Technical Comments

Comment on "Angle of Attack and Leading Edge Effects on the Flow about a Flat Plate at Mach Number 18"

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IN a recent paper, Allegre and Bisch[1] presented some very interesting data obtained on sharp and blunt plates at angles of attack and conditions where the flow is subjected to strong interaction effects. Comparisons are made between the data and the theory of Cheng et al.[2] The data for the sharp plate are found to agree reasonably well with the theory; however, when bluntness effects are examined, the agreement between data and the theory presented is poor. From this comparison the authors conclude that "Cheng's theory yields a good correlation of the effect of incidence but not for the bluntness effect." The purpose of the present Comment is to show that the differences observed by Allegre and Bisch are not due to the failure of Cheng's theory to predict bluntness effects but rather to the effects of viscosity.

Examination of the data for blunt plates considering the criteria established by Dewey[3] indicates that the flow conditions are of such a nature that bluntness, incidence, and viscosity are all of equal importance for most of the data presented. Thus the data should be compared with Cheng's general case solution, which includes the effects of viscosity, rather than with the particular solution used by Allegre and Bisch, which does not include the effects of viscosity. Cheng presented only the heat-transfer solution for the general case; however, the solution for pressure and shock shape can be obtained by standard computer techniques. The present author has computed the required solutions.[4] In Ref. 4 the solution presented is for the theory of Cheng modified to account for the effects of specific heat ratio γ; however, Cheng's solutions can be obtained from these curves by simply redefining the correlating parameters to those given by Cheng.

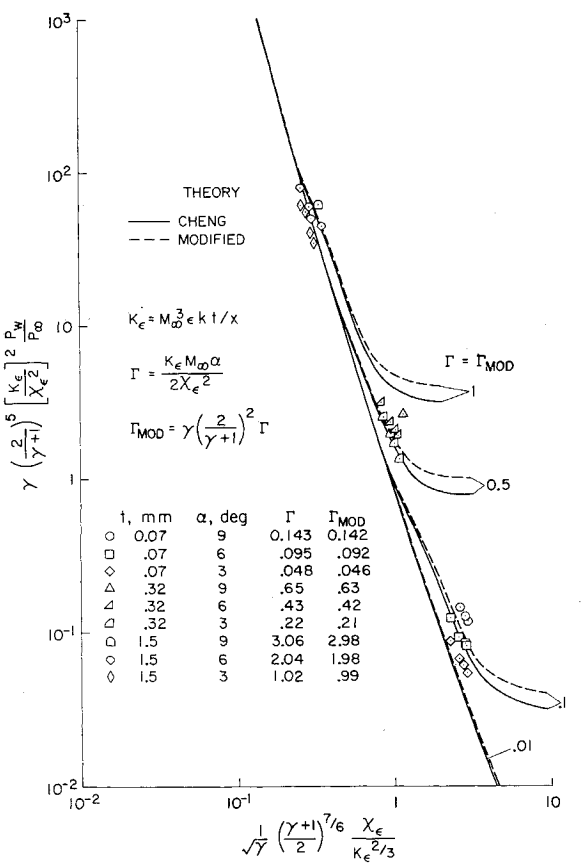

Fig. 1 Comparison of wall pressures on blunt plates with the general solution to Cheng's theory.

In Fig. 1 the data presented by Allegre and Bisch for blunt plates at positive angles of attack are compared with the general solutions to Cheng's original theory and with the values predicted by the present author's modification to Cheng's theory. In this example it is quite evident that both Cheng's original theory and the present author's modification to Cheng's theory predict the pressures reasonably well. Hence it can be concluded that the differences observed by Allegre and Bisch are not due to the failure of Cheng's theory to predict the effects of bluntness, but are primarily due to the effects of viscosity which were not accounted for in the theoretical values presented by Allegre and Bisch.

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References

[1] Allegre, J. and Bisch, C., "Angle of Attack and Leading Edge Effects on the Flow about a Flat Plate at Mach Number 18," *AIAA Journal*, Vol. 6, No. 5, May 1968, pp. 848–852.

[2] Cheng, H. K. et al., "Boundary-Layer Displacement and Leading-Edge Bluntness Effects in High-Temperature Hypersonic Flow," *Journal of the Aerospace Sciences*, Vol. 28, No. 5, May 1961, pp. 353–381.

[3] Dewey, C. F., Jr., "Bluntness and Viscous-Interaction Effects on Slender Bodies at Hypersonic Speeds," Paper RM-3832PR, Sept. 1964, Rand Corp.

[4] Kemp, J. H., Jr., "Hypersonic Viscous Interaction on Sharp and Blunt Inclined Plates," Paper 68-720, 1968, AIAA.

Comments on "Some Recent Advances in the Investigation of Shell Buckling"

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IN Ref. 1, Stein has concluded that the classical thin-shell buckling analyses are basically correct. Confining attention here to the case of cylinders under pure axial compression, his Fig. 1 indicates that the classical theory predicts the same buckling stress whether the ends be completely clamped ($u - \bar{u} = 0$, $v = 0$, $w = 0$, $\partial^2 w/\partial x^2 = 0$) or incompletely restrained ($u - \bar{u} \neq 0$, $v = 0$, $w = 0$, $\partial^2 w/\partial x^2 = 0$). He then compares this theory with only those experiments involving clamped ends. This raises two questions. First, if the theory applies for both end conditions, why should not the experimental results for cylinders with incompletely restrained ends also agree with the theory? Stein, himself,

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