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Some comments on the papers "Similar solutions for the incompressible laminar boundary layer with pressure gradient in micropolar fluids" and "Nonsimilar incompressible laminar boundary-layer flows in micropolar fluids" by G. Nath

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(Received September 15, 1976)

Recently, G. Nath has published two papers in Rheol. Acta on laminar boundary layer flows in incompressible micropolar fluids (1, 2). I believe that some comments on these studies are in order.

In the first paper (1) "Similar solutions for the incompressible laminar boundary layer with pressure gradient in micropolar fluids" Nath's studies are based on the assumption that similar solutions of the boundary layer equations exist if the velocity of the potential flow is given by $U(x) = u_1 x^m$. For boundary layers in viscous fluids this potential flow past a wedge leads to the well-known Falkner-Skan boundary layers, which are the basis for many solutions of boundary layer problems. For boundary layers in micropolar fluids however, this assumption is no longer justified. A search for similar solutions of the eqs. [1]–[3] reveals, as only possible form of the potential flow, the flow near a stagnation point with $U(x) = u_1 x$, where u_1 is a constant. This can easily be seen from Nath's eqs. [5]–[8]: eq. [8] is an ordinary differential equation only for $m = 1$; for $m \neq 1$ the coefficient G depends on x and is not constant as it should be for similar solutions to exist. Therefore only the results for $\beta = m = 1$ are mathematically justified and physically meaningful; the other results may at most exhibit some qualitative features of micropolar boundary layers.

For a similar reason the mathematical procedure in Nath's second paper (2) "Nonsimilar incompressible

laminar boundary-layer flows in micropolar fluids" may be questioned. The boundary layer equations are transformed – by means of a Görtler transformation and a subsequent transformation to achieve a finite range of integration – to the partial differential eqs. [16], [17] for functions of the new variables $\xi(x, y)$ and $\eta(x, y)$; these equations are then solved using finite difference techniques. At a first glance this procedure seems to be rather promising. This would indeed be so, if the coefficient G in eq. [17] would be a constant. However, G unfortunately is a function of x as can be seen from eq. [12]. Therefore I am not sure whether Nath's calculations with fixed values of G may give any meaningful quantitative results for boundary-layer flows of micropolar fluids over a sphere and a cylinder, respectively.

References

- 1) Nath, G., Rheol. Acta 14, 850 (1975).
- 2) Nath, G., Rheol. Acta 15, 209 (1976).

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Errata to

Rheological analysis of superplasticity in metallic materials

K. A. Padmanabhan and G. J. Davies

Rheol. Acta 13, 434–442 (1974)

The authors request the following rectification:

1. p. 438, column 2, line 3: substitute "volume" for "area".
2. p. 438, column 2, line 9–13: delete the sentence "If a unit area . . . grains of phase B".
3. In eqs. [16], [17], [A.1] and in the equation preceding

eq. [16], as well as in p. 439, column 1, lines 4 and 27, and column 2, line 2, N should be replaced by N^2 .

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