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discussion

Surface Effusion Drag Reduction Using Non-Newtonian Fluids[1]

P. S. GRANVILLE.[2] Issue is taken with the drag reduction implications and not with the mathematical analysis which is the similarity solution of the laminar boundary layer equations with injection and with a non-Newtonian power-law fluid. First, current efforts with drag reduction by polymer solutions are concerned with the turbulent flow in the boundary layer.[3]

Secondly, current efforts are concerned with dilute polymer solutions which display Newtonian characteristics in the laminar regime, the Toms effect.[3]

Thirdly, the drag reduction due to injection is misleading since it depends on injection from a reservoir of fluid in the moving body. The drag reduction disappears if the source of the injected fluid is the ambient fluid.[4]

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[1] By C. J. Scott and K. M. Kroll, published in the May, 1968, issue of the JOURNAL OF HEAT TRANSFER, TRANS. ASME, Series C, Vol. 90, pp. 277–279.

[2] Naval Ship Research and Development Center, Washington, D. C. 20007.

[3] Lumley, J. L., "The Toms Phenomenon: Anomalous Effects in Turbulent Flow of Dilute Solutions of High Molecular Weight Linear Polymers," *Applied Mechanics Reviews*, Vol. 20, No. 12, Dec. 1967.

[4] Granville, P. S., "The Effect of Fluid Injection on the Drag of Flat Plates at High Reynolds Numbers," *International Shipbuilding Progress*, Vol. 10, No. 101, Jan. 1963.

Turbulent Natural Convection From a Vertical Plane Surface[5]

G. S. H. LOCK[6] **and F. J. deB. TROTTER.**[6] We would like to begin by congratulating the author on presenting the results of a careful study which sheds considerable light on what has hitherto been a poorly understood subject. Several of the observations and conclusions are of particular importance since they question the validity of previously held assumptions and it is to these observations that our comments are addressed. Simultaneous with Dr. Cheesewright's study in air, an independent study in water has been carried out at the University of Alberta.[7] The findings listed below are in accord with those presented by Cheesewright:

1 The apparent absence of the laminar sublayer in air is also observed in water, at least over most of the region in which previous analyses have assumed it to exist. No evidence has been found contradicting the idea that a sublayer doesn't exist.

2 The incipience of hydrodynamic instability, as the point at which infinitesmal disturbances neither grow nor decay, is not well marked.

3 An exact similarity solution does not appear to exist, although an approximate solution incorporating an inner and outer solution may be practicable.

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[5] By R. Cheesewright, published in the February, 1968, issue of the JOURNAL OF HEAT TRANSFER, TRANS. ASME, Series C, Vol. 90, pp. 1–8.

[6] Department of Mechanical Engineering, University of Alberta, Alberta, Canada.

[7] Trotter, F. J. deB., "A Study of Turbulent Free Convection Near a Vertical Plate," MSc thesis, University of Alberta, 1967.