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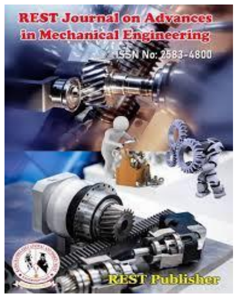

Impact of Chemical reaction on Stagnation Point Flow of Powell Eyring Fluid: HAM Analysis

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Abstract: *In the present study, the mathematical modelling for stagnation point flow of non-Newtonian Powell-Eyring fluid over a stretching surface is considered. The effect of thermal radiation and chemical reaction is taken into account. The non-linear governing partial equations are transformed to ordinary differential equation by using stretching similarity transformation. Homotopy analysis has been done to the reduced boundary layer equations. Numerical solutions are obtained for the velocity, temperature and concentration profiles with influence of non-Newtonian fluid parameter, radiation and chemical reaction respectively. It is found from the study that non-Newtonian fluid performs shear thinning behaviour. Radiation enhances the temperature of non-Newtonian Powell Eyring fluid and concentration of the fluid rises as the effect of chemical reaction increases.*

Key words: *Stagnation Point Flow, Chemical Reaction, Thermal Radiation, Homotopy Analysis Method.*

1. MATHEMATICAL MODELLING

A 2-D steady stagnation-point flow over a surface which is in an incompressible non-Newtonian fluid is considered. Suppose that the $\bar{U}_e = a\bar{X}$ is external velocity and $\bar{U}_w = b\bar{X}$ is stretching velocity, where *a* and *b* are constants. The equation which governs the flow are given by following equations. After introducing (19), momentum, energy and concentration equations, (1)-(5), reduced to

$$g'''(1+\varepsilon)+gg''-g'^2-\varepsilon\delta g''^2 g'''+1=0 \quad (1)$$

$$\frac{1}{\Pr}\left(1+\frac{4}{3}R\right)\theta''+g\theta'=0 \quad (2)$$

$$\frac{1}{Sc}\phi''+g\phi'-\lambda\phi=0 \quad (3)$$

and B. C. becomes,

$$g(0)=0,\ g'(0)=S\ \ \theta'(0)=1,\ \phi(0)=1 \quad (4)$$

$$g'(\infty)=1,\ \theta(\infty)=0,\ \phi(\infty)=0 \quad (5)$$

where prime denotes differentiation with respect to η, and fluid parameter is represented by ε *and* δ.

2. RESULTS AND ANALYSIS

The reduced system of equation in section 2 is solved via implementing HAM by choosing proper initial approximation, auxiliary linear operator and non-linear operator. The program is executed and the range of convergence control parameter is obtained using symbolic software MATHEMATICA. The following set of parametric values is considered throughout the present article. $\Pr = 1, \varepsilon = 0.2, \delta = 0.1, Sc = 0.6, R = 0.25, S = 0.5, \lambda = 0.1$.

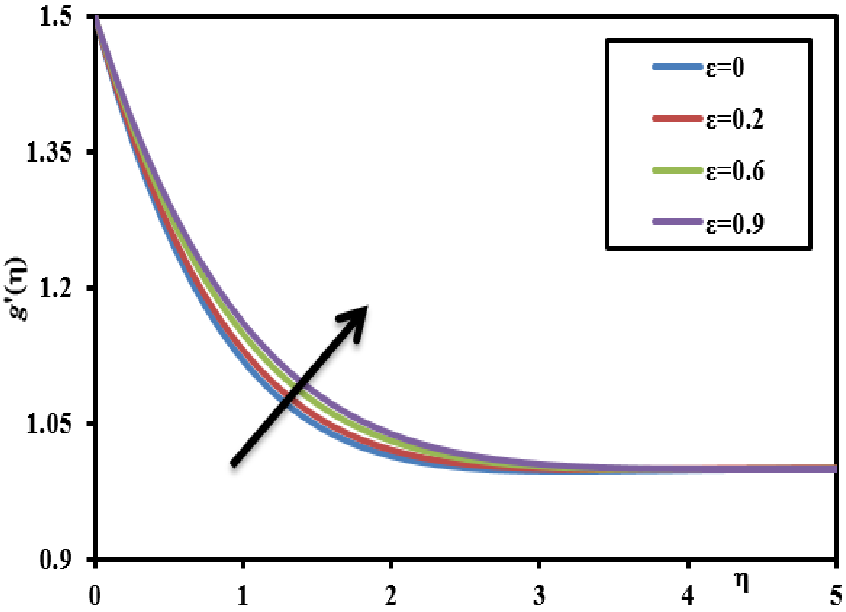

FIGURE 1. Variation of velocity with effect of non-Newtonian fluid parameter

3. CONCLUDING REMARKS

In the present study, influence of thermal radiation and chemical reaction on the stagnation point flow of Powell-Eyring fluid is discussed. The equation for the Newtonian case is limiting case of the present problem and can be recovered by substituting $\varepsilon = 0$. The non-dimensional governing equations are reduced to non-linear coupled ordinary differential equations. The HAM was used to solve the problem.

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