temperature flux vector, where \( V = (U, V) \) and \( q = -k \nabla T \)
In the case where the unlimited shear rate viscosity $\mu_\infty$ of this type of non-Newtonian fluids is abandoned (i.e., $\mu_\infty \approx 0$), the additional stress tensor $\tau$ is defined as:

$$\tau = \mu_0 \left( 1 + (\Gamma \dot{\gamma})^2 \right)^{\frac{(n-1)}{2}} \left( \mathbf{L} + \mathbf{L}^T \right)$$

Here $\mu_0$ is the nothing shear rate viscosity, $\Gamma$ is the moment in time constant, $n$ is the power-law index, $\dot{\gamma}$ is the shear rate and $n$ the second invariant strain rate tensor (i.e., $n = \text{trace} \left[ (\mathbf{L} + \mathbf{L}^T)^2 \right]$, where $\mathbf{L} = \nabla \mathbf{V}$ and $\dot{\gamma} = 12 \mathbf{\nabla}$).

We consider in the constitutive the case for which $\Gamma \dot{\gamma} \ll 1$, so we can write:

$$\tau = \mu_0 \left( 1 + \frac{(n-1)}{2} (\Gamma \dot{\gamma})^2 \right) \left( \mathbf{L} + \mathbf{L}^T \right)$$

Above the Boussinesq and boundary layer approximation, the simplify stable governing equations are expressed as follow:

$$\frac{\partial (\rho U)}{\partial z} + \frac{\partial (\rho V)}{\partial y} = 0 \quad (2)$$

$$U \frac{\partial U}{\partial z} + V \frac{\partial U}{\partial y} = \rho \beta (T - T_\infty) \cos A - \frac{\sigma B_0^2}{\rho} U + \nu \frac{\partial^2 U}{\partial y^2} \quad (3)$$

$$U \frac{\partial T}{\partial z} + V \frac{\partial T}{\partial y} = \alpha \frac{\partial^2 T}{\partial y^2} \quad (4)$$

Rewriting Eqs. (6) – (8) as far as the stream function $\Psi$ (i.e., $U = \partial \Psi/\partial y$ and $V = -\partial \Psi/\partial x$) in addition to the high temperature $T$, we obtain:

$$\frac{\partial \phi}{\partial y} \frac{\partial^2 \phi}{\partial x \partial y} - \frac{\partial \phi}{\partial x} \frac{\partial^2 \phi}{\partial x \partial y} = \rho \beta (T - T_\infty) \cos A$$

$$- \frac{\sigma B_0^2}{\rho} \frac{\partial \phi}{\partial y} + \nu \frac{\partial^3 \phi}{\partial y^3} + \nu \frac{3(n-1) \Gamma^2}{2} \frac{\partial^2 \phi}{\partial y^2} \frac{\partial^2 \phi}{\partial y^3} \quad (9)$$

$$\frac{\partial \phi}{\partial y} \frac{\partial T}{\partial z} = \alpha \frac{\partial^2 T}{\partial y^2} \quad (10)$$

Considering the instance of quality of velocity slip and temperature bounce conditions at the round and hollow outside divider, we can compose the limit conditions forced to the framework of Eqs. (9) with (10) as follow:

$$u = \mathbf{N}_0 \frac{\partial u}{\partial y}, \quad v = 0, \quad T = -k \frac{\partial T}{\partial y} = h v_0 (T_w - T) \text{ at } y = 0$$

$$u \to 0, \quad v \to 0, \quad T \to T_\infty \text{ as } y \to \infty \quad (11)$$
The parameters $N_0$ and $h_w$ used in the limit conditions (6) converse to the temperate jump and momentum slip factors, respectively. For getting better the no-slip case, one be capable of take $N_0 = h_w = 0$.

So as to compose the overseeing conditions and the limit conditions in dimensionless structure, the accompanying non-dimensional quantities are presented:

$$
\xi = \frac{V_0 x}{u_G r^{1/4}}, \eta = \frac{y}{u_G r^{1/4}}, \gamma = \frac{v}{u_G r^{1/4}} \left( f(\xi, \eta) + \frac{\xi}{2} \right),
$$

$$
Gr_r = \frac{\varphi_1(T_w - T_{\infty}) \delta \exp A}{4u^2}, \theta(\xi, \eta) = \frac{T - T_{\infty}}{T_w - T_{\infty}}.
$$

By apply the non-similar transformation of Eqs.(12) on the system of Eqs. (9) – (11), we get:

$$
f''''(\eta) + \frac{7}{4} f''(\eta) f''(\eta) + \frac{3(n-1)}{2} We f''(\eta)^2 f''(\eta) - \frac{1}{2} f(\eta)^2 + \phi - M f(\eta) = \frac{7}{4} \xi \left( f'' \frac{\partial^2 \theta}{\partial \eta^2} - \frac{\partial \phi}{\partial \eta} \frac{\partial f}{\partial \xi} \right)
$$

$$
Pr^{-1} \theta''(\eta) + \frac{7}{4} f(\eta) \theta(\eta) = \frac{7}{4} \xi \left( \frac{\partial \phi}{\partial \eta} \frac{\partial \theta}{\partial \xi} - \frac{\partial \theta}{\partial \eta} \frac{\partial f}{\partial \xi} \right)
$$

$$
f = 0, \quad f''(\eta) = S_f f''(\eta), \quad \theta = 1 + S_f \theta'(\eta) \quad \text{at} \quad \eta = 0
$$

$$
f' \rightarrow 0, \quad \theta \rightarrow 0 \quad \text{as} \quad \eta \rightarrow \infty
$$

The skin friction coefficient $C_f$ and the limited Nusselt number $Nu$ can be revealed utilizing the complementary expressions:

$$
\frac{1}{2} Gr^{-3/4} C_f = f(\xi, 0) \left( 1 + \frac{(n-1)We}{2} f''(\xi, 0) \right)
$$

$$
Gr^{-1/4} Nu = -\theta'(\xi, 0)
$$

**Flow formulation:**

Examination of consistent reliable laminar progression of two-dimensional electrically directing adjusted nanofluid more than exponentially extending outside within the sight of variable thickness have been contemplated, which is uncovered in Figure 1.

The fluid streams in the x-bearing and keeps up at a reliable divider temperature Tw. The working fluid is water-based, changed nanofluid including different sorts of solid particles (Al2O3, Cu, and Ni) while these particles having nanosized. These three particles are suspended with base fluid water. A couple of suppositions of these solid particles are following right now as inconsequential internal heat time, incompressible stream, insignificant radiative heat move, and no mixture reaction. The thermophysical qualities of modified nanofluid are addressed in Table 1.
Under these presumptions through the typical limit layer estimate, the administering degree of difference conditions of mass, force, and vitality designed for the issue viable are characterized as follows:

\[
\frac{\partial u}{\partial x} + v \frac{\partial u}{\partial y} = 0,
\]

\[
\frac{\partial u}{\partial x} + v \frac{\partial u}{\partial y} = \frac{1}{\rho_{mnf}} \frac{\partial}{\partial y} \left( \frac{\mu_{mnf}}{\partial y} \right) - \frac{\sigma B^2}{\rho_{mnf}} u - \frac{v_{mnf}}{R} u,
\]

### Numerical values of nanoparticles and water

<table>
<thead>
<tr>
<th>Thermo physical properties</th>
<th>Fluid phase</th>
<th>Cu</th>
<th>Al₂O₃</th>
<th>Ni</th>
</tr>
</thead>
<tbody>
<tr>
<td>$C_p (\text{J/kg} \cdot \text{K})$</td>
<td>4179</td>
<td>385</td>
<td>765</td>
<td>444</td>
</tr>
<tr>
<td>$\rho (\text{kg/m}^3)$</td>
<td>997:1</td>
<td>8933</td>
<td>3970</td>
<td>8900</td>
</tr>
<tr>
<td>$k (\text{W/mK})$</td>
<td>0.613</td>
<td>400</td>
<td>40</td>
<td>90.7</td>
</tr>
</tbody>
</table>

Numerical estimations of nanoparticles and water.

\[
\frac{\partial T}{\partial x} + v \frac{\partial T}{\partial y} = \alpha_{mnf} \frac{\partial^2 T}{\partial y^2},
\]

The appropriated boundary condition are stated the same as

\[
u \rightarrow U_0 \text{ as } y \rightarrow 0,
\]

\[
u \rightarrow 0, \quad T \rightarrow T_\infty \text{ as } y \rightarrow \infty,
\]

Every where u and v are the liquid speed parts within the x and y bearings, individually, T is the liquid high temperature, $U_0$ be signified as the stream speed, and $T_\infty$ speaks to as the temperature of the liquid far away from the surface. The thermophysical properties of nanofluid, mixture nanofluid, and adjusted nanofluid are spoken to in Tables 2 and 3.
An exceptional kind of physical qualities is familiar in the present assessment to research the limit layer conditions for altered nanofluid. Adjusted nanofluid is pondered through taking the blend of Al2O3 and Cu with base liquid water. The nano-particles Al2O3 and Cu (Φ1 ¼ 0.05 you and Φ2 ¼ 0.05 not, individually) are fixed all through this issue. To make it perfect, the last sort of the ground-breaking term physical attributes of (Al2O3=water) nano fluid, (Al2O3-Cu/water) half-breed nano fluids, and (Al2O3-Cu-Ni/water) adjusted nano fluid, is expected in Tables 2 and 3, while n = 3 is for circular nano particles. A few subscripts are characterized as following, strong nano particles of Al2O3, s2 strong nano particles of the Cu, s3 strong nano particles of Ni, or for base liquid (water), if for nano fluid, and for Hybrid nano fluid and mnf for changed nano fluid. The term physical attributes of liquid are spoken to in Table 1 at 25°C where Uw = U0ex/1, T = T∞+ T0ex/21. The μf is the coefficient of the thickness, which is accepted to fluctuate as an opposite capacity of Physical Properties of Nano fluid and Hybrid Nano fluid.

These techniques rough an obscure capacity f by a reaction surface (or metamodel)^f. Any confound among f with ~f is thought to be brought about by model mistake and not as a result of clamor in trial estimations. Reaction surfaces might be non-inserting or introducing. The previous is acquired by limiting the entirety of square deviation among f with ~fat various focuses, where estimations off have been gotten. The last produce works that go through the

\[ \hat{f}(x) = \sum_{i=1}^{m} \alpha_i f_i(x) + \sum_{i=1}^{p} \beta_i \phi \left( x - x^{(i)} \right) \]

inspected reactions.

Where fi is polynomial capacities, αi and βi are obscure coefficients to be evaluated, φ is a premise capacity, and x(i)∈Rn, i=1,..., p, are tests focuses. Premise capacities incorporate direct, cubic, flimsy plate splines, multi quadratic, and kriging. These are talked about beneath in more detail. Kriging Originally utilized for mining investigation models, kriging models a deterministic reaction as the acknowledgment of a stochastic procedure by methods for a kriging premise work.

\[ \hat{f}(x) = \mu + \sum_{i=1}^{p} b_i \exp \left[ -\sum_{h=1}^{n} \theta_h \left| x_h - x^{(i)} \right|^{p_h} \right] \]

\[ \theta_h \geq 0, \quad p_h \in [0, 2], \quad h = 1, \ldots, n. \]

Accepting ~f is an irregular changeable with known acknowledge ~f(x (i)), i=1,..., p, the parameters μ, bi, 0h and ph are assessed by boosting the probability of the watched acknowledge. The parameters are reliant on test point data yet free of the competitor point x. Close by focuses are expected to have profoundly corresponded capacity esteems, in this way.
creating a ceaseless interjecting model. The loads $\theta_h$ and $\phi_h$ represent the significance and the smoothness of the relating factors. The indicator $\hat{f}(x)$ is the limited over the whole area.

**NUMERICAL ANALYSIS**

Numerical arrangement utilizing Ansys 13.0 and correlation of mass stream rate utilizing James and King and Crocker condition were led on James and ChienSchrodt test condition. James utilized release pipe with basic distance across 6 on the basic weight of 20 to 60 psi. On the Chien and Schrodt explore, stifle was utilized with a basic width of 0, 3750-in and 4, 5 in the head weight of 400 to 800 psia. The result case of numerical reproduction is appeared in Fig. 1. Consequences of the stream reenactment are stream speed, weight, and mass stream rate.

![Sample simulation results for velocity (a) and static pressure (b) and mass flow rate report (c)](image_url)
So as to evaluate the nature of the arrangements acquired by various solvers, we thought about the arrangements returned by the solvers against the all around ideal answer for every issue. A solver was considered to have effectively tackled an issue during a run on the off chance that it restored an answer with a target work an incentive inside 1% or 0.01 of the worldwide ideal, which at any point was bigger. At the end of the day, a solver was viewed as fruitful on the off chance that it revealed an answer y with the end goal that \( f(y) \leq \max(1.01 f(x^*), f(x^*)+0.01) \), where \( x^* \) is an all around ideal answer for the issue. To get worldwide ideal answers for the test issues, we utilized the broadly useful worldwide improvement solver BARON to comprehend however many of the test issues as could be allowed. In contrast to subsidiary free solvers, BARON requires unequivocal mathematical articulations as opposed to work esteems alone. Nobleman's branch-and-bound methodology had the option to ensure worldwide optimality for the vast majority of the test issues, despite the fact that this solver doesn't acknowledge trigonometric and some other nonlinear capacities. For the last issues, LINDOGLOBAL was utilized to get a worldwide arrangement.

Most occurrences were settled inside a couple of moments. Since the test issues are arithmetically with computationally basic and little, the all out time necessary for work assessments for all runs was insignificant. The greater part of the CPU time was used up by the solvers on preparing capacity esteems and deciding the arrangement of repeats. A farthest point of 10 CPU minutes was forced on each run. Figure exhibits the part of issues of various size that were ended at any of the 10 streamlining occasions in the wake of arriving at the CPU time limit. As found in this figure, no solver arrived at this CPU time limit for issues with up to nine factors. For issues with ten to thirty factors, just SID-PSM and SNOBFIT
must be ended as a result of as far as possible. These two solvers likewise hit as far as possible for all issues with in excess of thirty factors, alongside seven extra solvers. Most occurrences were tackled inside a couple of moments. Since the test issues are logarithmically and computationally basic and little, the all out time required for work assessments for all runs was immaterial. A point of confinement of 10 CPU minutes was forced on each run. As found in this figure, no solver arrived at this CPU time limit for issues with up and about to nine factors. For issues with ten on the way to thirty factors, just SID-PSM and SNOBFIT must be alive ended due to as far as possible.

**RESULTS**

The abundance work exhausted in hauling the polymer adjacent to the activity of the attractive field is scattered as temperate vitality (heat). This empowers the limit layer and expands warm limit layer thickness. Again the impact of attractive field is continued all through the whole limit layer space. This stimulates the limit layer since the active vitality is disseminated as temperate vitality, and this further serve to disturb enhanced species dispersion. Therefore, mutually temperate and nano-molecule (species) focus limit layer thicknesses be extended.
Graph Influence of T S on (a) velocity profiles (b) temperature profiles (c) concentration profiles

Figs. delineate the development in speed, temperature and nanoparticle focus qualities with transverse organize for example ordinary to the Sphere surface for different Prandtl numbers, Pr. Moderately high estimations of Pr are considered. Prandtl number encapsulates the proportion of energy diffusivity to warm diffusivity in the limit layer system. It additionally speaks to the proportion of the result of explicit warmth limit and dynamic thickness, to the liquid warm conductivity. For polymers energy dispersion rate extraordinarily surpasses warm dissemination rate. The low estimations of warm conductivity in many polymers additionally bring about a high Prandtl number. With expanding Pr from 1 to 50 there is clearly a significant deceleration in limit layer stream for example a thickening in the force limit layer.

The impact is most unmistakable near the Sphere surface. Additionally fig. shows that with more prominent Prandtl number the temperature esteems are firmly diminished all through the limit layer transverse to the Sphere surface. Warm limit layer thickness is hence altogether diminished. Assessment of fig. 10c uncovers that expanding Prandtl number emphatically raises the nano-molecule fixation sizes. Truth be told, a fixation overshoot is actuated close to the Sphere surface. Along these lines, while warm vehicle is decreased with more prominent Prandtl number, species dissemination is empowered and nanoparticle focus limit layer thickness develops. The asymptotically smooth profiles in the free stream (high values) affirm that a satisfactorily enormous interminability limit condition has been forced in the Keller box numerical code.

Figs. outline the variety of speed, temperature and nano-molecule fixation with transverse arranges ( ), for various estimations of warm slip parameter (ST). Warm slip is forced in the
enlarged divider limit condition in eqn. With expanding warm slip less warmth is transmitted to the liquid and this de-empowers the limit layer. This likewise prompts a general deceleration as saw in fig. and furthermore to an increasingly articulated exhaustion in temperatures in fig., specifically close to the divider.
Graph Effect of $\varepsilon$ on (a) Skin friction profiles (b) Nusselt number profiles (c) Shear wood number profiles

The impact of warm slip is dynamically diminished with further good ways from the divider (bended surface) into the limit layer and evaporates some separation before the free stream. It is additionally evident from fig. that nanoparticle focus is diminished with more prominent warm slip impact. Energy limit layer thickness is accordingly expanded while warm and species limit layer thickness are discouraged. Clearly the non-unimportant reactions processed in figs. further accentuate the need to consolidate warm slip impacts in reasonable nanofluid enrobing streams.
Figs. presents the influence of Eyring–Powell liquid parameter, $\varepsilon$, on dimensionless skin erosion coefficient, Nusselt number and Sherwood number at the circle surface. It is seen that the dimensionless skin grinding is upgraded with the expansion in $\varepsilon$, for example the limit layer stream is quickened with diminishing thickness impacts in the non-Newtonian system. Then again, Nusselt number and Sherwood number is generously diminished with expanding $\varepsilon$ values. Diminishing thickness of the liquid (prompted by expanding the $\varepsilon$ esteem) lessens warm dissemination as contrasted and energy dispersion. A reduction in heat move rate and mass exchange rate at the divider infers less warmth is convicted from the liquid system to the circle, in this manner warming the limit layer and upgrading temperatures and focuses.
Graph Effect of T S on (a) Skin friction profiles (b) Nusselt number profiles (c) Shear wood number profiles

Figs. show the skin rubbing, Nusselt number and Sherwood number dispersions with different estimations of warm slip impact (ST). Both skin grinding and Nusselt number are firmly diminished and Sherwood number is upgraded with an expansion warm slip (ST). The limit layer is subsequently decelerated and warmed with more grounded warm slip. With warm slip missing in this way the skin grating is expanded at the Sphere surface. The consideration of warm slip, which is experienced in different slippy polymer streams, is consequently significant in more physically practical recreations.

CONCLUSION

The reason for the present examination is to explore the impact of the Hall current on a peristaltic transport of a non - Newtonian stream. The Casson model through a vertical chamber is considered. The framework is influenced by a solid level uniform attractive field. Also, the warmth radiation, thick scattering, permeable media and compound response are considered. The nonlinear overseeing halfway differential conditions are displayed in a dimensionless structure. The came about framework is convoluted to be illuminated logically. To loosen up the numerical control, the present examination relies primarily upon the long wavelength estimate also with the law Reynolds number. The definite arrangement is gotten, without the Eckert number, as far as the adjusted Bessel's elements of the principal kind. The HPM, within the sight of the Eckert number, is used up to the subsequent request. Once more, a numerical strategy dependent on the Runge – Kutta Merson with shooting system is accepted. A lot of graphs are plotted to outline the impact of the different physical parameters on the speed, temperature and focus conveyances. Likewise, to make an examination between the diagnostic arrangements and numerical ones. A graphical and information design is contrasted and some pervious works.
NOMENCLATURE

A  Half angle of the cone, m
B₀  Externally imposed radial magnetic field
C  Specific heat, $Jkg^{-1}K^{-1}$
Cᵢ  Skin friction coefficient
F  Dimensionless stream function
Gr  Grashof number
G  Gravity field
K  Thermal conductivity of fluid, $Wm^{-1}K^{-1}$
N  Power law index parameter
K₀  Thermal jump factor, m⁻¹
N₀  Momentum slips factor, m⁻¹
Nu  Local Nusselt number
M  Magnetic parameter
P  Pressure, Pa
Pr  Prenatal number ($Pr = ν/α$)
Sᵢ  Velocity slip parameter
Bi  Biot number
T  Temperature, K
U, V  Dimensionless velocity components, $ms^{-1}$
We  Wiesenberger number
X  Stream wise coordinate, m
Y  Transverse coordinate, m

REFERENCES


