

Comments on “Flow and Heat Transfer of Powell–Eyring Fluid due to an Exponential Stretching Sheet with Heat Flux and Variable Thermal Conductivity” by Ahmed M. Megahed, Z. Naturforsch.2015; 70(3)a: 163–169

By

Mostafa A. A. Mahmoud

Department of Mathematics, Faculty of Science, Benha University (13518), Benha ,Egypt

E-mail: mostafabelhameed@yahoo.com

Mustafa.ahmed@fsc.bu.edu.eg

In the above paper the author studied the effects of the thermal conductivity parameter, suction parameter, dimensionless Powell–Eyring parameters and the Prandtl number on the flow and heat transfer as well as on the local skin-friction coefficient and the local Nusselt number of Powell–Eyring fluid over an exponentially stretching porous sheet with heat flux . There are many fundamental errors:

1. The author defined the local Reynolds number as: $Re_x = \frac{UL}{\nu}$. This definition

is incorrect. The correct definition of the local Reynolds number is :

$$Re_x = \frac{Ux}{\nu} , \text{ while } Re(x) = \frac{U(x)L}{\nu} [1] .$$

2. The dimensional temperature θ defined in Eq.(9) as :

$$\theta(\eta) = \kappa_{\infty} \left(\frac{T}{q_w L} \right) \left(\frac{Re(x)}{2} \right)^{\frac{1}{2}} , \text{ is wrong .}$$

It is not known that how $\theta \rightarrow 0$ when $T \rightarrow T_{\infty}$.

The correct form is :
$$\theta(\eta) = \kappa_{\infty} \left(\frac{T - T_{\infty}}{q_w L} \right) \left(\frac{Re(x)}{2} \right)^{\frac{1}{2}} .$$

3. The local skin-friction coefficient defined in Eq.(15) is incorrect . It must be :

$$Cf_x \left(\frac{x Re_x}{2L} \right)^{\frac{1}{2}} = - \left[(1 + \alpha) f''(0) - \frac{\alpha \beta}{3} f'''(0) \right]$$

4. The local Nusselt number defined in Eq.(15) is wrong . Consequently , the local Nusselt number given by Eq.(16) is wrong [1] .

The correct form of the local Nusselt number is :

$$\left(\frac{x \text{Re}_x}{2L} \right)^{-\frac{1}{2}} Nu_x = \frac{1}{\theta(0)}$$

From the above it was found that the definitions of the local skin-friction coefficient , the dimensional temperature θ and the local Nusselt number are incorrect . **Then the results obtained for the local Nusselt number in Table 2 are wrong.**

References

- [1] Schlichting, H. and K. Gersten, "Boundary-Layer Theory," Part I, 8th ed., Springer-Verlag, New York (2000).