

Numerical Solution of the Flow of the Upper Convicted Maxwell Fluid in Boundary Layer of Stretching Sheet in the Presence of MHD



J. Suresh Goud, Pudhari Srilatha, R. Sivaiah

Abstract: In this study, the solution of the upper limit of Maxwell liquid flow in the boundary layer stretch Sheet MHD side extension with integrated bvp5c digital solution from MATLAB. An approximate solution has been derived for suction velocity, and injection velocity, skin friction. Use the graph to discuss the results obtained to track the impact of different flow parameters.

Keywords: Boundary Layer, Upper Convicted Maxwell Fluid, Stretching Sheet

Pudhari Srilatha and M N Raja Shekar [10] analyzed magnetohydrodynamic studies in laminar flow on nonlinear drawn plates by injection / blowing and thermal radiation. Pudhari Srilatha and M N Raja Shekar [11] studied the effects of radiation on vertical surface convection and mass transfer during chemical reactions and heat/absorption processes. Shankar Goud, Srilatha and Raja Shekar [12] discussed the influence of Hall current and radiation on the parabolic acceleration plate of temperature variations in porous media through free convection.

I. INTRODUCTION

Stretching sheet is particularly important in the process of casting copy for the polymer industry. [1] Alizadeh-Pahlavan *et.al* [4] discussed using two ancillary parameter homotopy analysis methods, the UCM fluid flows over the MHD above the porous stretched sheet. El-Aziz, M.A [5] studied the dissipative effect on the viscous liquid is that the micropolar convection stretches the convection in an exponential manner to form a film. Alizadeh-Pahlavan[6] analyzed using two ancillary parameter homotopy analysis methods, the UCM fluid flows over the MHD above the porous stretched sheet. I.A. Hassanien [7] analyzed the heat transfer from the boundary layer occur in a continuous acceleration path extending into the micropolar fluid environment. Influence of ion current and Hall sliding on micropolar magnetic fluid, and effect of heat transfer on absorption and permeation of non-isothermal stress plates was studied by M.A. Seddeek [8]. Both heat transfer and momentum transfer are present in both the manufacture of plastic sheets and foils, but sometimes the plastic sheets can be stretched without involving heat transfer. Singh [9] analyzed the authority has a porosity parameter for flux flow through the porous tank through the elastomeric plate.

The present study is the Maxwell fluid flow solution condemned at the top of the MHD lateral expansion boundary layer with integrated bvp5c digital solution from MATLAB is presented in this paper clearly.

II. MATHEMATICAL ANALYSIS

Examine two unstable, electrically conductive, irradiating liquids with two increasing Maxwell flow rates.

The x axis is located along the plate, and the y axis is perpendicular to this direction. In the y-axis direction, a transverse static magnetic field is used. Because of the length of the two variables, their properties differ from the width of the x dimension. By adjusting the velocity component and velocity in x and y directions, the fluid continuity and moment equations are:

$$\frac{\partial u^*}{\partial x} + \frac{\partial u^*}{\partial y} = 0 \quad \text{---} \quad (1)$$

$$u^* \frac{\partial u^*}{\partial x} + v^* \frac{\partial u^*}{\partial y} = -\frac{1}{\rho} \left(\frac{\partial p}{\partial X} - \frac{\partial S_{XX}}{\partial X} - \frac{\partial S_{XY}}{\partial Y} + \sigma B_0^2 u^* \right) \quad \text{---} \quad (2)$$

$$u^* \frac{\partial v^*}{\partial x} + v^* \frac{\partial v^*}{\partial y} = \frac{1}{\rho} \left(-\frac{\partial p}{\partial X} + \frac{\partial S_{YX}}{\partial X} + \frac{\partial S_{YY}}{\partial Y} \right) \quad \text{--} \quad (3)$$

Use the following boundary layer approximation [2] is

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$$u^* = O(1), v^* = O(\delta), X = O(1), Y = O(\delta)$$

--- (4)

$$\frac{T_{XX}}{\rho} = O(1), \frac{T_{XY}}{\rho} = O(\delta), \frac{T_{YY}}{\rho} = O(\delta^2) \quad \text{--- (5)}$$

The pressure gradient does not exist and is controlled by the equation (4)

$$\lambda \left(u^{*2} \frac{\partial^2 u^*}{\partial X^2} + v^{*2} \frac{\partial^2 u^*}{\partial Y^2} + 2u^* v^* \frac{\partial^2 u^*}{\partial X \partial Y} \right) v^* \frac{\partial^2 u^*}{\partial Y^2} - \frac{\sigma B_0^2}{\rho} u^* = - \left(u^* \frac{\partial u^*}{\partial x} + v^* \frac{\partial u^*}{\partial y} \right) \quad \text{--- (6)}$$

There are relevant boundary conditions for the flow

$$\begin{cases} u^* = BX, & \text{at } y = 0 \\ v^* = V_0 & \text{at } y = 0 \\ u^* \rightarrow 0 & \text{as } y \rightarrow \infty \end{cases} \quad \text{--- (7)}$$

Where $\eta' = \sqrt{\frac{B}{v^*}} y, u^* = BXp'(\eta)$

Using the similarities described above, the governing equations and boundary conditions are reduced to

$$\frac{\partial^3 p}{\partial \eta'^3} = M^2 \frac{\partial p}{\partial \eta'} + \left(\frac{\partial p}{\partial \eta'} \right)^2 - \frac{\partial^2 p}{\partial \eta'^2} - \beta \left(2p \frac{\partial p}{\partial \eta'} \frac{\partial^2 p}{\partial \eta'^2} - p^2 \frac{\partial^3 p}{\partial \eta'^3} \right) = 0 \quad \text{--- (8)}$$

$$\begin{cases} p = R, p' = 1 & \text{at } \eta' = 0 \\ p' \rightarrow 0 & \text{as } \eta' \rightarrow \infty \end{cases} \quad \text{--- (9)}$$

Here $M^2 = \frac{\sigma B_0^2}{\eta' B}, \beta = \lambda B, R = \frac{v_0}{\sqrt{v^* B}}$

III. NUMERICAL PROCEDURE

Equation (8) under the boundary condition (9) has been numerically solved using the firing method. we consider $p = p_1, p' = p_2, p'' = p_3$, Equation (8) is converted to a first-order differential equation system as follows:

$$p' = p_2$$

$$p_1 = p_3 \quad \text{--- (10)}$$

$$p_3' = M^2 p_2 + (p_2)^2 - p_1 * p_3 - 2\beta p_1 p_2 p_3 - (p_1)^2 p_3' \quad \text{--- (11)}$$

In this method, we assume that the unspecified condition in equations (11) and (10) is the initial value problem for a given endpoint calculated by using MATLAB.

IV. RESULTS AND DISCUSSION

Figure keeping in mind the final goal to understand the impact of relaxation time, made 1-14 the influence of suction/spray parameters and magnetic parameters on speed. Figure 1-4 shows radiation parameter of the velocity segment p' and moment of the magnetic fluid p. As with the results of HAM, it was found that in Figures 1 and 2, the influence of suction was important. As shown in Figures 1-3, the velocity component is reduced but increases first. Then, in estimate 1,

it decreases between 1 and 2 as the radiation parameter evolves. In both cases, the boundary layer thickness is reduced. Figure 5 to 8 shows influence of dimensionless relaxation time on velocity component p' and p. Due to suction, Figures 5 to 7 shows that by increasing the speeds p' and p reducing the thickness of the boundary layer. However, due to the injection, the two reductions have increased. The figure depicts Figures 9 to 12 observe the effect of magnetic parameters on the velocity component p' and p. These indicates indicate in the case of aspiration and injection, p' and p are reduced by increasing magnetic parameter. In Figures 1 to 12, a good coincidence was found in the report of Hayat et al. and visualization strategies. When the magnetic parameters are increased, the reduction in wall shear stress during suction and ejection is shown in both Figures 13 and 14. The wall shear stress can easily obtained by $p''(0) = u(0)$ Wall shear stress values for different values of magnetic and radiation parameters HAP, HAM, bvp4c depicted.

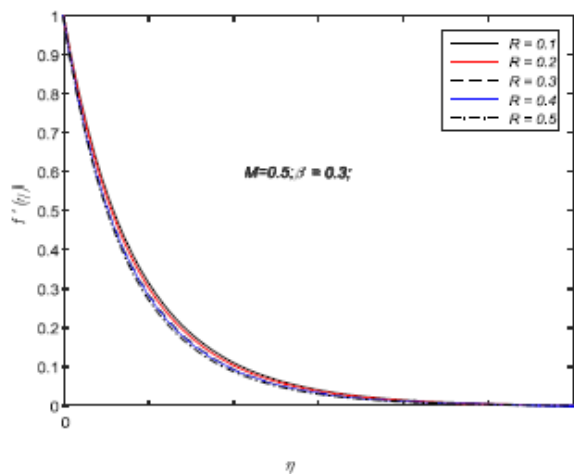


Figure.1

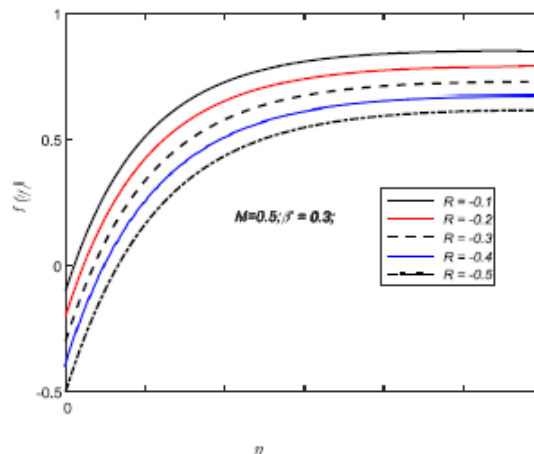


Figure.4

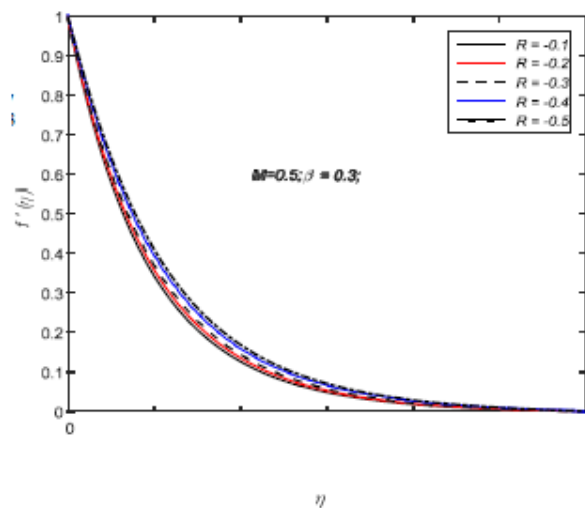


Figure.2

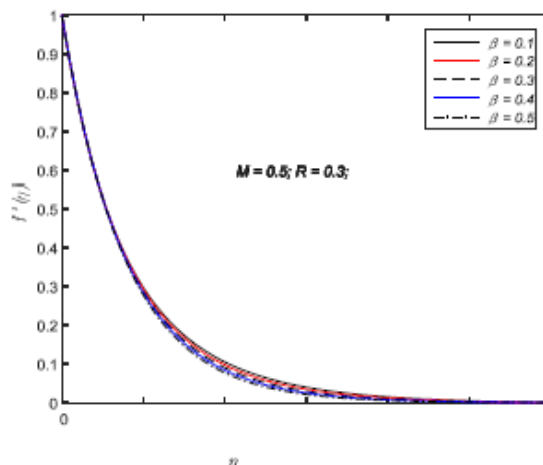


Figure.5

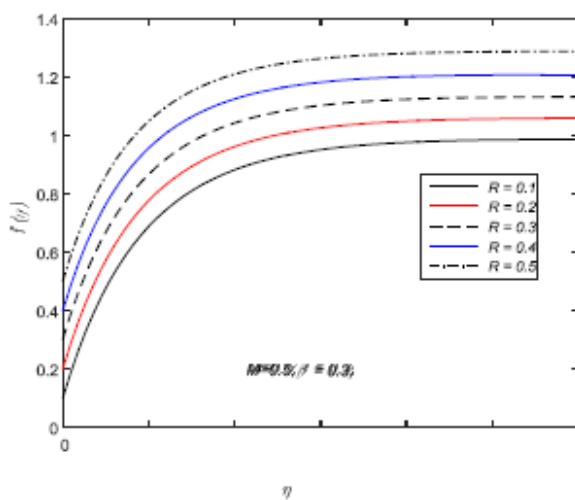


Figure.3

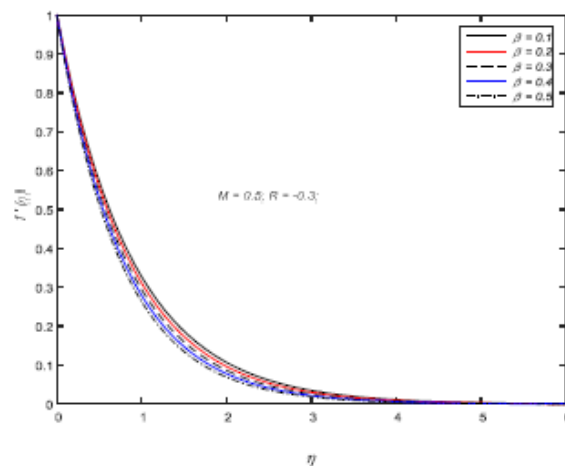


Figure.6

Numerical Solution of the Flow of the Upper Convicted Maxwell Fluid in Boundary Layer of Stretching Sheet in the Presence of MHD

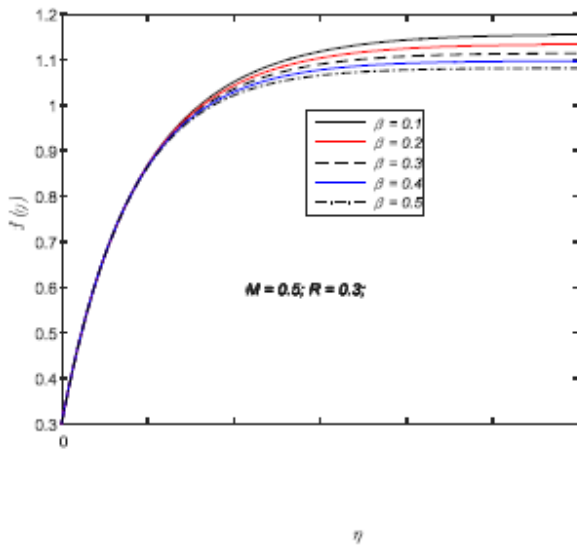


Figure.7

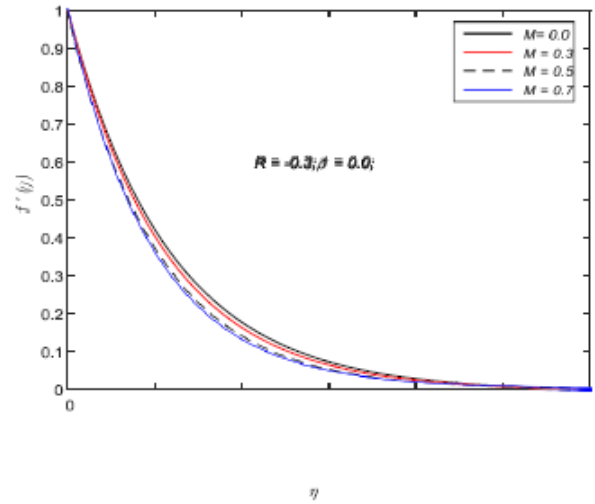


Figure.10

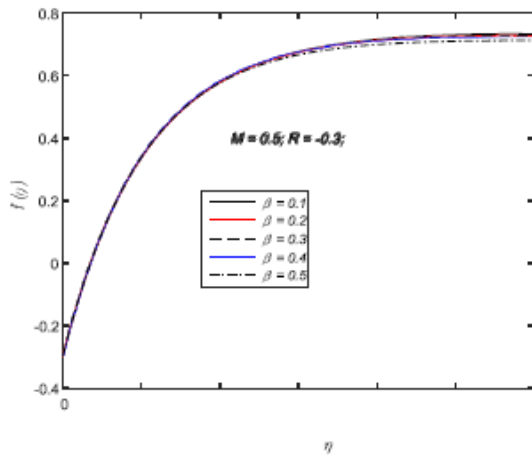


Figure.8

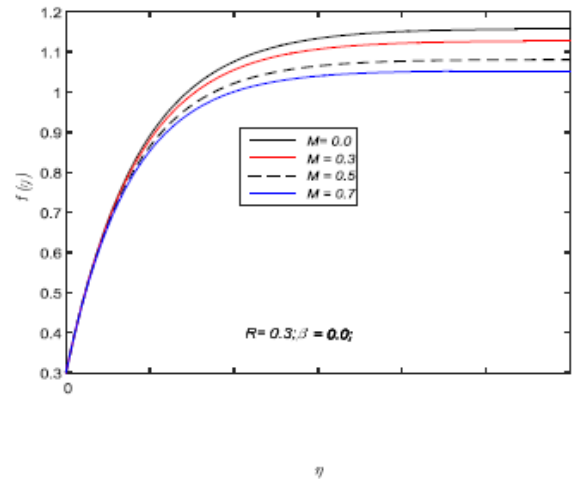


Figure.11

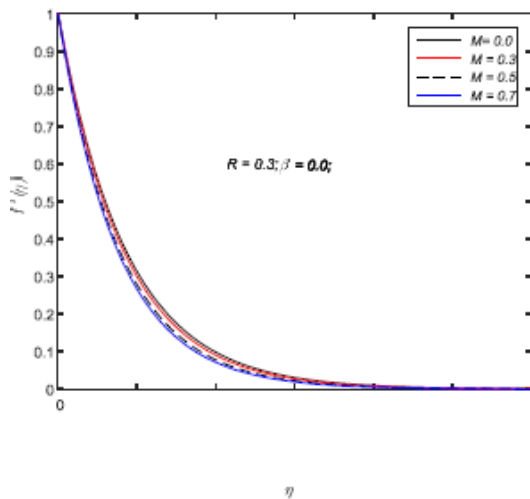


Figure.9

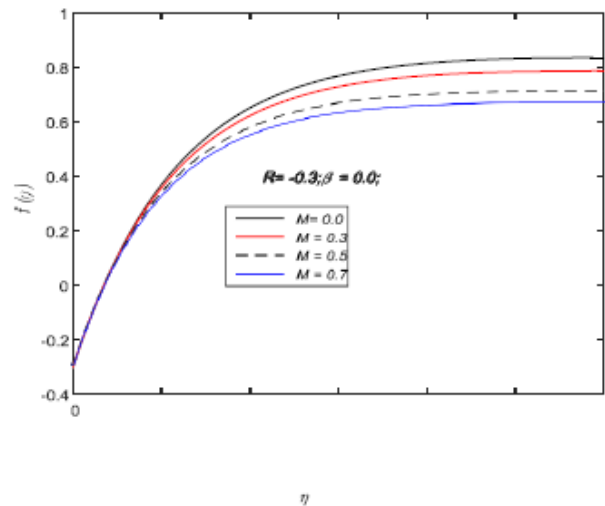


Figure.12

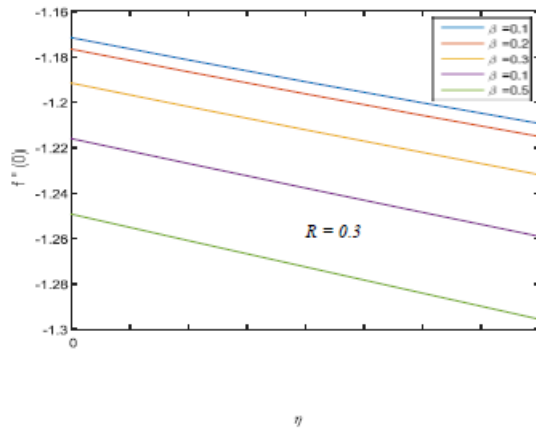


Figure.13

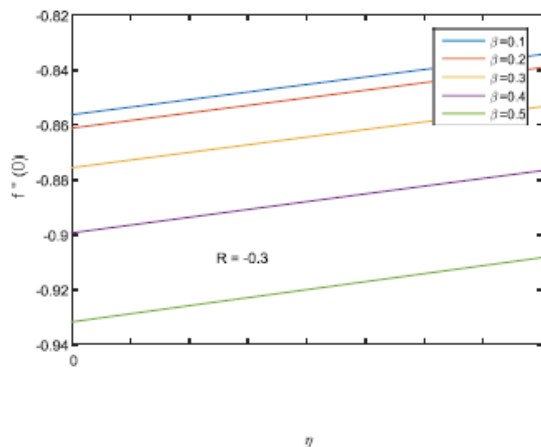


Figure.14

V. CONCLUSION

In the current study, we have discussed the solution of the upper limit of Maxwell liquid flow in the boundary layer stretch Sheet MHD. Solution has been derived for suction velocity, and injection velocity.

1. When radiation parameter increasing then suction velocity and injection velocity increasing.
2. When magnetic parameter increasing suction and injection velocity decreasing.
3. When increasing the magnetic parameter wall shear stress decreases in both the cases suction and injection.

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