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BIOCONVECTIVE STUDY ON FLOW ANALYSIS OF THE MHD FALKNER-SKAN FLOW OF EYRING-POWELL NANOFLUID WITH GYROTATIC MICROORGANISM PAST A WEDGE

Tapas Datta,
State Aided College Teacher (SACT), Department of Mathematics, A.K.P.C. Mahavidyalaya, Subhasnagar, Bengai, Hooghly, West Bengal, India.
Ph.D scholar , Dr. A P J Abdul Kalam University, Indore, Madhya Pradesh - 452016
Email: tapasdatta9999@gmail.com

Dr. Anjana Rajoria,
Department of Mathematics, Dr. A P J Abdul Kalam University, Indore, Madhya Pradesh - 452016
E-mail: anjna_rajoria@rediffmail.com

Dr. Md Tausif Sk,
Department of Mathematics, Acharya B N Seal Colllege, Cooch Behar – 736101, West Bengal, India
Email: tausifdropbox@gmail.com

ABSTRACT: These days, numerous hypothetical models are accessible for dissecting properties of moves through various calculations. Our point is to consider the MHD limit layer Falkner Skan flow of Eyring-Powell nanofluid stream with gyrotactic microorganisms containing in it. The wedge is moving and Brownian development, thermophoretic occasion have been thinking about building the streaming model. Reasonable dimensionless closeness variable has been acquainted with computing the displaying mathematically utilizing Runge Kutta technique with secant scheme of arrangement. Our findings have been illustrated through fitting diagrams and graphs. To quantify the relationship between the streaming factor and the actual estimations of the stream we assess the connection and assurance coefficients. We've discovered a phenomenal level of relationship between the components and the stream execution.

KEY WORDS: MHD boundary layer flow; Bioconvection; gyrotactic microorganism; Falkner Skan Flow; Brownian Motion; Thermophoresis; Wedge; Eyring-Powell Nanofluid.

LITERATURE REVIEW:

Bioconvection is the unprompted design of perceptible liquid examples, for example, falling crest. There are mostly two kinds of up swimming miniature living beings that are by and large applied in bioconvection tests: base substantial green growth and firm oxytactic microorganisms. Even though the bioconvection designs molded by them are indistinguishable, the instruments of course are distinctive [1]. These manuals for the improvement of hydrodynamic precariousness under specific conditions. The motile miniature organic entities are self-impelled which expand the thickness of the base liquid by swimming with a certain goal in mind in the liquid in response to such improvement as light, gravity, and so on through nanoparticles are not self-moved. The developments of nanoparticles occur because of Brownian movement and thermophoresis property and are conveyed by the progression of the base liquid. Nanofluids have incredible potential in the uses of miniature fluidic gadgets since they are exceptionally useful for a mass vehicle upgrade, initiate blending, particularly in miniature volumes, just as develop the soundness of nanofluids. The idea of nanofluid bioconvection containing gyrotactic microorganisms was first presented by Hillesdon et al. [2]. By and large, bioconvection in nanofluids happens when the centralization of nanoparticles is little, so the consistency of the base liquid doesn't change altogether. For down to earth reason, at the essential level, the idea of suspensions conveying both nanoparticles and motile microorganisms in Microsystems should be perceived. One of the promising uses of bioconvection in bio-microsystems is the upgrade of the mass vehicle and blending [3, 4]. There is additionally significant potential in utilizing nanofluids in various bio-microsystems, for example, improvement of celluloses creation, catalyst biosensors [5], chip-size miniature gadgets utilizing to assess harmfulness of nanoparticles [6], and provocative reactions of the lung to silica nanoparticles [7] and so on Ghorai et al. [8] first present the bioconvection issue conveying little strong particles and gyrotactic microorganisms. A few scientists [9-12] have been conveyed forward crafted by Ghorai et al. [8]. Khan and Pop [13] experienced a blended convection issue of a nanofluid containing both nanoparticles and gyrotactic microorganisms.

Nanofluids lately are viewed as fundamental in designing applications, however, they likewise assume an expressive job in late modern turns of events. Indeed in the advanced world, an Earth-wide temperature boost and natural contamination unavoidably make energy emergencies. In this manner, for constant turns of events, specialists and researchers are looking for new energy creations. In light of the new headway in nanotechnology, the communication of nanoparticles is viewed as more helpful to develop warm proficiency of base liquids. Nanoparticles are additionally utilized as coolants in gigantic mechanical and modern frameworks. This thought was exuded by Choi and Eastman [14] and entranced the consideration of agents lately. Buongiorno [15] admonished the two fundamental highlights specifically thermophoresis and Brownian viewpoints for the development of warmth move related with nanoparticles. Bhatti et al. [16] executed the Buongiorno model to analyze the thermo-dispersion examination in Eyring-Powell nanofluid deluged in the permeable surface. The particular qualities of non-Newtonian liquids have been as of late concentrated immeasurably by different examiners as a result of their fascinating applications in the time of synthetic and mechanical businesses. These liquids are multidisciplinary and liked over reliably gooey liquids because of their incomparable rheological properties. Makeup, blood, black-top, stick, natural solvents, nectar prompts such class of liquids. Non-Newtonian liquids, because of their significant impacts, has various applications in the atomic fuel slurries, ointments, bio-liquids in organic tissue, polymeric fluid expulsion, emulsions and polymers, and some more. Confused to the thick liquids, the rheology of non-Newtonian liquids can't be estimated by a solitary numerical articulation. In this manner, to feature such complex properties as viscoelasticity, shear thickening, diminishing and thixotropy, and so forth, some unconventional liquid models have been propounded in the writing. Amid such models, Eyring-Powell liquid is of them which fulfilled the shear diminishing (consistency declined with shear rate) properties. Naseer et al. [17] examined the progression of Eyring-Powell liquid over a vertically moving extending chamber. The non-comparable parts of the displayed issue have been dealt with mathematically by utilizing Runge–Kutta–Fehlberg iterative plan. Hamid et al. [18] presented the mathematical recreations on the wedge stream of Eyring-Powell liquid within the sight of warmth move. They worried that the wedge point boundary successfully adjusted the thickness of the limit layer. The extending stream of Eyring-Powell liquid bookkeeping, the electric and attractive field impacts, have been summed up by Hayat et al. [19]. The impedance of speed and warm slip in Eyring-Powell liquid stream screamed by a moving plate has been indicated by Lund and collaborators [20]. Hayat et al. [21] inspected the effect of warm radiation in the progression of exaggerated digression liquid by utilizing convective conditions. The 3D progression of Eyring-Powell-Casson liquid with heat assimilation/age and homogeneous-heterogeneous highlights were examined by Raju et al. [22]. Marin [23] examined the thermoelasticity conduct of dipolar bodies by methods for Cesaro.

Then again, the thermal move stream past wedge molded bodies has been the subject of incredible interest, predominantly because of its functional applications in groundwater contamination, heat exchangers, geothermal energy recuperation, electronic cooling, raw petroleum extraction, heat protection inside airplane lodges, stockpiling of atomic waste, and so forth Falkner and Skan [24] unexpectedly proposed likeness arrangements of the thick stream over a fixed wedge. This pioneering work has been additionally investigated by Lin and Lin [25] and examined the constrained convection stream past an isothermal and uniform transition wedge for various Prandtl numbers. The conduct of thermal move in constrained convection stream prompted by wedge towards pull and infusion was examined by Watanabe [26]. Later on, Ishak et al. [27] completed an investigation of the two-dimensional limit layer stream of gooey liquid brought about by moving wedge. They got the mathematical outcomes utilizing the Keller box technique. Also, they had the option to deal with the answer for huge estimations of wedge point boundaries. The impact of heat radiation on blended convection stream created by static wedge immersed in a permeable medium loaded up with nanofluid was inspected by Chamkha et al. [28]. They changed the administering fractional differential conditions over to normal halfway differential conditions utilizing non-comparative changes and mathematical outcomes were acquired employing the Keller box technique. Yih [29] examined MHD convective stream over a non-isothermal wedge. At that point, Mukhopadhyay et al. [30] considered Casson liquid stream over the wedge.

All the previously mentioned examines focused on the stream over a wedge with substance response, attractive field, and warmth source/sink boundaries. However, no examination has been accounted for, up to the creators' information, on the investigation of the thermophoresis and Brownian movement impacts on magnetohydrodynamic Falkner-Skan and Blasius stream over a wedge loaded up with gyrotactic microorganisms. The numerical arrangements are dictated by applying the Runge-Kutta and the Newton techniques. Charts are appeared and are portrayed for different non-dimensional administering boundaries of interest.

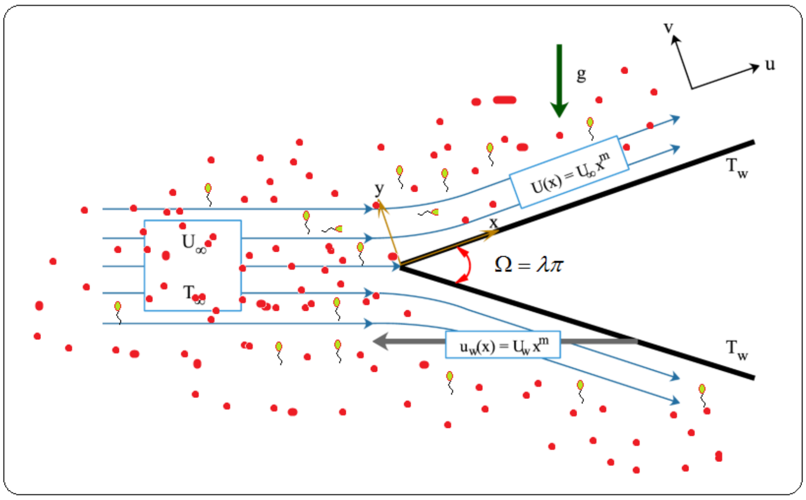

FIGURE 1: PHYSICAL MODEL OF THE FLOW

MODEL FORMATION:

Think about a consistent, two-dimensional magnetohydrodynamic Falkner-Skan stream of a Eyring-Powell liquid over a wedge loaded up with gyrotactic microorganisms. Brownian movement and thermophoresis impacts are considered. The total angel of the wedge $\Omega = \lambda\pi$, Here $\lambda = \frac{2m}{m+1}$ is the wedge angle parameter. The speeds at the wedge and free stream are $U_{wg}(x) = U_w x^m$ and $U_e(x) = U_\infty x^m$, separately. Likewise, the temperature and concentration at the boundary and free stream are indicated by T_{wg}, T_∞ and N_{wg}, N_∞. A fluctuating attractive field $G(x) = G_o x^{\frac{m-1}{2}}$, is applied to the stream bearing. Further, in such a moving calculation, the pivot is taken with a surface wedge while the hub is opposite to it. The flat and vertical parts of speeds are described in and course, separately. The attractive field of steady greatness is using typically, and under the little attractive Reynolds number theory, the prompted attractive field impacts are ignored (see Fig. 1). Reproducing these suppositions, we can communicate the stream issue in streaming conditions:

$$\left.\begin{aligned}
&\frac{\partial u_x}{\partial x} + \frac{\partial u_y}{\partial y} = 0 \\
&u_x \frac{\partial u_x}{\partial x} + u_y \frac{\partial u_x}{\partial y} = U_e \frac{\partial U_e}{\partial x} + \nu_f \left(1 + \frac{1}{\rho_f \beta^* c_1}\right) \frac{\partial^2 u_x}{\partial y^2} - \frac{1}{2\rho_f \beta^* c_1^3} \left(\frac{\partial u_x}{\partial y}\right)^2 \frac{\partial^2 u_x}{\partial y^2} - \frac{\sigma_f G^2}{\rho_f}(U_e - u_x) \\
&+ \frac{g}{\rho_f}\left\{(1 - N_\infty)\rho_{f\infty}\beta^*(T - T_\infty) - (\rho_p - \rho_{f\infty})(N - N_\infty) - \lambda(M - M_\infty)(\rho_{m\infty} - \rho_{f\infty})\right\} \\
&u_x \frac{\partial T}{\partial x} + u_y \frac{\partial T}{\partial y} = \frac{\kappa_f}{(\rho c_p)_f} \frac{\partial^2 T}{\partial y^2} + \Lambda\left\{D_B \frac{\partial T}{\partial y}\frac{\partial N}{\partial y} + \frac{D_T}{T_\infty}\left(\frac{\partial T}{\partial y}\right)^2\right\} \\
&u_x \frac{\partial N}{\partial x} + u_y \frac{\partial N}{\partial y} = D_B \frac{\partial^2 N}{\partial y^2} + \frac{D_T}{T_\infty}\frac{\partial^2 T}{\partial y^2} \\
&u_x \frac{\partial M}{\partial x} + u_y \frac{\partial M}{\partial y} = D_M \frac{\partial^2 M}{\partial y^2} - \frac{bW_C}{N_\infty}\frac{\partial}{\partial y}\left(M \frac{\partial N}{\partial y}\right)
\end{aligned}\right\} \quad (3)$$

The corresponding boundary conditions are

$$\left.\begin{array}{l} u_x = U_{wg}(x), v = 0, T = T_{wg}, N = N_{wg}, M = M_{wg} \text{ at } y = 0 \\ u_x \to U_e(x), T \to T_\infty, N \to N_\infty, M \to M_\infty \text{ as } y \to \infty \end{array}\right\} \quad (4)$$

Here, (β^*, c_1) Eyring – Powell fluid parameter, ρ_f symbolized the fluid density, ν_f is the viscosity, β^* volume expansion coefficient,g is the gravity, ρ_p the density of the nanoparticles, σ_f mentioned the electric conductivity, N is concentration of nanoparticle, M density of gyrotactic microorganism, T is temperature of the flow, D_T is the diffusion thermophoretic coefficient, D_B Brownian motion constant, D_M is the concentration density of diffusion coefficient, b is the chemo taxis coefficient.

To change the overseeing partial differential conditions into a bunch of coupled nonlinear ordinary differential conditions, we currently present the following similarity transformations:

$$\left.\begin{array}{l} \psi = \left(\frac{2\nu_f U_e x}{m+1}\right)^{\frac{1}{2}} F(\xi), \xi = \left(\frac{(m+1)U_e}{2\nu_f x}\right)^{\frac{1}{2}} y, u_x = \frac{\partial \psi}{\partial y} = U_e F^I, \\ u_y = -\frac{\partial \psi}{\partial x} = -\left(\frac{2\nu_f U_\infty}{m+1}\right)^{\frac{1}{2}} x^{m-1/2}\left(\frac{m+1}{2}F + \frac{m-1}{2}\xi F^I\right), \\ \vartheta(\xi) = \frac{T - T_\infty}{T_{wg} - T_\infty}, \varphi(\xi) = \frac{N - N_\infty}{N_{wg} - N_\infty}, \chi(\xi) = \frac{M - M_\infty}{M_{wg} - M_\infty} \end{array}\right\} \quad (5)$$

The transformed suit of Ordinary differential equations are

$$\left.\begin{array}{l} (1+\varepsilon_1)F^{III} - \varepsilon_1\omega(F'')^2 F''' - H(F^I - 1) + FF^{II} + \lambda\left(1 - (F^I)^2\right) + \gamma_{mc}(\vartheta - N_R\varphi - N_C\chi) = 0 \\ \frac{1}{P_R}\vartheta^{II} + F\varphi^I + N_T(\vartheta^I)^2 + N_B\vartheta^I\varphi^I = 0 \\ \varphi^{II} + L_E F\varphi^I + \frac{N_T}{N_B}\vartheta^{II} = 0 \\ \chi^{II} + L_B F\chi^I - P_E\left\{\varphi^I\chi^I + \varphi^{II}(\varepsilon + \chi)\right\} = 0 \end{array}\right\} \quad (6)$$

The converted boundary conditions are

$$\left.\begin{array}{l} F(0) = 0, F^I(0) = \delta, \vartheta(0) = 1, \varphi(0) = 1, \chi(0) = 1 \\ F^I \to 1, \vartheta \to 0, \varphi \to 0, \chi \to 0 \text{ as } \xi \to \infty \end{array}\right\} \quad (7)$$

Here, $\delta = \frac{U_{wg}}{U_\infty}$ (the wedge factor), $\left(\varepsilon_1 = \frac{1}{\mu_f\beta^* c_1}, \omega = \frac{u_w^3}{2x\nu_f c_1^2}\right)$ are the dimensionless Eyring – Powell fluid constants, $H = \frac{2\sigma_f G_0^2}{\rho_f U_\infty(m+1)}$ (reduced magnetic factor), $\gamma_{mc} = \frac{\beta^*(1-N_\infty)(T_{wg} - T_\infty)}{(m+1)U_e^2}$ (the mixed convection parameter), $N_R = \frac{(\rho_p - \rho_{f\infty})(N_{wg} - N_\infty)}{\beta^*(1-N_\infty)(T_{wg} - T_\infty)}$ (buoyancy ratio parameter), $N_C = \frac{\lambda(\rho_{m\infty} - \rho_{f\infty})(N_{wg} - N_\infty)}{\beta^*(1-N_\infty)(T_{wg} - T_\infty)}$ (bioconvection Rayleigh number), $P_R = \frac{\mu c_p}{\kappa_f}$ (Prandtl Number), $N_T = \frac{\Lambda D_T(T_{wg} - T_\infty)}{\nu_f T_\infty}$ (thermophoresis factor), $N_B = \frac{\Lambda D_B(N_{wg} - N_\infty)}{\nu_f}$ (Brownian motion factor),

$L_E = \frac{\nu_f}{D_B}$ (Lewis number), $L_B = \frac{\nu_f}{D_M}$ (bioconvection Lewis number), $P_E = \frac{bW_C}{D_M}$ (Peclet number) and $\varepsilon = \frac{N_\infty}{\left(N_{wg} - N_\infty\right)}$ (fluid parameter).

For engineering interest, physical quantities like the local shear stress coefficient(Cfr_x), local Nusselt number(Nur_x) and local Sherwoodnumbers (Shr_{np} and Shr_{mo}) are given by

$$\begin{pmatrix} Cfr_x \\ Nur_x \\ Shr_{np} \\ Shr_{mo} \end{pmatrix} = \begin{pmatrix} F^{II}(0) + \frac{1}{2} We\left(F^{II}(0)\right)^2 \\ -\vartheta^I(0) \\ -\varphi^I(0) \\ -\chi^I(0) \end{pmatrix} \quad (8)$$

SOLUTION METHODOLOGY:

The nonlinear differential conditions (6) alongside the limit conditions (7) from a two-point boundary value problem (BVP) are settled utilizing shooting strategy, by changing over into an initial value problem (IVP). In this technique, the arrangement of Eqs. (6) is changed over into the arrangement of following the first-request framework

$$F = \phi_0, F^I = \phi_0^I = \phi_1, F^{II} = \phi_1^I = \phi_2, F^{III} = \phi_2^I = \frac{1}{\left[1 + \varepsilon_1\left\{1 - \omega\left(F''\right)^2\right\}\right]} \begin{Bmatrix} H\left(\phi_1 - 1\right) - \phi_0\phi_2 - \lambda\left(1 - \left(\phi_1\right)^2\right) \\ -\gamma_{mc}\left(\phi_3 - N_R\phi_5 - N_C\phi_7\right) \end{Bmatrix}$$

$$\vartheta = \phi_3, \vartheta^I = \phi_3^I = \phi_4, \vartheta^{II} = \phi_4^I = -P_R\left\{\phi_0\phi_6 + N_T\left(\phi_4\right)^2 + N_B\phi_4\phi_6\right\},$$

$$\varphi = \phi_5, \varphi^I = \phi_5^I = \phi_6, \varphi^{II} = \phi_6^I = -L_E\phi_0\phi_6 + \frac{N_T P_R}{N_B}\left\{\phi_0\phi_6 + N_T\left(\phi_4\right)^2 + N_B\phi_4\phi_6\right\} \quad (9)$$

$$\chi = \phi_7, \chi^I = \phi_7^I = \phi_8, \varphi^{II} = \phi_8^I = -L_B\phi_0\phi_8 + P_E\left\{\phi_4\phi_6 + \left(\varepsilon + \phi_7\right)\left[\begin{matrix} -L_E\phi_0\phi_6 + \frac{N_T P_R}{N_B} \\ \times\begin{Bmatrix} \phi_0\phi_6 + N_T\left(\phi_4\right)^2 \\ +N_B\phi_4\phi_6 \end{Bmatrix} \end{matrix}\right]\right\}$$

with the boundary conditions,

$$\varphi_0(0) = 0, \varphi_1(0) = \delta, \varphi_3(0) = 1, \varphi_5(0) = 1, \varphi_7(0) = 1 \quad (10)$$

To solve Eqs. (9) and (10) as an IVP we must need the values foR $\varphi_2(0)$ i.e. $F^{II}(0)$, $\phi_4(0)$ i.e. $\vartheta^I(0)$, $\phi_6(0)$ i.e. $\varphi^I(0)$ and $\phi_8(0)$ i.e. $\chi^I(0)$, however, no such qualities are given. The underlying conjecture esteems for $F^{II}(0), \vartheta^I(0), \varphi^I(0)$ and $\chi^I(0)$ are picked and the fourth request Runge-Kutta mix plot is applied to acquire the arrangements of (6) fulfilling the underlying conditions (7).The computed values of $F^I(\xi), \vartheta(\xi), \varphi(\xi)$ and $\chi(\xi)$ at ξ_∞ are compared with the given boundary conditions $F^I(\xi_\infty) = 0, \vartheta(\xi_\infty) = 0, \varphi(\xi_\infty) = 0$ and $\chi(\xi_\infty) = 0$, and adjust the values of $F^{II}(0), \vartheta^I(0), \varphi^I(0)$ and $\chi^I(0)$ utilizing "secant strategy" to give the best estimate for the arrangement. The progression size $\Delta\xi = 0.01$ of was taken to be fulfilled for the assembly measure of 10^{-5}.

CODE VERIFICATION:

Before we talk about the stream highlights it is imperative to get the congruity of our current examination with the past exploration works in this field. To approve the current model, a correlation table (see Table 1) is drawn based on $F^{II}(0)$ for various qualities m without $\varepsilon_1, \omega H, \gamma_{mc}$ and δ. Table 1 affirms that the mathematical results delivered by the current code are in brilliant congruity with the results of Yih [29] and Mukhopadhyay et al.[30], along these lines, worthy of the work of present code for this model.

Table 1: Values Of $F^{II}(0)$ With Variation In m

m	Present work	Yih [29]	Mukhopadhyay et al. [30]
-0.05	0.2146781	0.21348	0.21380
0.0	0.3321247	0.33323	0.333220
0.333	0.7564154	0.75745	0.75758
1.0	1.2342318	1.232588	1.23271

TABLE 2: VALUES OF PHYSICAL QUANTITIES FOR VARIOUS VALUES OF FLOW FACTORS

N_B	N_T	P_E	Cfr_x	Nur_x	Shr_{np}	Shr_{mo}
0.1	0.2	0.5	1.489531	0.308046	0.435776	0.589201
0.3	--	--	1.476501	0.324191	0.457238	0.613184
0.5	--	--	1.462347	0.332989	0.468706	0.625805
0.7	--	--	1.442348	0.338512	0.475826	0.633566
0.9	--	--	1.420125	0.342298	0.480673	0.638823
0.3	0.1	0.5	1.470564	0.421529	0.473142	0.638468
--	0.3	--	1.477151	0.379207	0.470156	0.631553
--	0.5	--	1.481204	0.345191	0.467078	0.625263
--	0.7	--	1.490247	0.317172	0.463983	0.619498
--	0.9	--	1.510215	0.293645	0.460914	0.614141
0.3	0.2	0.0	1.490159	0.324601	0.645548	0.707412
---	--	0.3	1.485107	0.329669	0.492964	0.635865
--	--	0.6	1.480124	0.332591	0.399019	0.588546
--	--	0.9	1.473261	0.334472	0.335291	0.554883
--	--	1.2	1.480125	0.335778	0.289191	0.529688

TABLE 3: CORRELATION OF COEFFICIENTS (r) BETWEEN VARIOUS FACTORS WITH VARIOUS PHYSICAL QUANTITIES

r	Cfr_x	Nur_x	Shr_{np}	Shr_{mo}
N_B	-0.98343	0.97457	0.96475	0.94851
N_T	0.97596	-0.98674	-0.98594	-0.97388
P_E	-0.99277	0.97870	0.97676	0.97092

STATISTICAL ANALYSIS:

From table 2, the creators have processed the coefficients of relationship (r) between the different relevant components of the stream and actual amounts and introduced them in table 3. Here we can see that all the connection is huge as their qualities are exceptionally near +1 or - 1. Likewise utilizing the information from table 3, creators have assessed the qualities coefficients of assurance ($D = r^2$) in table 4, which empowers us to check up the strength of affiliation and control of fitting variable of the stream on the actual amounts.

TABLE 4: COEFFICIENTS OF DETERMINATIONS (D) BETWEEN VARIOUS FACTORS WITH VARIOUS PHYSICAL QUANTITIES

$D = r^2$	Cfr_x	Nur_x	Shr_{np}	Shr_{mo}
N_B	0.967135	0.949787	0.930743	0.899671
N_T	0.952498	0.973656	0.972078	0.948442
P_E	0.985592	0.957854	0.95406	0.942686

It is seen that Brownian movement and Peclet number have a huge negative effect on skin grinding of the stream, while it has a profoundly certain effect on warmth and mass exchange capacity of the stream. Yet, on the opposite thermophoresis has a positive effect on skin contact however negative impact on warmth and mass exchange of both nanoparticles and microorganisms.

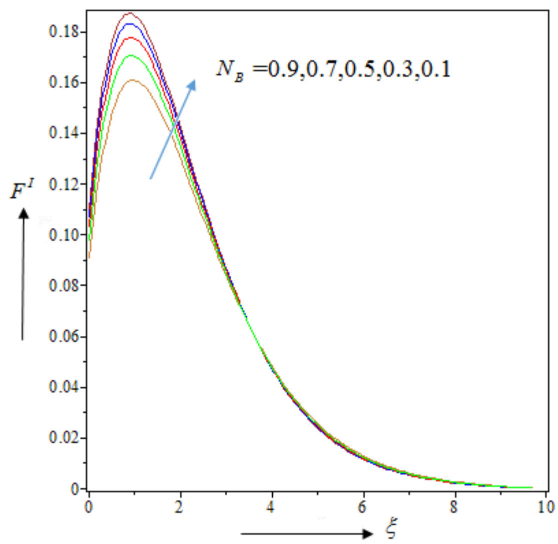

FIGURE 2: EFFECT OF N_B ON THE VELOCITY PROFILE OF THE FLOW

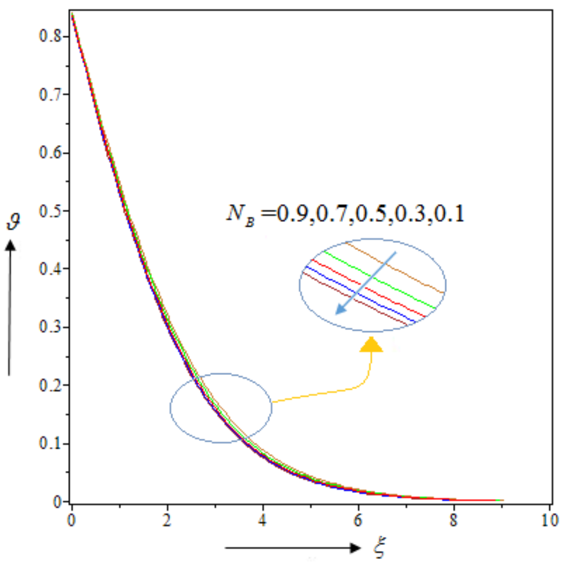

FIGURE 3: EFFECT OF N_B ON THE TEMPERATURE PROFILE OF THE FLOW

DELIBERRATION AND DISCUSSION:

We analysed MHD boundary layer flow of Eyring-Powell Nanofluid past over a wedge. The fluid contains nanoparticles and gyrotactic microorganisms in it. In the flow analysis, Brownian motion and thermophoresis effect have been taken into consideration while formulating the mathematical model.Here we discussed the influence of Brownian motion, thermophoretic event and the Peclet number on the flow character and its properties.

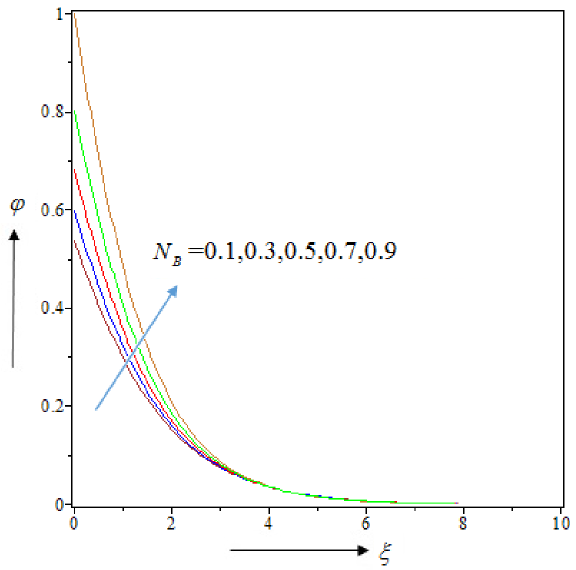

FIGURE 4: EFFECT OF N_B ON THE NANOPARTICLE DENSITY PROFILE OF THE FLOW

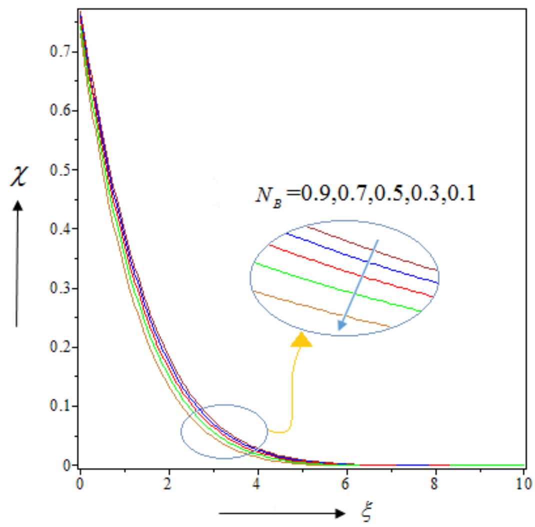

FIGURE 5: EFFECT OF N_B ON THE MICROORGANISM DENSITY PROFILE OF THE FLOW

INFLUENCE OF BROWNIAN MOTION PARAMETER (N_B):

In table 2, we witness that influence in Brownian movement intensifies the heat and mass transfer ability of both nanoparticles and organisms in the fluid while it lessens the skin friction at the surface. As a result, we witness a spike in the velocity profile of the flow in figure 2. But due to the random movement at that surface of the wedge, nanoparticles gets less time to absorb thermal energy from the surface and that's why temporal profile gets diminished in the flow as shown in figure 3.

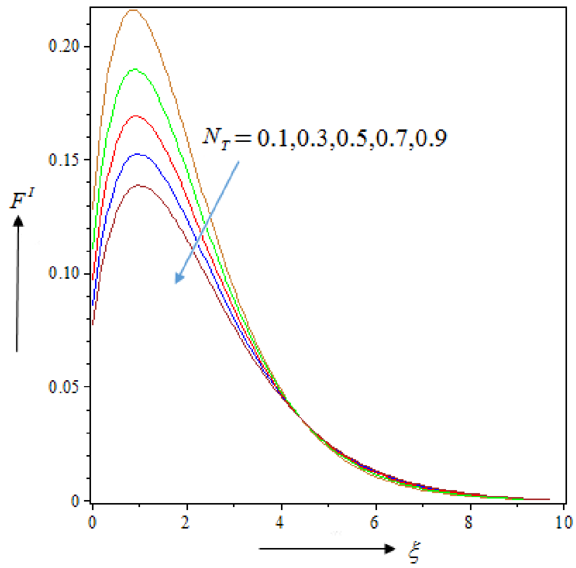

FIGURE 6: EFFECT OF N_T ON THE VELOCITY PROFILE OF THE FLOW

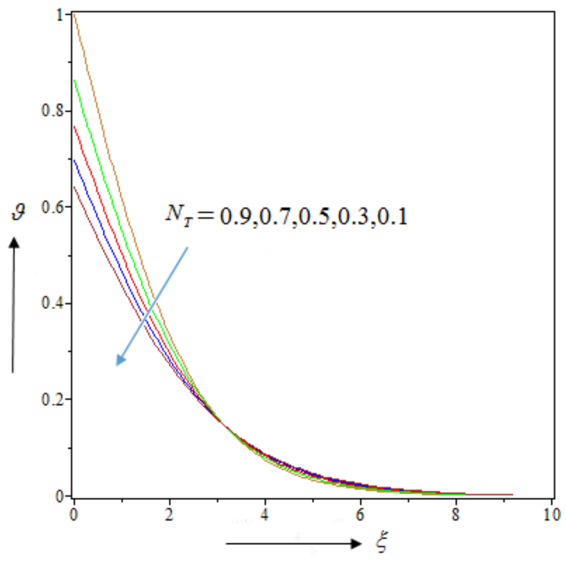

FIGURE 7: EFFECT OF N_T ON THE TEMPERATURE PROFILE OF THE FLOW

Similarly the nanoparticle density and organism density of the fluid also lessens with higher Brownian movement (see figure 4 and 5).

INFLUENCE OF THEMOPHORESIS PARAMETER (N_T):

Thermophoresis event intensifies the skin friction and faded away the heat and mass transfer in the flow (see table 2). Due to increased skin friction in the flow thermophoresis hinders the flow velocity significantly (figure 6).

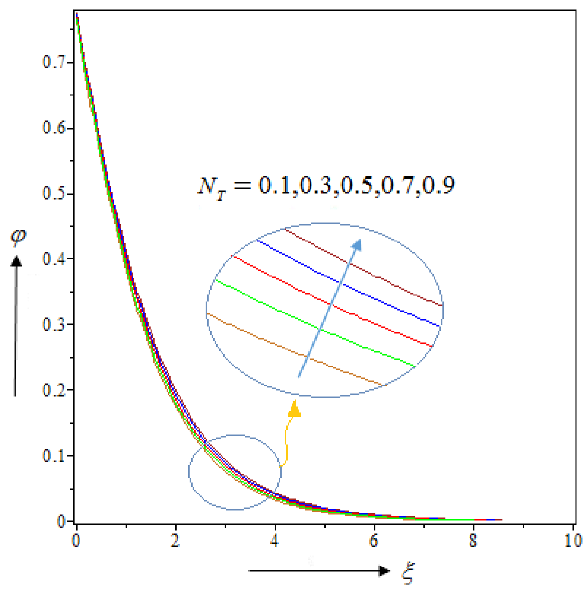

FIGURE 8: EFFECT OF N_T ON THE NANOPARTICLE DENSITY PROFILE OF THE FLOW

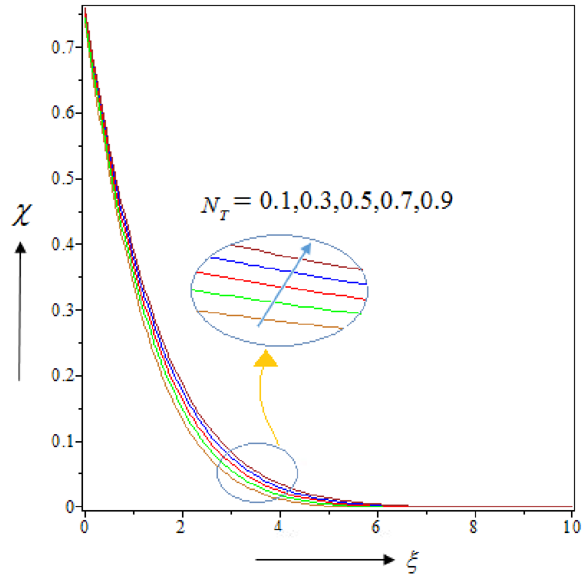

FIGURE 9: EFFECT OF N_T ON THE MICROORGANISM DENSITY PROFILE OF THE FLOW

Thermophoretic movement implies thermally charged nanoparticles and organisms move away form the heated surface of the flow. That's why temporal profile intensifies of the system spikes with more thermophoresis (Figure 7). Due to that charged up movement of the particles, it's density incearses significantly (figure 8). Also microorganism density elevates with thermophoretic event in the flow (figure 9).

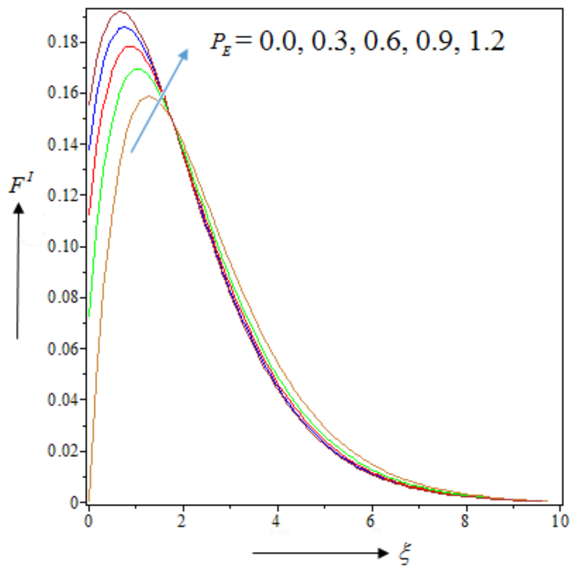

FIGURE 10: EFFECT OF P_E ON THE VELOCITY PROFILE OF THE FLOW

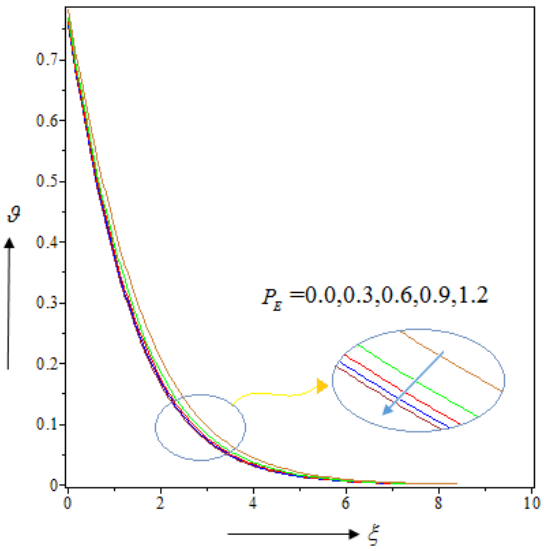

FIGURE 11: EFFECT OF P_E ON THE TEMPERATURE PROFILE OF THE FLOW

INFLUENCE OF PECLET NUMBER (P_E):

Peclet number is defined as the ratioofconvection mass transfer to the diffusive mass transport. So higher Peclet number symbolizes that convective mass transfer is on the higher side. This justifies that higher Peclet number intensifies the overall heat and mass transfer rate of the flow while by default it lessens the skin friction of the flow (Table 2). As the skin friction lessens and the heat transfer is elevated, the velocity of the flow automatically intensifies (figure 10). Although it is note worthy to mention that temperature and densities of nanoparticle and microorganisms of the flow diminishes with more Peclet number (figure 11-13).

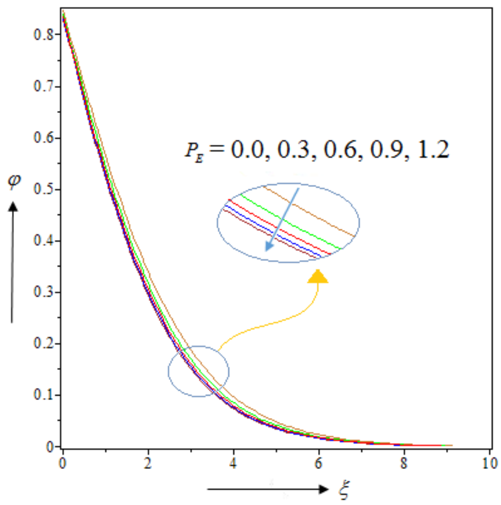

FIGURE 12: EFFECT OF P_E ON THE NANOPARTICLE DENSITY PROFILE OF THE FLOW

FINAL REMARKS:

After all the ardous work, it's time for final remarks of the current study. We have done a investigation on the MHD boundary layer flow of Eyring-Powell fluid over a wedge containing nanoparticles and microorganisms in it. We ought to see the influence of Brownian motion, thermophoretic motion and Peclet number on the flow characterstics. At last we have come to the following remarks to be make.

A. The parameters of interest in this study are highly correlated with the physical quantities of the flow as the value of correlation coefficients and determination coefficients suggest.

B. We've found the negetive correlation andpositive correlation between the factors and flow performance. This'll enables us to regulate the flow according to our need.

C. Brownian movment highly influence the nanoparticle density and the velocity of the flow.

D. Thermophoresis influences the organism density, temperature and velocity of the flow very significantly.

E. Peclet number is significant to intensify the velocity of the flow.

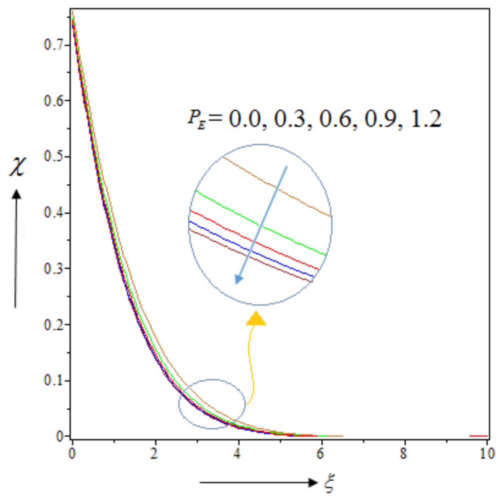

FIGURE 13: EFFECT OF P_E ON THE MICROORGANISM DENSITY PROFILE OF THE FLOW

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