Comment on "Results of a Strong Interaction, Wake-Like Model of Supersonic Separated and Reattaching Flows"

T. J. KESSLER*
Bell Telephone Laboratories, Whippany, N.J.
AND
R. H. PAGE†
Rutgers University, New Brunswick, N.J.

HUNTER and Reeves[1] recently presented a theoretical approach which they applied to turbulent flow separation ahead of a wedge. Their analysis was based on critical point methods. It is well known that both "critical point" and "component analyses" have been successfully applied to determine the over-all features of separated flow problems.

The critical point approach, often referred to as the Crocco-Lees-Reeves model, has grown from Crocco and Lees concepts.[2] The component analyses approach, often referred to as the Korst-Chapman model utilizes detailed studies of the various flow components in a merged over-all analysis in order to account for interaction between components.[3,4] Although we do not wish to quarrel with the authors' approach to the problem, we do feel that they neglected to reference earlier successful studies of the problem using an alternate approach. Figure 1, which is taken from a 1967 paper,[5] presents a curve from Fig. 7 of Ref. 1 for comparison. In this figure α is the wedge angle, L_s is the separation length ahead of the corner, θ is the momentum thickness upstream of the separation point, M_1 is the freestream Mach number before separation, H is the usual boundary-layer shape parameter, and γ is the specific heat ratio. We are pleased to note the general agreement of the two approaches to the same problem. It is also pleasing to note that the authors have theoretically confirmed our earlier theoretical conclusion that increasing the unit length Reynolds number will decrease the extent of the separated region for fully developed turbulent flow at constant Mach number.

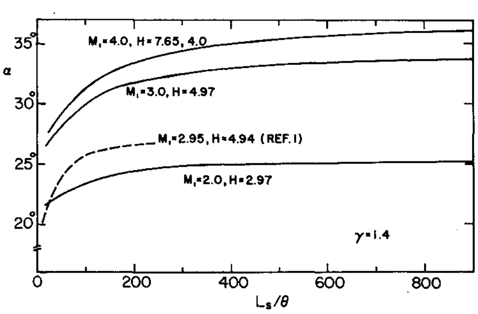

Fig. 1 Variation of wedge angle with dimensionless separation length, $\gamma = 1.4$ (Ref. 5).

References

[1] Hunter, L. G. Jr. and Reeves, B. L., "Results of a Strong Interaction, Wake-Like Model of Supersonic Separated and Reattaching Turbulent Flows," *AIAA Journal*, Vol. 9, No. 4, April 1971, pp. 703–712.

[2] Crocco, L. and Lees, L., "A Mixing Theory for the Interaction Between Dissipative Flows and Nearly Isentropic Streams," *Journal of the Aeronautical Sciences*, Vol. 19, No. 10, Oct. 1952, pp. 649–676.

[3] Korst, H. H., "A Theory for Base Pressure in Transonic and Supersonic Flow," *Journal of Applied Mechanical*, Vol. 23, 1956, pp. 593–600.

[4] Chapman, D. R., Kuehn, D. M., and Larson, H. K., "Investigation of Separated Flows in Supersonic and Subsonic Streams with Emphasis on the Effect of Transition," Rept. 1356, 1958, NACA.

[5] Kessler, T. J. and Page, R. H., "Supersonic Turbulent Boundary Layer Separation Ahead of a Wedge," *10th Midwestern Mechanics Conference, Developments in Mechanics*, Vol. 4, Colorado State Univ., 1968, pp. 1011–1028.

Received June 23, 1971.
* Supervisor. Member AIAA.
† Professor and Chairman, Department of Mechanical and Aerospace Engineering. Associate Fellow AIAA.

Reply by Authors to T. J. Kessler and R. H. Page

LOUIS G. HUNTER* and BARRY L. REEVES†
Avco Systems Division, Wilmington, Mass.

REFERENCE was made to several papers dealing with "component type analyses" in the first paper[1] (Ref. 6 of Hunter and Reeves) of our study of turbulent separated and reattaching flows. That paper (Ref. 1) described some of the shortcomings of a "component type analysis" and it gave the motivation for treating a turbulent separated flow as a wake-like, boundary-layer/inviscid stream interaction.

Reference

[1] Todisco, A. and Reeves, B. L., "Turbulent Boundary Layer Separation and Reattachment at Supersonic and Hypersonic Speeds," *Proceedings of Symposium on Viscous Interaction Phenomena in Supersonic and Hypersonic Flow*, University of Dayton Press, Dayton, Ohio, 1969, pp. 139–179.

Received August 4, 1971.
* Staff Scientist; now Assistant Professor, Matlow State College, Tullahoma, Tenn. Member AIAA.
† Senior Consulting Scientist.

Errata: "Bending Stress in a Conical Shell Subjected to Thermal and Pressure Loadings"

H. D. FISHER
Sandia Laboratories, Albuquerque, N. Mex.

[AIAA J. **9**, 977–979 (1971)]

THE third term on the right-hand side of Eq. (4c) should be

$$b^2 d^2 \overline{W}_0 / d\eta^2$$

There should be a minus sign preceding the quantity

$$16b/(1 + s^2)^{5/2}$$

in Eq. (7d).

Received August 9, 1971.