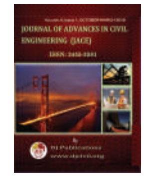
Journal of Advances in Civil Engineering, Vol. 4(1) 2018, pp. 1-3



ERRATUM

Unsteady Flow of Grade-3 Fluid in the case of Suction, Mathematical & Computer Modelling, 38(1-2), 201-208, (2003), S. Asghar, Muhammad R. Mohyuddin, T. Hayat

*Muhammad Raheel Mohyuddin[1]

[1]Department of Mathematics & Statistics, Caledonian College of Engineering, Oman.

Received- 7 February 2017, Revised- 11 August 2017, Accepted- 26 September 2017, Published- 4 October 2017

ABSTRACT

In this erratum, we have given the corrections in the referenced paper [1] that is published in Mathematical & Computer Modelling. This work leads to differential forms of the fluid for $n = 3$ whose solution is presented in terms of perturbation & the similarity transform.

Keywords: Differential fluid, Perturbation, Similarity transform, Velocity, Viscosity.

---

1. INTRODUCTION

In this paper the authors have given the flow of a differential form of the fluid for $n = 3$, that is solved for the velocity profile in the form of perturbation. The perturbed velocity is then transformed to ODE's to have the similarity transform. The solution is given in equations (1) & (2) of the referenced paper [1]. In these, the solution given in equations (1) & (2), containing the non-zero viscosities of differential fluid $n = 3$, that is, (β_1, β_2, β_3) are not zero. This fact is also presented in equations (8) to (12) and in the solution of the problem. However, in equation (4) authors have used the fluid assumptions [2], that is not applicable.

Therefore, equation (4), the statement of equation (4) & the reference [2], are not implemented in this study. The analysis is shown in equations (1) to (7).

2. FORMULATION OF EQUATIONS

The differential fluid $(n = 3)$ in one-dimensional, two-directional flow is given by [1].

$$V = [u(y,t), V(t)] \tag{1}$$

$$\frac{\partial u}{\partial t} + V\frac{\partial u}{\partial y} = V\frac{\partial^2 u}{\partial y^2} + \beta\left(\frac{\partial^3 u}{\partial t \partial y^2} + V\frac{\partial^3 u}{\partial y^3}\right) + \gamma\left(\frac{\partial u}{\partial y}\right)^2\frac{\partial^2 u}{\partial y^2} + \varepsilon\left(\frac{\partial^4 u}{\partial t^2 \partial y^2} + V\frac{\partial^3 u}{\partial y^3} + 2V\frac{\partial^4 u}{\partial t \partial y^3} + V^2\frac{\partial^4 u}{\partial y^4}\right) \tag{2}$$

The flow is in the x-direction whereas change in the velocity is in the y-direction. Therefore, the boundary conditions are

$$\begin{aligned} u(y,t) &= U, Y = 0 \\ u(y,t) &= 0, Y = \infty \\ u(y,t) &= 0, t = 0 \end{aligned} \tag{3}$$

Remark-I In the governing equation [1], authors have given the reference of [2] with the conditions

$$\begin{aligned} \mu \geq 0, \alpha_1 \geq 0, |\ \alpha_1 + \alpha_2\ | \leq \sqrt{24\mu\beta_3} \\ \beta_1 = \beta_2 = 0, \beta_3 \geq 0 \end{aligned} \tag{4}$$

*Corresponding author. Tel.: +96899852897
Email address: mraheel.mohyuddin@caledonian.edu.com (M.R.Mohyuddin)
Double blind peer review under responsibility of DJ Publications
http://dx.doi.org/10.18831/djcivil.org/2018011001

These restrictions are not applicable to this study, as the equations (8) to (14) are formed where

$$\beta_1 \neq 0, \beta_2 \neq 0, \beta_3 \neq 0 \tag{5}$$

3. SOLUTION

The solution to this work is given in perturbation & similarity transform

$$\begin{aligned} \alpha &= \frac{y - \int V(t)dt}{2\sqrt{\nu t}} \\ f &= f_0 + \frac{1}{\tau} f_1 \end{aligned} \tag{6}$$

where

$$\begin{aligned} f_0 &= 1 - \frac{2}{\sqrt{\pi}} \int_0^{\alpha} e^{-x^2} dx \\ f_1 &= \left(A\alpha + \frac{\beta}{\sqrt{\pi}} \alpha^3 \right) e^{-\alpha^2} + F(\alpha) e^{-3\alpha^2} \\ F(\alpha) &= \sum_{n=1} a_{2n+1} \alpha^{2n+1} \\ A &= -\frac{\beta}{\sqrt{\pi}} - \sum_{n=1} \frac{n!}{3^{n+1}} a_{2n+1} \end{aligned} \tag{7}$$

The values of a_{2n+1} in terms of $a_3 = -.11972475$ are

$$\frac{a_5}{a_3} = 1.60000000,$$
$$\frac{a_7}{a_3} = 1.40952381,$$
$$\frac{a_9}{a_3} = 0.87619048,$$
$$\frac{a_{11}}{a_3} = 0.42528139,$$
$$\frac{a_{13}}{a_3} = 0.17053169,$$
$$\frac{a_{15}}{a_3} = 0.05858776,$$
$$\frac{a_{17}}{a_3} = 0.01769331,$$
$$\frac{a_{19}}{a_3} = 0.00478697,$$
$$\frac{a_{21}}{a_3} = 0.00117728,$$
$$\frac{a_{23}}{a_3} = 0.00026620,$$
$$\frac{a_{25}}{a_3} = 0.00005584,$$
$$\frac{a_{27}}{a_3} = 0.00001094,$$
$$\frac{a_{29}}{a_3} = 0.00000201,$$
$$\frac{a_{31}}{a_3} = 0.00000035,$$
$$\frac{a_{33}}{a_3} = 0.00000006,$$

Remark-II The solution (6) is given when $\beta_1 \neq 0, \beta_2 \neq 0, \beta_3 \neq 0$ which again shows that the reference [2] is not for this study.

REFERENCES

[1] S.Asghar, M.R.Mohyuddin and T.Hayat, Unsteady Flow of Third-Grade Fluid in the Case of Suction, Mathematical and Computer Modelling, 38, 1-2, 2003, 201-208, https://doi.org/10.1016/S0895-7177(03)90016-1.

[2] R.L.Fosdick, K.R.Rajagopal, Thermodynamics and Stability of Fluids of Third Grade, Proceedings of the Royal Society A Mathematical, Physical and Engineering Sciences, 369, 1738, 1980, https://doi.org/10.1098/rspa.1980.0005.