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FOREWORD

I warmly welcome all and sundry to the volume 3 issue 1 of Federal Polytechnic – Journal of Pure and Applied Sciences (FEPI-JOPAS) which is a peer reviewed multi-disciplinary accredited Journal of international repute. FEPI-JOPAS publishes full length research work, short communications, critical reviews and other review articles. In this issue, readers will find a diverse group of manuscripts of top-rated relevance in pure and applied science, engineering and built environment. Many of the features that you will see in the Journal are result of highly valuable articles from the authors as well as the collective excellent work of our managing editor, publishing editors, our valuable reviewers and editorial board members.

In this particular issue, you will find that Joseph and Adebanji provided innovative technology on light traffic control system. Ogunkoya and Sholotan engaged standard method for microbiological assessment of shawarma from Igbesa metropolis for possible microbial contamination. Ilelaboye and Kumoye unveiled the effect of inclusion of different nitrogen source on growth performance of mushroom. Ogunyinka et al utilized Fletcher Reeves conjugate gradient method as a robust prediction model for candidates' admission to higher institutions. Omotola and Fatunmbi examined the impact of thermal radiation with convective heating on magnetohydrodynamic (MHD), incompressible and viscous motion of non-Newtonian Casson fluid. Aako and Are meticulously investigated factors affecting mode of delivery using binary dummy dependent models. Abiaziem and Ojelade successfully synthesized biologically active silver nanoparticles using *Terminalia catappa* bark as the eco-friendly source.

In addition, Olowosebioba et al. assessed the rectifying effects of various diodes in power supply units using multisim circuit design software programme. Olujimi et al. successfully accomplished the use of fingerprint based biometric attendance system for eliminating examination malpractices with enhanced notification. Alaba reported the nutritional status assessment of school age children (6-12 years) in private primary school in Ilaro. Muhammed-lawal et. al. assessed the execution and effect of corporate social responsibilities and return to marketing. Awolola and Sanni's research was about achieving quality of engineering education and training in Nigeria using Federal Polytechnic, Ilaro as the case study. Oladejo and Ebisin expatiated on virtual laboratory as an alternative laboratory for science teaching and learning.

Finally, Aneke and Folalu investigated the prospect and problems of the hotels in Ilaro, Ogun State.

I would like to thank and extend my gratitude to my co-editors, editorial board members, reviewers, members of FEPI-JOPAS, especially the Managing Editor, as well as the contributing authors for creating this volume 3 issue 1. The authors are solely responsible for the information, date and authenticity of data provided in their articles submitted for publication in the Federal Polytechnic Ilaro – Journal of Pure and Applied Sciences (FEPI-JOPAS). I am looking forward to receiving your manuscripts for the subsequent publications.

You can visit our website (https://www.fepi-jopas.federalpolyilaro.edu.ng) for more information, or contact us via e-mail us at fepi.jopas@federalpolyilaro.edu.ng.

Thank you and best regards.

E-Signed
Prof. Olayinka O. AJANI

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Magnetohydrodynamic Radiative Casson Fluid Motion Past a Convectively Heated and Slippery Non-linear Permeable Stretching Plate

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Abstract

This study examines the impact of thermal radiation with convective heating on magnetohydrodynamic (MHD), incompressible and viscous flow of non-Newtonian Casson fluid along a non-linear permeable stretched device. In engineering and manufacturing operations such as hot rolling, textile and paper processing, plastic and rubber sheet manufacturing, the assessment of an electroconductive fluid movement along a permeable stretching surface is commonly applicable. A relevant similarity transformation has been employed to transmute the non-linear differential system with its associated boundary conditions from partial to ordinary differential equations. Afterwards, shooting technique alongside Runge-Kutta method of order four was applied to obtain numerical solutions to the set of the transport equations. Validation of the generated results with past data in the literature in respect of skin friction coefficients and Nusselt number demonstrated great agreement under limiting situations. Likewise, the reactions of disparate emerging terms as regards to the velocity and temperature profiles are propounded and depicted in graphical forms. The findings of this study are that the fluid motion can be reduced by raising magnetic field and Casson fluid parameters whereas the heat transfer can be improved by a hike in thermal buoyancy force and Prandtl number.

Keywords: Casson fluid, Magnetohydrodynamic; Convective heating, Nonlinear plate; Thermal radiation.

INTRODUCTION

The complexity in the transport of non-Newtonian type of fluids poses many questions to scientists, engineers, and researchers. Many researchers in the past few years have discussed several models of non-Newtonian fluids because no single model captures completely the attributes of these fluids. In published studies, one of the most popular model is the power model which exhibits shear thinner and thickening tendencies. Das and Batra (1993) cited Casson fluid as a type of non-Newtonian liquid demonstrating yield stress. The fluid nature is solid as long as imposed shear stress is below the elastic point, while when applied, it begins flowing. In this case, the shear stress is higher compared to the yield stress. This model is commonly found in concentrated juices, human blood, jelly, tomato sauce, honey, and other substances. The Casson model is extensively examined in the literature as one of the best viscoelastic models for assessing boundary layer fluid flow (Sulochana and Poornima, 2019; Asogwa et al., 2020; Qushairi et al., 2019; Afify, 2017).

The challenges of non-Newtonian fluids past stretching sheets have many practical usefulness and have piqued considerable research interest over the last several years. Crane (1970) evaluated the flow spawned by a stretched sheet which speed is relative to a fixed origin. Subsequently, many researchers expanded on this work by considering the influences of various symmetries and boundary conditions on Newtonian and non-Newtonian fluids, see for example, (Bhattacharyya, 2013; Fatunmbi and Fenuga, 2017; Jabeen et al., 2020). However, most of these research studies were concerned with linearly stretching sheet but for practical situations such as annealing of copper wire, the speed of the stretching sheet does not have to be uniform, according to Cortell (2012). Keeping this in mind, Kumar et al. (2018) examined the upshot of a superlinear stretching sheet of electrically conducting viscous fluid. Motivated by this, Ibrahim (2020) successfully studied Eyring-Powell fluid as a kind of non-Newtonian liquid over a stretched nonlinear surface using a finite element method. They discovered that massive nonlinear stretching values obtained had little influence on fluid velocity. Similarly, Megahed (2018) explored the flow of non-Newtonian fluid caused by a nonlinear stretched plate with interacting effects of viscous dissipation and non-uniform heat production. Mustafa and Khan (2015) disintegrated the out-turn of magnetic fields on Casson nanofluid on a nonlinearly stretching surface while recently, Fatunmbi, Ogunseye and Sibanda (2020) reported on such a concept via micropolar fluid across and revealed that the nonlinear stretching sheet triggers the skin friction.

The magnetohydrodynamic boundary layer flow across a permeable medium has attracted the interest of many scientists in the recent years. Many studies have examined the phenomenon of stretching sheets in a permeable medium for different forms of non-Newtonian fluids with magnetic field reaction. Parida and Panta (2011) expounded the hydrodynamic flow of second-grade fluid by pumping the cooling fluid into a porous medium via one phase of the channel wall and through the other preheated impervious wall. Hayat et al. (2010) explored MHD boundary layer flow across a permeable medium past a steep moving sheet. Subsequently, Nadeem et al. (2013) examined three-dimensional Casson fluid boundary layer on electrically conductive flow through a permeable medium embedded in a saturated stretching sheet. Jat et al. (2014) researched the magnetohydrodynamic boundary layer viscous fluid movement through a nonlinearly stretching plate immersed in a permeable medium. In their report, the skin friction factor improves as the porosity parameter rises. An intriguing research on stationary point flow on a penetrable shrinking surface within magnetic fields outcome was conducted by Akbar et al. (2014). Khalid et al. (2015) deliberated the impact of MHD fluid transport passing a penetrable channelinserted in a permeable medium. In addition, Krishna et al. (2015) investigated the Magnetohydrodynamic motion of Casson fluid across a porous stretching layer in a permeable medium. The researchers indicated that increasing the porosity function and Casson fluid flow boost the velocity distribution. Furthermore, Fatunmbi and Fenuga (2017) engaged the weighted residual method to deliberate magneto-micropolar fluid movement along with a permeable stretching sheet with variable viscosity effects. The authors concluded that the fluid motion fall off with a spike in the magnetic field value.

Moreso, slip conditions effects have significant uses in different sectors and are very efficient in the production process. Gad-el-hak (1999) depicts that the velocity slip on the wall significantly influences microelectronic flow. For this cause, scholars have suggested great care to include slip condition on the wall. Zakaria and Selim (2019) addressed the influence of slip factor on the study of linear and nonlinear resonance on an inclined plane. Gbadeyan et al. (2020) studied the influence of slip on a steady flow of an incompressible viscous fluid, taking into account a slip condition at a flat wall. Poornima et al. (2014) explores the Casson fluid speed alongside its slip at the wall past a permeable stretching medium. Obviously, the report unravelled slip factor minimizing flow speed and strengthens the shear stress at the boundary wall. Also, Hayat et al. (2015) defined the phenomenon of slip out-turn on Casson fluid boundary layer flow. Likewise, an investigation of the impact of partial slip on a non-Newtonian fluid flow being influenced by magnetic field through a stretching surface was deliberated by Nadeem et al. (2019). The studies reckon that the slip variable lowers the flow speed at the boundary region. Moreso, Fatunmbi and Fenuga (2018) addressed heat-mass transport of micropolar fluid with slip effects. It was reported that velocity slip criterion lowers the skin friction factor.

Many scientists have successfully given importance to convective heating instead of constant surface temperature as the constant temperature theory may not be valid in many physical contexts. Convective heating is explicated as the action in which heat condition at the surface relates to the heat convection in the same direction. The exertion of convective heating includes solar radiation, transportation cooling process, material drying, heat exchanger (Fatunmbi, Okoya, and Makinde, 2020). The four kinds of temperature profiles at the wall was examined by Merkin (1994), with convective heating being one of them. Likewise, Aziz (2010) studied the convective heating situation on a linear impermeable sheet and reported that there is possibility for similarity solution only if the convective heat movement of fluid is indirectly proportional to the root of x. Thermal radiation impact on electrically conducting fluid has a wide application in many scientific processes including manufacturing processes and atmospheric science. Mahanthesh et al. (2015) explored thermal radiation influence by considering such effect on magnetohydrodynamic heat transport of a Newtonian fluid.

It is evident from the preceding discussions that the combined impact of convective heating alongside thermal radiation and associated with nonlinear slippery stretching sheet confined in a porous medium has not been adequately investigated. More so, a review of existing literature reveals that no extensive work has been done in this regard inspite of its applications in engineering and manufacturing processes. The consequential applications in chemical engineering, hot rolling, food processing, paper and textile making have triggered the current analysis. The impacts of the important parameters have been graphically described and discussed in this study. Frankly speaking, to the best of authors knowledge, the current investigation has not been analyzed so far in the literature. It is therefore desirable to embark on this present study.

PROBLEM FORMULATION

For this problem, at wo dimensional, incompressible, steady and natural convective motion of radiative Casson fluid over a nonlinearly permeable stretching plate is assumed. It is supposed that a non-constant magnetic field $B(x)$ is transversely applied to the path of motion as depicted in Fig. 1 but induced magnetic field is ignored. The velocity $u_w(x) = cx^n$ is assumed at the sheet with n being a power law index and $c$describes a constant, the motion of flow is directed through the x-axis and y-components is normal to it. The motion is conditioned at the wall by velocity and temperature slip attributes as described in equation (4) while the thermal field features thermal radiation and heat source. Taking cognizance of the highlighted assumptions together with Boussinesq and the boundary layer approximations, the outlining equations are communicated as (see Imran. et al., 2016; Sharada and Shanker, 2015).

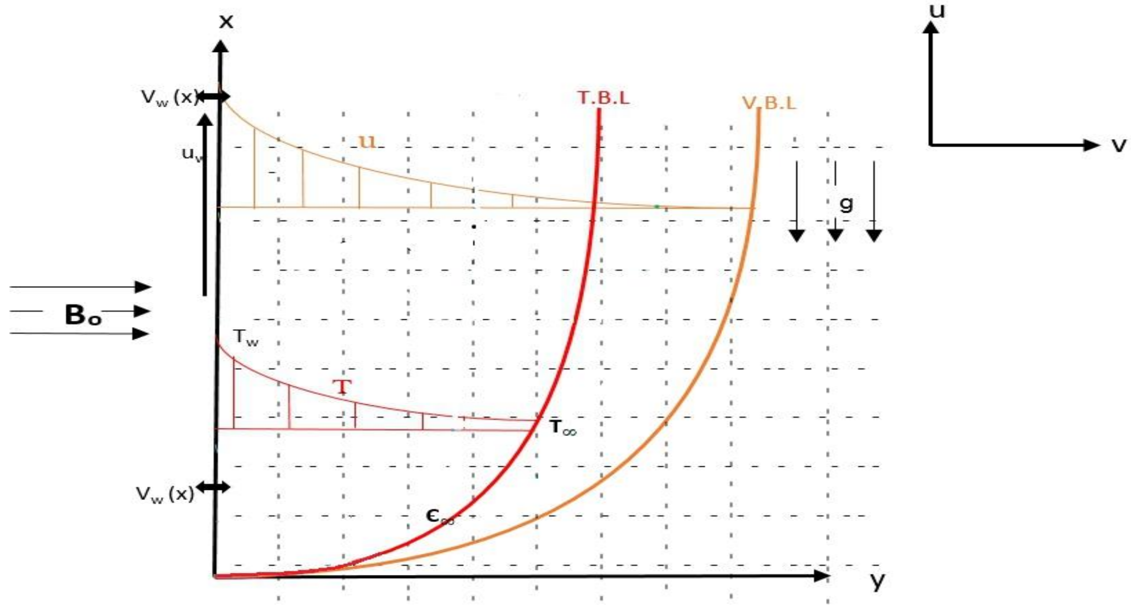

Fig. 1 Geometry of Flow

$$\frac{\partial u}{\partial x}+\frac{\partial v}{\partial x}=0, \quad (1)$$

$$u\frac{\partial u}{\partial x}+v\frac{\partial u}{\partial y}=\nu\left(1+\frac{1}{\beta}\right)\frac{\partial^2 u}{\partial y^2}-\left(\frac{\sigma B^2(x)}{\rho}+\frac{\nu\phi}{k_1}\right)u+g\beta_T(T-T_\infty), \quad (2)$$

$$u\frac{\partial T}{\partial x}+v\frac{\partial T}{\partial y}=\alpha\frac{\partial^2 T}{\partial y^2}-\frac{1}{\rho C_p}\frac{\partial q_r}{\partial y}+\frac{Q_o}{\rho C_p}(T-T_\infty), \quad (3)$$

subject to the wall conditions:

$$u=cx^n+S_1\nu\left(1+\frac{1}{\beta}\right)\frac{\partial u}{\partial y}, v=0, -K\frac{\partial T}{\partial y}=-h_s\left(T_f-T\right)\ at\ y=0, \quad (4)$$

$$u\longrightarrow 0, T\longrightarrow T_\infty\ as\ y\longrightarrow\infty. \quad (5)$$

With the application of the Rosseland approximation in Eq. (3),

$$q_r=-\left(\frac{4\sigma^*}{3k^*}\right)\frac{\partial T^4}{\partial y^2} \quad (6)$$

With assumption of low temperature variation in the flow region,T^4 can be expanded by Taylor series about T_∞ and neglecting higher order terms as

$$T^4\approx 4T_\infty^3-3T_\infty^4. \quad (7)$$

From the preceding Eqs (1-7), u, v signifies the velocity directions in x, y accordingly, k_1 symbolizes the permeability of porous medium, ν represent kinematic viscosity, σ indicates fluid's electrical conductivity, $S_1 = Sx^{\frac{-n-1}{2}}$ indicates motion slip factor, β defines Casson fluid parameter. Likewise, $B(x) = B_o x^{\frac{n+1}{2}}$ represents the non-uniform magnetic field with strength B_o, ρ denotes the fluid density, g stands for gravitational acceleration, Q_o typifies the volumetric heat generation/absorption of the fluid, T is the fluid temperature , thermal diffusivity of the Casson fluid is represented by α, β_T describes thermal expansion coefficient and $h_s = h_o x^{\frac{n-1}{2}}$ equals the heat transfer coefficient with h_o being a constant, σ typifies the Stefan Boltzmann constant whereas k stands for the mean absorption coefficients (Sumalatha and Bandari, 2015). The underlisted similarity variables are introduced (Fatunmbi et al. 2020):

$$\psi = f(\eta)\left(\frac{2\nu c x^{n+1}}{n+1}\right)^{\frac{1}{2}}, \eta = y\left(\frac{(n+1)cx^{n-1}}{2\nu}\right)^{\frac{1}{2}}, T = (T_f - T_\infty)\theta(\eta) + T_\infty, \quad (8)$$

where the stream function ψ expression is illustrated below:

$$u = \frac{\partial\psi}{\partial y}, v = \frac{-\partial\psi}{\partial x} \quad (9)$$

The preceding assertion also suffices the continuity Eq. (1). Also, Eqs. (2-4) yield following non-dimensional system.

$$\left(1+\frac{1}{\beta}\right)f'''(\eta) + f(\eta)f''(\eta) - \left(\frac{2}{n+1}\right)f' - (M^2 + Da)f' + \lambda\theta = 0, \quad (10)$$

$$(1+R)\theta''(\eta) + Prf(\eta)\theta'(\eta) + \left(\frac{2}{n+1}\right)BPr\theta(\eta) = 0, \quad (11)$$

$$f(0) = 0, f'(0) - 1 = \delta\left(1+\frac{1}{\beta}\right)f''(0), \theta'(\eta) = \gamma(\theta(0) - 1), \quad (12)$$

$$f'(\infty) = 0, \theta(\infty) = 0. \quad (13)$$

The emerging parameters in Eqs. (10-13) are: magnetic field parameter $M^2 = \frac{2\sigma B_0^2}{\rho c(n+1)}$, porosity parameter $K = \frac{2x\nu\phi}{k(n+1)cx^n}$, buoyancy parameter $\lambda = \frac{Gr_x}{Re_x^2}$, local Grashof number $Gr_x = \frac{2gB_T(T_f - T_\infty)x^3}{c^2(n+1)x^{2n-1}}$, $\delta = S\sqrt{\frac{(n+1)c\nu}{2}}$ is the slip parameter, $\gamma = h_o$ represent the convective heating parameter, Reynolds number $Re_x = \frac{cx^{n+1}}{\nu}$, Prandtl number $Pr = \frac{\nu}{\alpha}$, heat source parameter $B = \frac{Q}{c\rho C_p}$, radiation parameter $R = \frac{16\sigma \ T_\infty^3}{3k \ \ k}$ and the primes stands for derivatives with regards to η.For the engineering community, the relevant parameters of delight includes the skin friction coefficient Cf_x and the Nusselt number Nu_x. Sequentially,these quantities are defined in Eq. (14) as

$$(Cf_x)(\rho u_w^2) = \tau_w, k(T - T_\infty)Nu_x = xq_w, \quad (14)$$

where τ_w denotes the wall shear stress and q_w signals surface heat flux defined as

$$\tau_w = \mu\left(1+\frac{1}{\beta}\right)\frac{\partial u}{\partial y}\bigg|_{y=0}, q_w = -k\left(1+\frac{16\sigma \ T_\infty^3}{3k \ \ k}\right)\frac{\partial T}{\partial y}\bigg|_{y=0}, \quad (15)$$

substituting Eqs. (8) and (15) into (14) to obtain the respective non-dimensional skin friction coefficients and local Nusselt value as

$$Re^{\frac{1}{2}}Cf_x\left(\frac{2}{n+1}\right)^{\frac{1}{2}} = \left(1+\frac{1}{\beta}\right)f''(0), Re^{\frac{-1}{2}}Nu_x\left(\frac{2}{n+1}\right)^{\frac{1}{2}} = -\theta'(0). \quad (16)$$

RESULTS AND DISCUSSION

The nonlinear system of Eqs. (10-11) subject to (12-13) are evaluated computationally by employing shooting technique alongside Runge-Kutta method of order 4 using MAPLE software. The use of this method is necessitated in view of nonlinearity of the governing equations. Furthermore, the MAPLE software algorithm was used to garner results obtained for the specified boundary value problem with the quantities of engineering interest. Also, numerical computations are implemented for varying estimates of the emerging parameters to investigate their response on the non-dimensional velocity and temperature fields of the physical problem. The emerging parameters under consideration are the radiation parameter R, Prandtl number Pr, convective heating parameter γ, magnetic field parameter M, slip parameter δ, thermal buoyancy parameter λ, heat Source B, porosity parameter K, nonlinear stretching parameter n and Casson fluid term β. Tables 1-3 demonstrate the outcomes of Cf_x and Nu_x which are validated with existing reports. The comparisons are found to be in excellent conformity with the existing literature.

In particular, Table 1shows the impact of n on the skin friction coefficient when $\delta = K = \lambda = M = 0$ and for the Newtonian fluid ($\beta = 10^8$). The current results are validated with that of Cortell (2007) and Imran *et al.* (2016).

Table 1 Values of $\left(1+\frac{1}{\beta}\right)f''(0)$ for distinct estimates of n

n	Cortell (2007)	Imran (2016)	Present values
0.0	0.6275	0.6276	0.6276
0.2	0.7667	0.7668	0.7669
0.5	0.8895	0.8896	0.8897
1.0	1.0000	1.0000	1.0000
3.0	1.1485	1.1486	1.1486
10.0	1.2348	1.2349	1.2347
100.0	1.2768	1.2768	1.2768

Besides, Table 2 presents the computational values of the Nusselt number for changes in Pr and n when $\lambda = K = M = \delta = 0 = \gamma$ and $\beta = 10^8$. Evidently, a rise in n results in fall off values of Nusselt number with a surge in Pr.

Table 2 Values of Nusselt number Nu_x for varying estimates of Pr and n

	$Pr = 1$		
n	Cortell(2007)	Imran (2016)	Present values
0.2	0.6103	0.6102	0.6102
0.5	0.5953	0.5949	0.5952
1.5	0.5745	0.5747	0.5748
3.0	0.5645	0.5647	0.5647
1.0	0.5549	0.5549	0.5820

	$Pr = 5$		
n	Cortell, (2007)	Imran (2016)	Present values
0.2	1.6072	1.6076	1.6080
0.5	1.5867	1.5868	1.5870
1.5	1.5575	1.5576	1.5579
3.0	1.5423	1.5430	1.5434
1.0	1.5286	1.5286	1.5283

Furthermore, Table 3 reveals the correlation of current outcomes for Nusselt number with distinct values of Pr when $M = \delta = \lambda = K = 0, \beta = 10^8, n = 1$ and $\gamma = 0$ as compared with published works (Wang, 1989;Imran et al. 2016). It follows that the heat transfer factor rises with advancing Pr.

Table 3 ValuesNu_x for distinct values of Pr.

Pr	Wang (1989)	Imran (2016)	Current values
0.7	0.4539	0.4544	0.4544
$2.o$	0.9114	0.9113	0.9114
7.0	1.8954	1.8953	1.8957
20.0	3.3539	3.3538	3.3550

Figures (2-5) graphically displays some emerging parameters with pertinent discussions of their impacts on the fluid velocity. The graphical analysis from Fig. 2 convey the reactions of Casson fluid parameter (β) and porosity term (K) on the motion of the fluid. Evidently, the graph indicated that improving β results to a decline in the fluid flow. Vividly, a surge in β makes the fluid become more dense and thus retards the speed of flow. Likewise, enhancing the value of the porosity parameter (K) lowers the fluid velocity in the confined zone. Obviously, permeability enhances the strength of the porous medium to minimize fluid speed. Fig. 3 illustrates the reactions of nonlinear stretching sheet (n) and magnetic field factor (M) on the fluid speed. The case $n = 1$ and $n \neq 1$ illustrates linear and nonlinear stretching sheet case respectively. Apparently, improving the magnitude of the nonlinear stretching sheet variable (n) lowers the fluid flow in the confined boundary region. Similarly, a rise in (M) propels a fall in the fluid velocity falls.

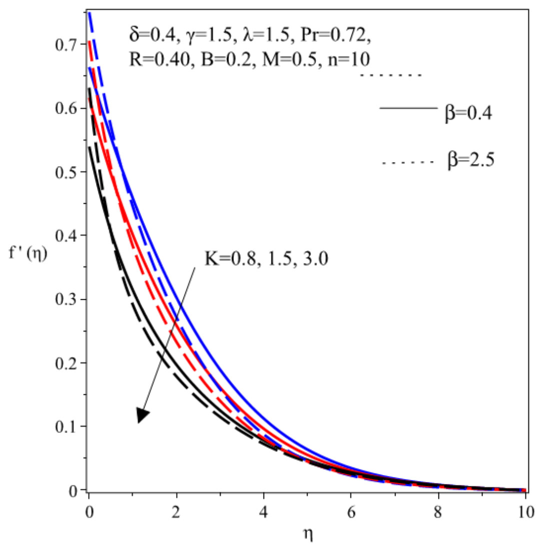

Fig. 2 Impacts of β and K on $f'(\eta)$

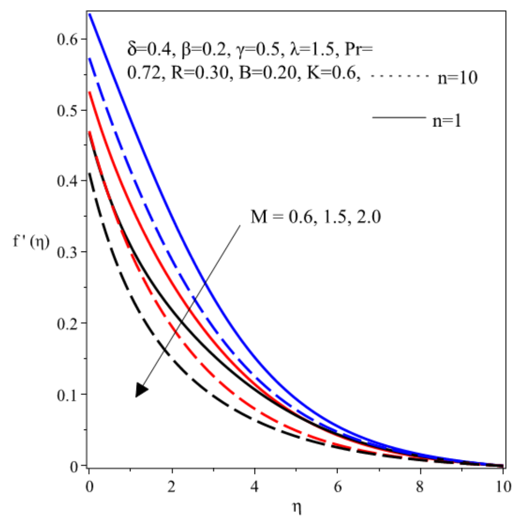

Fig. 3 Effect of n and M on $f'(\eta)$

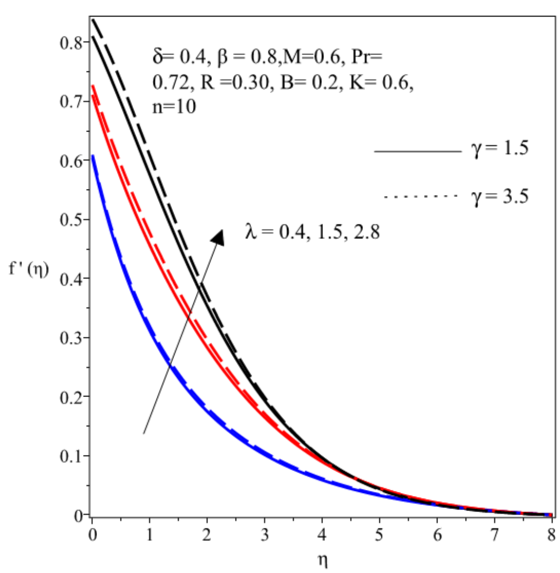

Fig. 4 Effects of λ and γ on $f'(\eta)$

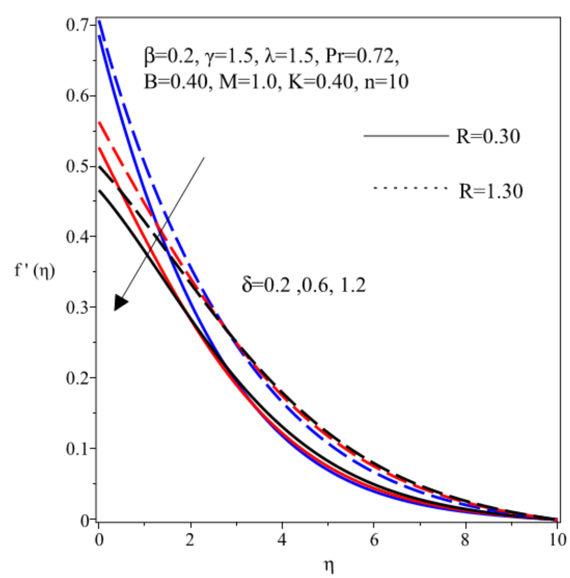

Fig. 5 Impacts of δ and R on $f'(\eta)$

This trend manifests due to the extreme advent of Lorentz force due to existence of magnetic field interaction with the electrically conducting Casson fluid. This Lorentz force depletes the fluid's momentum in the boundary layer and at such, a sharp decline in the fluid speed.

On the other hand, the fluid velocity rises with a jump in thermal buoyancy (λ) and convective heating parameter (γ) as shown in Fig. 4. Obviously, increasing λ decreases the fluid viscosity and strengthens the buoyancy force over the viscous force, thus, the flow rate is enhanced. The graphical nature of slip parameter (δ) with respect to velocity profile is depicted in Fig. 5.

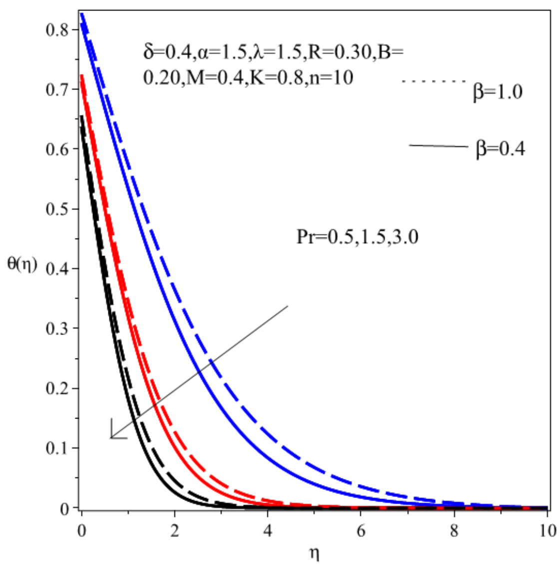

Fig. 6 Impacts of Pr and β on $\theta(\eta)$

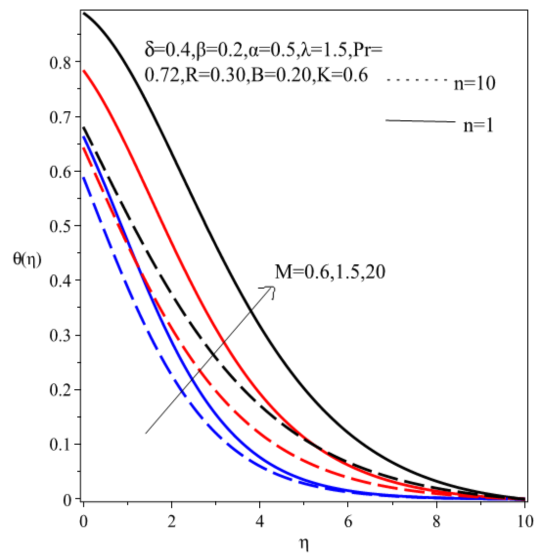

Fig 7. Impact of M and n on $\theta(\eta)$

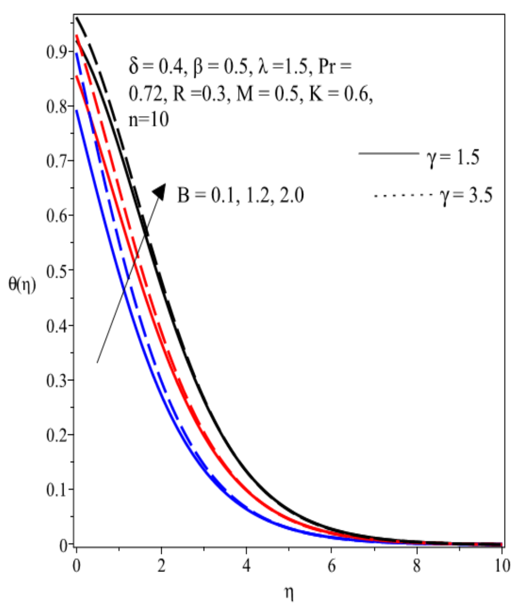

Fig. 8 Effects of B and γ on $\theta(\eta)$

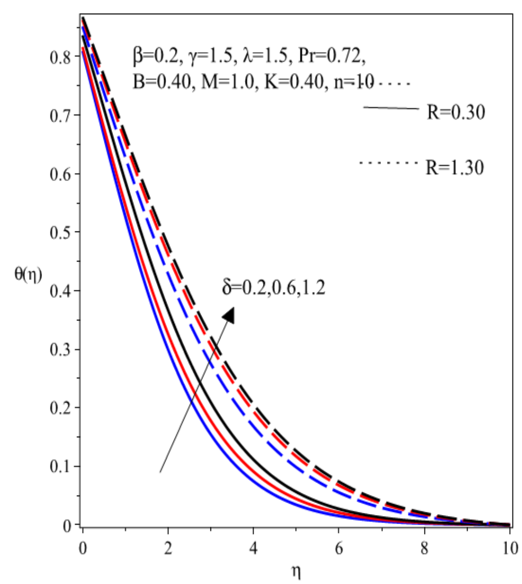

Fig. 9 Plot of δ and R on $\theta(\eta)$

The fluid motion decelerates (δ) grows. The intensity of the impulsive boundary region is also minimized. This is proven within the velocity-slip region where the impulse given by the sheet is partially conveyed to the fluid.

In Figs. 6-10, the graphs portray some emerging parameters on temperature profile $(\theta'(\eta))$ are displayed. Fig. 6 describes the upshots of Prandtl number (Pr) and (β) on temperature profile. The dimensionless temperature enhances as (β) rises whereas $\theta'(\eta)$ together with the thermal boundary structure fall as Pr grows. This indicates that an improvement in Pr typifies a surge in fluid viscosity while lowering the thermal conduction of the fluid and at such, the fluid temperature falls. Likewise, Fig. 7 portrays the variation of M alongside nonlinear stretching parameter (n) on $\theta'(\eta)$. This plot ascertained that enhancing The magnitude of M induces a spike in boundless temperature and thermal boundary region. Nevertheless, an opposite pattern is perceived on dimensionless temperature for a rising value of (n).

Figure 8 represents the impact of heat source term B and convective heating parameter (γ) on $\theta(\eta)$. Obviously, augmenting the heat source parameter (B) raises the temperature profile. The advancement B adds more heat towards the stretching sheet and significantly contributes to increased temperature. Similarly, temperature is a rising function of convective heating parameter (γ). Fig. 9 reveals that enhancing the radiation parameter (R) and the slip parameter (δ) raises $\theta(\eta)$ strengthens the thermal boundary region.

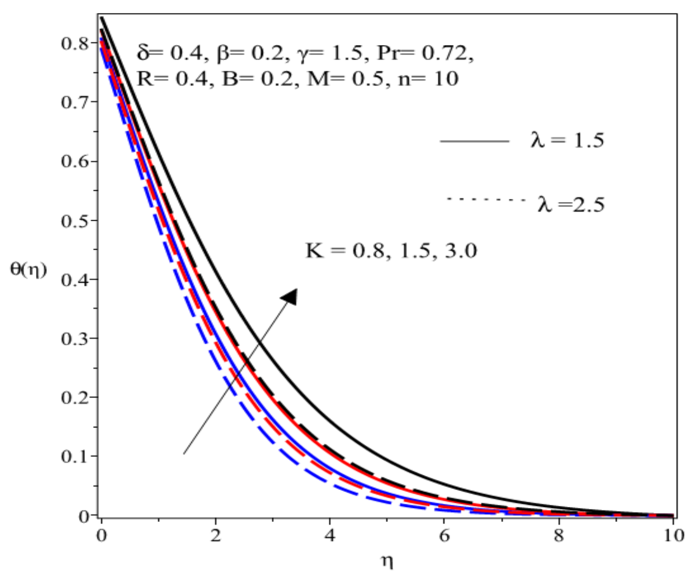

Fig. 10 Impact of K and λ on $\theta(\eta)$

Fig. 10 depicts the impact of porosity parameter (K) and thermal buoyancy (λ) on $\theta(\eta)$. It should be noted thattemperature rises as porosity (K) rises and falls as (λ) increases. This shows how buoyancy increases fluid density thereby facilitating the fall of temperature gradient. The result clearly shows that temperature increases more rapidly in permeable medium.

CONCLUSION

This current study theoretically investigated magnetohydrodynamic Casson fluid flow over a convectively heated and slippery nonlinearly stretched sheet configured in a porous medium. The incompressible viscous fluid flow is characterized by thermal radiation and heat source. The non-dimensional transport equations are numerically solved using shooting technique cum fourth-order Runge-Kutta technique implemented via MAPLE software. The reactions of the embedded physical parameters on the motion and heat dissipation fields are depicted graphically and discussed. Comparably, the results obtained for the shear stress together with Nusselt numbers are validated with the published results under limiting conditions and found to be in conformity. From the findings of this study, it is recommended that researchers in this field should incorporate convective heating condition at the wall for better prediction as this gives better and accurate results than isothermal conditions at the bounding surface. The analysis has also shown that:

• The Casson fluid acts to reduce the motion of the fluid as it falls also with growth in the magnitude of the slip term, magnetic field, porosity and nonlinear stretching parameters. However, the situation is reversed in the existence of the buoyancy and convective heating parameters.
• The thermal field with its boundary layer structure declines with advancing effect of the Prandtl number and buoyancy force while such a trend is reversed in the presence of slip term, radiation and magnetic field parameters.
• The rate of heat transfer can be improved with higher Prandtl number whereas the surface shear stress can be lowered by reducing the magnitude of the nonlinear stretching parameter.

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