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LETTER TO THE EDITORS

SOME REMARKS ON CALCULATIONS OF HEAT TRANSFER IN THE AXISYMMETRIC BOUNDARY LAYER OVER A CIRCULAR CYLINDER

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IN A PAPER published in 1967, Eshghy and Hornbeck [1] solved the problem of heat transfer through the axisymmetric laminar boundary layer on a circular cylinder, the cylinder being maintained at a constant uniform temperature. It was evidently overlooked that the problem was solved several years earlier in two contributions by Bourne and Davis [2] and Bourne *et al.* [3]. The corresponding problem for a cylinder of *arbitrary* cross-section has also been solved by Bourne and Wardle [4]. It is of interest to compare the method of Eshghy and Hornbeck with that of the other contributors.

Finding an exact solution for all downstream distances x unattainable, Eshghy and Hornbeck and Bourne and Davies sought: (a) a series solution valid for small values of x; (b) an asymptotic series solution valid for large values of x; (c) an approximate solution to bridge the gap between the solutions (a) and (b). Each pair of investigators gave the same solutions for (a) and (b), but their treatments of the intermediate region were different.

Using Euler's transformation, Eshghy and Hornbeck [1] cast the series expansions for the heat transfer coefficient for small x in a form which allows it to be matched to the solution for large x and thereby give a guide to the heat transfer coefficient in the intermediate zone. Bourne and Davies [2] solved the problem in the intermediate zone by using power laws in an approximate representation of the velocity profile. In a further paper, Bourne *et al.* [3] gave an alternative treatment using the Karman–Pohlhausen integral method and showed that in the intermediate range of x the predicted values of the heat transfer coefficient were probably more reliable than those of Bourne and Davies [2]. When the values obtained by the three methods are compared, it is found that those of Bourne *et al.* agree to within 3 per cent with the values of Eshghy and Hornbeck.

Of the three methods, that of Eshghy and Hornbeck is undoubtedly the simplest and merits attention because a similar technique of interpolating between asymptotic solutions may be applicable in other problems. The method of Bourne *et al.* does have the advantage, of course, that it gives a solution over the whole range of x.

The subject of a recent note by Eshghy and Hornbeck [5] pertaining to their first paper [1] was also covered in the original contribution by Bourne and Davies.

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