behavior of the approximation in Ref. 1 is observed in the present results, namely $F_{\eta}(0)$ reaches a minimum and then increases with ξ. The minimum points shifts to smaller ξ values as ζ increases. The calculations of $G_{\eta}(0)$ by both approximate methods, and for all ζ values, even in the region where the approximate methods fail to predict flow reversal, again show good agreement.

Of the three approximations, that of Ref. 1 is in better agreement with the full three-dimensional calculations. The boundary-layer calculations for the problem in Ref. 1 should now be carried out in transformed streamline coordinates in order to complete the discussions of Wang's approximation.

References

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[2] Wang, K. K., "An Effective Approximation for Computing the Three-Dimensional Laminar Boundary-Layer Flows," *AIAA Journal*, Vol. 9, No. 8, Aug. 1971, pp. 1645–1651.

Comment on "Wind-Tunnel Interference Reduction by Streamwise Porosity Distribution"

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FROM the theoretical point of view, the walls of constant porosity do not behave necessarily as bas as the recent paper[1] suggests. The comparison with the "optimum" porosity (closed walls in the two-dimensional case) which produces the lift interference factor of small absolute value, but of a large gradient at the model position, seems to be irrelevant in the context.

Using the notation of Ref. 1, and assuming $R(x) = R = \text{constant}$, we find the following closed-form solution for the lift interference factor along the wind-tunnel axis[2] $\delta(x) = 1/2\pi x - \exp[x \tan^{-1}(R/\beta)]/4 \sinh(\pi x/2)$, $0 \leqq R < \infty$. The singularity at $x = 0$ is removable;

$$\delta(0) = -\tan^{-1}(R/\beta)/2\pi$$

Letting

$$(d/dx)\delta(x)|_{x=0} = 0$$

we obtain

$$\beta/R = \cot[\pi(3)^{1/2}/6] \cong 0.782$$

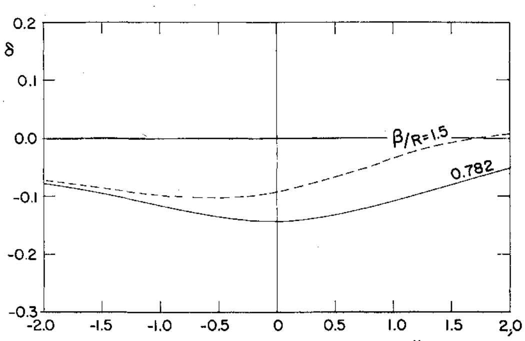

Fig. 1 Distribution of lift interference factor $\delta(x)$ along centerline.

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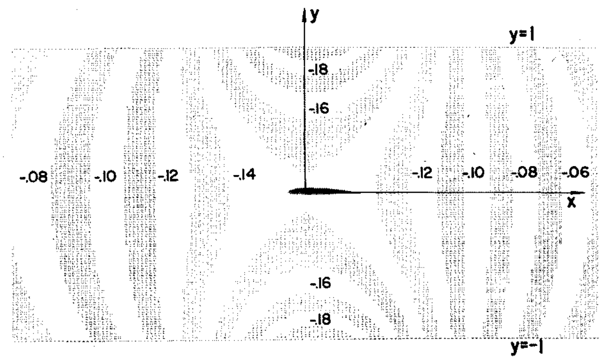

Fig. 2 Distribution of lift interference factor $\tilde{\delta}(x, y)$ for $\beta/R = 0.782$, coordinates $x = X/\beta h$, $y = Y/h$ in same scale.

For a given compressibility factor β, this gives the porosity parameter R about twice that selected in Ref. 1 ($\beta/R = 1.5$).

Figure 1 compares $\delta(x)$ for $\beta/R = 0.782$ and 1.5. The wall induced downwash corresponding to the average of δ over the model is certainly larger in the higher porosity case, but the variations in δ (streamline curvature) near $x = 0$ are roughly of the same magnitude as those obtained by the Gaussian distributions of lower porosity in Ref. 1.

For illustration, a two-dimensional distribution of the lift interference factor

$$\tilde{\delta}(x, y) = Re\{\delta(x + iy)\}$$

was printed in the form of fringes of equal $\tilde{\delta}$ in Fig. 2. In the considered case $\beta/R = 0.782$, a sufficiently small model is seen to lie in the neighborhood of the saddle point of the $\tilde{\delta}$ distribution, and hence in the region of nearly parallel flow. In general, this is a desirable test condition.

Nevertheless, the author Ref. 1 deserves credit for having been able to demonstrate that with the walls of variable porosity, a reasonably parallel flow at the model location can be achieved together with the reduction of the interference downwash.

References

[1] Lo, C. F., "Wind-Tunnel Wall Interference Reduction by Streamwise Porosity Distribution," *AIAA Journal*, Vol. 10, No. 4, April 1972, pp. 547–550.

[2] Mokry, M., "Higher-Order Theory of Two-Dimensional Subsonic Wall Interference in a Perforated Wall Wind Tunnel," LR-553, Oct. 1971, National Research Council of Canada, National Aeronautical Establishment, Ottawa, Ontario, Canada.

Reply by Author to M. Mokry

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THE evidence cited in Refs. 1, 5 and 6 of the Note[1] includes theoretical and experimental studies of three-dimensional tunnels in which it has been shown that it is difficult to eliminate pitching moment interference simultaneously with lift interference when using walls with uniformly distributed porosity. Some recent work in connection with the development of walls

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