COMMENTS ON "A GENERALIZED FOURIER AND FICK'S PERSPECTIVE FOR STRETCHING FLOW OF BURGERS FLUID WITH TEMPERATURE-DEPENDENT THERMAL CONDUCTIVITY"

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Abstract: The equations of θ(η) and φ(η) are not valid.

Waqas et al. [1] investigated mixed convection and heat generation characteristics in flow of Burgers fluid induced by moving surface with variable thermal conductivity as a function of temperature. The researchers introduced simultaneously the revised Fick-Fourier relations covering mass/heat paradoxes. They implemented boundary-layer concept to simplify the mathematical model of their physical problem. Waqas et al. [1] presented the equations of energy and concentration (Eqs. (3) and (4) in Ref. [1]) as:

$$u\frac{\partial T}{\partial x}+v\frac{\partial T}{\partial y}+\lambda_T\left[\begin{array}{c} u\frac{\partial u}{\partial x}\frac{\partial T}{\partial x}+v\frac{\partial v}{\partial y}\frac{\partial T}{\partial y}+v\frac{\partial u}{\partial y}\frac{\partial T}{\partial x}+2uv\frac{\partial^2 T}{\partial x\partial y}+u^2\frac{\partial^2 T}{\partial x^2}+ \\ +v^2\frac{\partial^2 T}{\partial y^2}-\frac{Q}{\rho c_p}\left(u\frac{\partial T}{\partial x}+v\frac{\partial T}{\partial y}\right)\end{array}\right] \tag{1}$$
$$=\frac{1}{\rho c_p}\frac{\partial}{\partial y}\left[K(T)\frac{\partial T}{\partial y}\right]+\frac{Q}{\rho c_p}(T-T_\infty)$$

$$u\frac{\partial C}{\partial x}+v\frac{\partial C}{\partial y}+\lambda_C\left(\begin{array}{c} u\frac{\partial u}{\partial x}\frac{\partial C}{\partial x}+v\frac{\partial v}{\partial y}\frac{\partial C}{\partial y}+v\frac{\partial u}{\partial y}\frac{\partial C}{\partial x}+ \\ 2uv\frac{\partial^2 C}{\partial x\partial y}+u^2\frac{\partial^2 C}{\partial x^2}+v^2\frac{\partial^2 C}{\partial y^2}\end{array}\right)=D\frac{\partial^2 C}{\partial y^2} \tag{2}$$

From Eqs. (1) and (2), temperature (T) and concentration (C) depend on x, y.

Waqas et al. [1] introduced the following variables to convert PDEs into ODEs (Eq. (15) in Ref. [1]):

$$\eta = y\sqrt{\frac{c}{\nu}} \tag{3}$$

$$\theta(\eta) = \frac{T - T_\infty}{T_w - T_\infty} \tag{4}$$

$$\varphi(\eta) = \frac{C - C_\infty}{C_w - C_\infty} \tag{5}$$

From Eq. (3), the similarity variable (η) depends only on y. From Eq. (4), the temperature θ(η) depends only on y while RHS $\frac{T(x, y) - T_\infty}{T_w - T_\infty}$ depends on x, y. Hence, there is no agreement between LHS & RHS so that Eq. (4) is not valid. From Eq. (5), the concentration φ(η) depends only on y while RHS $\frac{C(x, y) - C_\infty}{C_w - C_\infty}$ depends on x, y. Hence, there is no agreement between LHS & RHS so that Eq. (5) is not valid.

Pantokratoras [2-5] revealed the same errors. As shown by Pantokratoras [5], Minkowycz and Sparrow [6] defined the similarity variable (η) as:

$$\eta = \left[\frac{g\beta(T_w - T_\infty)}{4\nu^2}\right]^{1/4} \frac{y}{x^{1/4}} \tag{6}$$

to be compatible with their energy equation.

$$u\frac{\partial T}{\partial x} + v\frac{\partial T}{\partial y} = \alpha \frac{\partial^2 T}{\partial y^2} \tag{7}$$

Recently, Awad [7] revealed the same errors.

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Accepted: 17.12.2020.