Comments on "Variable fluid properties and variable heat flux effects on the flow and heat transfer in a non-Newtonian Maxwell fluid over an unsteady stretching sheet with slip velocity" by Ahmed M. Megahed, Chin. Phys. B Vol. 22, No. 9 (2013) 094701

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Recently, Megahed [1] numerically investigated the influences of variable viscosity and thermal conductivity on the boundary layer flow and heat transfer of a non-Newtonian Maxwell fluid over an unsteady stretching sheet with variable heat flux in the presence of slip velocity. The main aim of the boundary layer flow and heat transfer study is to calculate the physical quantities of interest namely, the local skin-friction coefficient and the surface heat flux. Unfortunately, the definitions of these quantities and the boundary condition $\theta'(0) = -1$ are wrong .

Comments

(1) In ref.[1] the author defined C_{f_x} as given by Eqs. (18) . This definition is wrong. The correct form of C_{f_x} given in the following form

$$C_{f_x} = -\frac{\tau_w}{\rho U^2/2} = \frac{-\left[\mu\frac{\partial u}{\partial y} - \lambda_1(2uv\frac{\partial u}{\partial x} + v^2\frac{\partial u}{\partial y})\right]_{y=0}}{\rho U^2/2} = -2\,\mathrm{Re}_x^{-1/2}\, e^{-\alpha\theta(0)} f''(0).$$

This is common error in many papers [2-6] .

(2) The definition of the surface heat flux $q(x,t)$ given by Eq.(13) is wrong. The correct form is

$$q_w(x,t) = -\kappa_{eff}\frac{\partial T}{\partial y} = -\kappa_\infty(1+R+\varepsilon\theta(0))\frac{\partial T}{\partial y} \ ,$$

where κ_{eff} is the effective thermal conductivity and $R = \frac{16\sigma^* T_o^3}{3\kappa_\infty k^*}$ is thermal radiation parameter .

(3) The boundary condition $\theta'(0) = -1$ is wrong. The correct form for $\theta'(0)$ is

$$\theta'(0) = \frac{-1}{(1+R+\varepsilon\theta(0))}$$

.

(4) The velocity slip factor $\gamma_1 = \sqrt{1-at}$ is dimensionless quantity (a is constant with dimension (time^{-1})). This is wrong and must have dimension of length .

(5) The slip parameter $\gamma = \sqrt{\frac{\rho b}{\mu_\infty}}$ has dimensional of (length^{-1}). This is wrong because γ must be in dimensionless form .

From the above comments it was found that the dimensionless boundary condition $\theta' = -1$, the local skin-friction coefficient C_{f_x} and the surface heat flux are incorrect so all results obtained are wrong. The corrected forms of the boundary condition $\theta'(0)$, the local skin-friction coefficient and the surface heat transfer were derived.

References

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