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A STUDY ON NONLINEAR VISCO-ELASTIC FLUIDS WITH A RELATION TO MAGNETIC FIELD

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Abstract

The fundamental limit layer equations for momentum and warmth exchange which are non-linear partial differential equation are changed over into non-linear common differential equation utilizing comparability transformation. The subsequent non-linear equation is fathomed utilizing numerical shooting technique for three obscure beginning conditions with fourth request Runge-Kutta strategy.

This work manages the limit layer flow and warmth move in a visco-flexible fluid flow an extending sheet within the sight of radiation. Two distinctive temperature are considered here, (I) PST, that is the sheet with endorsed surface temperature (ii)PHF, that is the sheet with recommended warm transition. To know the material science of the issue, numerical outcomes are talked about with the assistance of charts for different of parameters, for example, fluid consistency parameter, visco-versatile parameter, Prandtl number, Eckert number, warm source/sink parameter and radiation parameter.

Keywords: *Visco-elastic, temperature, parameter*

1. INTRODUCTION

The investigation of the boundary layer flow over a nonstop strong surface moving with steady speed. The investigation of the flow and heat exchange of an incompressible homogeneous second grade fluid over a non-isothermal stretching sheet. Utilizing likeness transformation they change over the fractional Differential equations to standard differential equations. Double buddy and Hiranmoymondal researched the investigation of consolidated impacts of Soret and Dufour on insecure MHD non-Darcy blended convection over a stretching sheet.

Boundary layer conduct over a moving consistent strong surface is a critical sort of flow happening by and large engineering forms. The heat exchange because of a ceaselessly moving surface through an encompassing fluid is one of the push zones of ebb and flow investigate. Such examinations discover their application over an expansive spectrum of science and engineering disciplines especially in the field of synthetic engineering process like metallurgical process, polymer expulsion process involves cooling of a liquid, fluid being extended into a cooling [1].

The impact of radiation on the heat and fluid flow over an insecure stretching surface. MHD flow of a visco versatile fluid past a stretching surface. Heat and mass move in a stretching sheet suction or blowing[2]. These coupled non-linear equations, representing the issue, are decreased to a system of coupled non-linear higher-order conventional differential equations by applting reasonable likeness transformations. This resultant boundary esteem issue has been changed over into the system of six-concurrent equations of first order for six questions. At that point this system is illuminated by utilizing a numerical shooting technique (for two obscure beginning conditions) with fourth-order Runge-Kuttamix conspires.

Calculation is completed for temperature and even velocity profiles, Nusselt number and skin erosion parameter when the walls are kept up with recommended surface temperature and endorsed wall heat transitions. Examinations have been made to explore the impact of fluid thickness, visco-versatility, penetrability of the permeable medium and Prandtl number on the flow conduct and heat exchange process. Accentuation has been laid to contemplate the impact of fluid thickness on the other physical attributes. One of the vital discoveries in the present investigation is that the impact of fluid viscocity parameter is to diminish the temperature profile essentially when the flow is through a permeable medium.

2.MATHEMATICAL FORMULATION

Consider a consistent laminar flow of an incompressible visco-flexible fluid (walter's fluid B) in a permeable medium past a semi-infinite stretching sheet matching with a plane y=0 and the n flow being proceeded to y>0, keeping the origin settled, caused by the concurrent application of two equivalent and inverse powers along the x-axis which brings about stretching of the sheet and thus the flow is produced because of the stretching of the sheet. We have x-axis along the surface, y-axis being normal to it and u and v are the fluid tangential velocity and normal velocity individually[3].

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

$$u\frac{\partial r}{\partial x} + v\frac{\partial T}{\partial y} = v\frac{k}{Pc_P}\frac{\partial^2 T}{\partial y^2} + \frac{Q}{Pc_p}(T - T\infty) + \frac{\square}{Pc_P}\left(\frac{\partial u}{\partial y}\right)^2 \frac{1}{Pc_P}\frac{\partial qr}{\partial y} \quad (2)$$

Where $k_0$is the visco versatile parameter, ν is the kinematic viscosity, are penetrability of the permeable medium, k is the thermal conductivity of the fluid, μ is the coefficient of thickness of the fluid, is the steady estimation of temperature and coefficient of thickness far from the sheet and qr is the radiative heat transition. The term Q speaks to the volumetric rate of heat age. Eq. (2) has been inferred with the suspicion that the commitment from the normal pressure is of an indistinguishable order of magnitude from the shear worry, notwithstanding the typical boundary layer estimation. Here, μ is the coefficient of thickness, which is considered to change as a component of temperature [4].

3. NUMERICAL SOLUTION

The above equations (1) and (2) are nonlinear customary differential equation. Which constitute the nonlinear boundary esteem issue as no recommended technique is accessible to tackle nonlinear boundary esteem issue; it must be decreased to an initial esteem issue. This procedure is finished by Runge-Kutta shooting strategy. To start the shooting procedure. We need to make an initial figure wisely for the values of f''' (0), f'' (0) θ' (PHF case). The achievement of the technique depends especially on how great the figure is .Numerical outcomes are found for a few values of the physical parameters E, Pr, k1, k2,, R.

4. RESULTS AND DISCUSSION

In the present work, the impact of fluid consistency, visco-elasticity, permeability of the permeable medium and prandtl number on the flow conduct and heat transfer process. The boundary layer incomplete differential equation which are very non-linear, have been changed over into set of normal differential equation by applying similitude transformation and they are illuminated by numerically utilizing Runge-Kuttastrategy [5].

Fig1depicts the impact of radiation for different viscoelastic parameter on the heat transfer on account of PST. Two plots uncover that the dimensionless temperature θ (n) versus from the wall, increments with expanding the values of visco-flexible parameter (k1) and diminishing values of radiation parameter(R).Fig.2 Depicts the impact of radiation for different values of visco-versatile parameter on the heat transfer on account of PST. Two plots uncover that the dimensionless velocity f'(n) versus from the wall, increments with expanding values of visco-flexible parameter (k1) and diminishing values of radiation parameter (R).

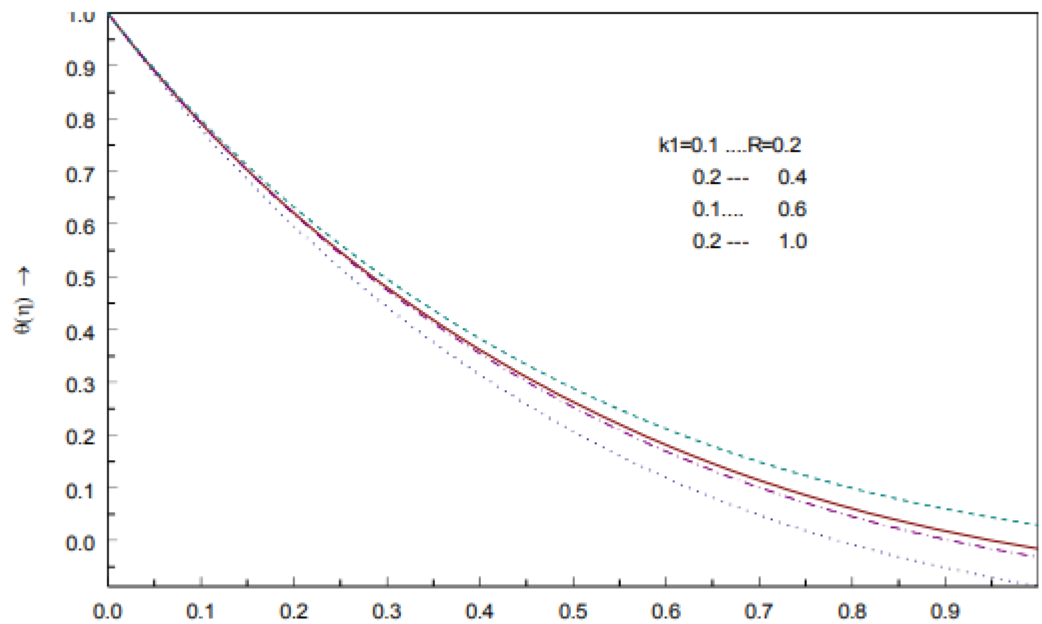

Fig.1 Effect of radiation parameter for various values of K1 in PST case with Pr=7.0, E=0.02, K2=0.0, B=- 0.05 for temperature profile

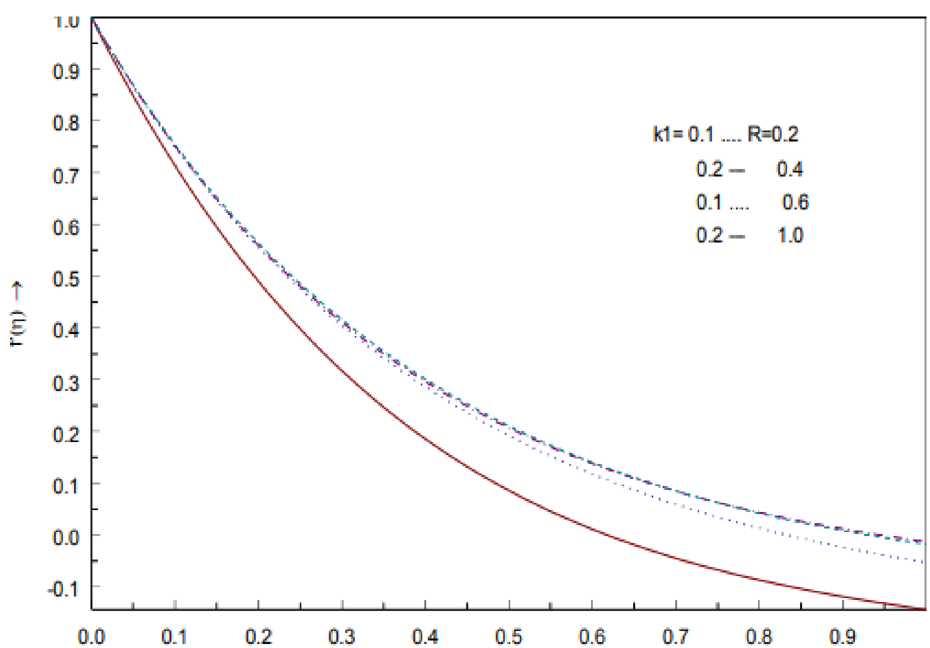

Fig.2 Effect of radiation parameter for various values of K1 in PST case with Pr=7.0, E=0.02, K2=1.0, B=-0.05 for velocity profile.

Fig 3 Portrays the impact of radiation for different of fluid thickness parameter on the heat transfer on account of PST. Two plots uncover that the dimensionless temperature θ (n) versus from the wall, increments with expanding values of fluid consistency

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parameter (An) and diminishing values of radiation parameter (R).fig4 Shows the impact of radiation for different values of prandtl number on the heat transfer on account of PST. Two plots uncover that the dimensionless velocity f'(n) versus from the wall increments with expanding values of prandtl number (Pr) and diminishing values of radiation parameter (R)[6]. It is seen from that the impact of expanding values pf prandtl number and radiation parameter decreased the velocity profile in PST case.

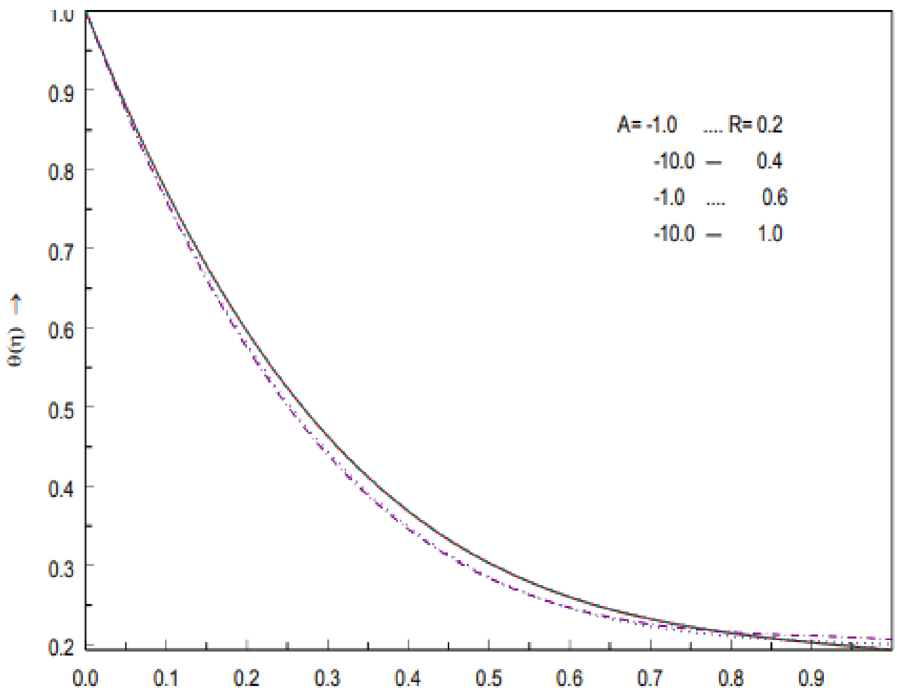

Fig.3 Effect of radiation parameter for various values of A in PST case withPr=7.0, E=0.02, K1=0.1, K2=0.2, B=-0.05 for temperature profile

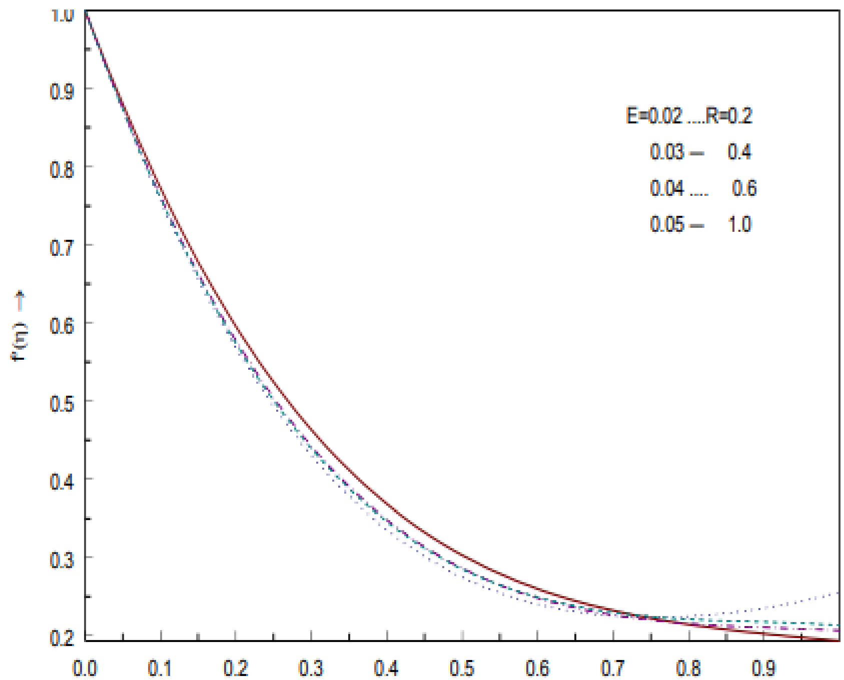

Fig.4 Effect of radiation parameter for various values of Prandtl number in PST case with E=0.02, B=-0.05, K1=0.1, K2=0.2 for velocity profile

Fig 5 represents the impact of radiation for different values of Eckert number on the heat transfer on account of PST. Two plots uncover that the dimensionless temperature θ (n) versus from the wall increments with expanding values of Eckert number (E) and decreasing values of radiation (R). It is seen from assume that the impact of expanding values of Eckect number and radiation lessened the temperature profile in PST case [7].

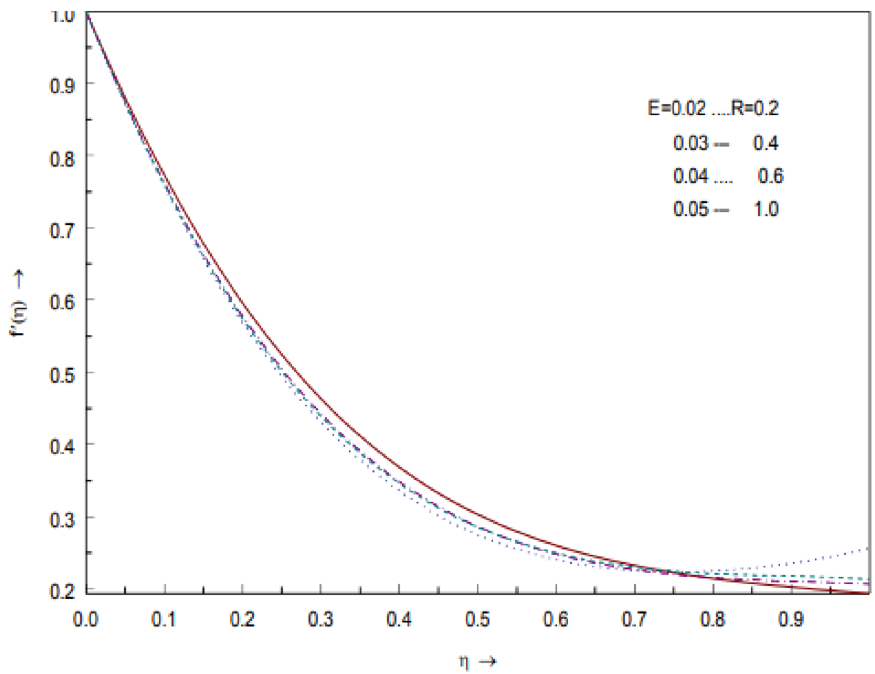

Fig.5 Effect of radiation parameter for various values of Eckert number in PST case with Pr=7.0, B=-0.05, K1=0.1, K2=0.2 for velocity profile

Fig 6.Shows the impact of radiation for different values of heat source/sink parameter on the heat transfers on account of PST. Two plots uncover that the dimensionless velocity f'(n) versus n from the wall, increments with expanding values of heat source/sink parameter (β) and decreasing values of radiation parameter (R). It is seen from the assume that the impact of quicken values of heat source/sink parameter and radiation parameter decelerate the velocity profile in PST case.

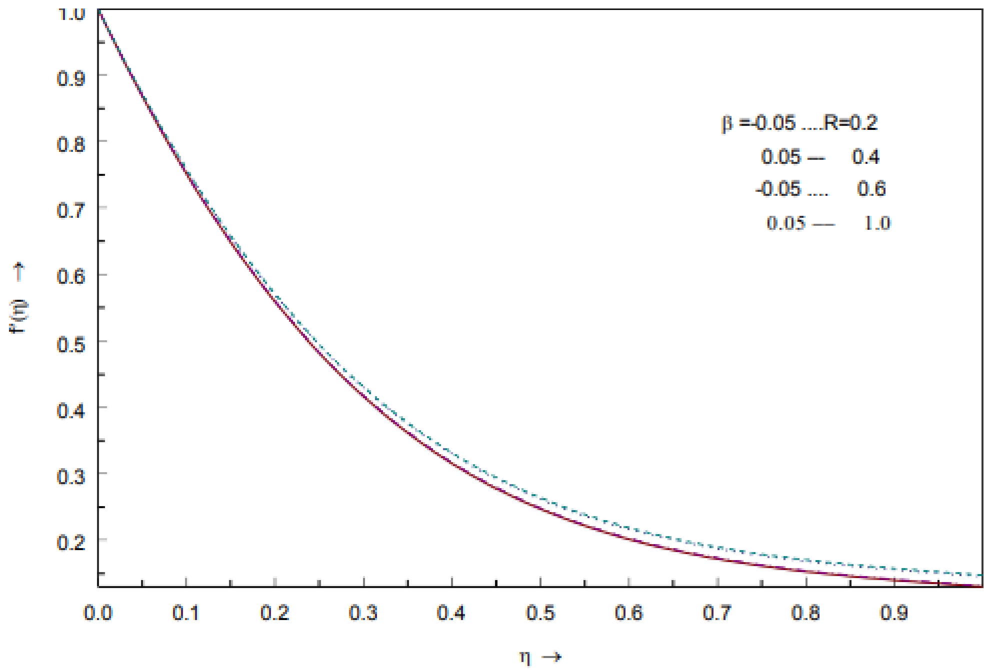

Fig 6 Effect of radiation parameter for various values of heat source/sink in PST case with Pr=7.0, E=0.02, K1=0.1, K2=0.2 for velocity profile

Table I gives the values of skin friction coefficient for different values of Pr, k1, k2, and R. The expands singular values of Pr, k1, k2, and R are to diminishes, the rate of heat transfer in skin friction coefficients [8].

Table 1: Variation of f" (0) for different values of Pr, K1, K2, R and A (PHF case)

Prandtl	Visco-elastic	Porosity	Fluid Viscosity	Radiation	Present	Present
number Pr	paramet er	Paramet er	Parameter	Parameter	result	result
	k1	k2	(A)	(R)	(PST)	(PHF)
7.0	0.1	0.0	-1.0	0.2	-1.803727	-1.794640
			-10.0	0.4	-1.814058	-1.764740
			-1.0	0.6	-	-1.664788

					1.800378	
			-10.0	1.0	-1.794640	-1.217190
		1.0	-1.0	0.2	-2.766242	-0.154601
			-10.0	0.4	-2.758705	-0.159342
			-1.0	0.6	-2.753568	-0.153365
			-10.0	1.0	-2.755034	-0.154730
	0.2	0.0	-1.0	0.2	-1.803521	-0.252098
			-10.0	0.4	-1.824108	-0.249914
			-1.0	0.6	-1.800178	-0.250445
			-10.0	1.0	-1.784141	-0.249657
		1.0	-1.0	0.2	-2.771242	-0.219494
			-10.0	0.4	-2.701142	-0.218273
			-1.0	0.6	-2.701243	-0.218273
			-10.0	1.0	-2.701122	-0.219698

5. CONCLUSION

The impact of heat radiation on the flow of walter's fluid B over an impermeable stretching sheet with heat source/sink and versatile parameter have been talked about. The investigation were completed for two sorts of various heating process specifically (I) Prescribed surface temperature (PST) and (ii) Prescribed wall heat transition (PHF). The impacts of rising parameters have been and examined through table in (PHF)[9]. The conclusion got from this examination as said beneath

- It is discovered that the temperature profile and velocity profile diminishes with the expanding estimation of the visco-flexible parameter, Eckert number and heat source/sink parameter.
- The temperature diminishes with the expanding estimation of Prandtl number, fluid thickness parameter and radiation parameter.
- The consolidated impact of expanding of radiation parameter with expanding visco versatile parameter, Eckert number, Prandtl number and fluid thickness diminishes the temperature profile and velocity profile [10].

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