In addition to the static and oscillatory cases, Ref. 2 also considers the transient case. The simplicity of slender-body theory permits the definition of a series of transient AICs from which the control-point forces can be found in terms of the control-point deflections and their first two derivatives:

$$\{F(t)\} = (qS/\bar{c})([C_{hs}]\{h\} + [C_{hd}]\{\dot{h}\bar{c}/V\} + [C_{hi}]\{\ddot{h}\bar{c}^2/V^2\})$$

The option for the transient case in the computer program of Ref. 2 generates the static AICs $[C_{hs}]$, the damping AICs $[C_{hd}]$, and the inertial AICs $[C_{hi}]$.

References

[1] Rodden, W. P. and Revell, J. D., "The status of unsteady aerodynamic influence coefficients," Inst. Aerospace Sci. Paper FF-33 (January 1962).

[2] Rodden, W. P., Farkas, E. F., and Takata, G. Y., "Aerodynamic influence coefficients from slender body theory: analytical development and computational procedure," Aerospace Corp. Rept. TDR-169 (3230-11) TN-6 (October 31, 1962).

Comments on "Angle of Attack and Sideslip from Pressure Measurements on a Fixed Hemispherical Nose"

FREDERICK O. SMETANA*
North Carolina State College, Raleigh, N. C.

KEENER[1] calls attention to "a simple method for sensing angle of attack and sideslip that appears to have been overlooked in the design of flow-direction probes." The writer, in a study conducted for the then Wright Air Development Center[2] five years ago, used a simple variant of Keener's method to normalize the pressure difference on blunt angle-of-attack, angle-of-sideslip probes. This involves the use of the pitot pressure alone (or P_{90} in Keener's notation) rather than the difference between the pitot pressure and some other surface pressure. For $M > 3$, this method has the advantage of the requiring fewer measurements and involves a simpler calibration formula. Since

$$P_{90} = P_{90\alpha=0} \cos^2\alpha \tag{1}$$

on a hemisphere for these conditions, the calibration formula becomes

$$\frac{P_l - P_u}{P_{90}} = \frac{\cos^2(\delta_l - \alpha) - \cos^2(\delta_u + \alpha)}{\cos^2\alpha} \tag{2}$$

where δ_l is the angular displacement of the lower orifice measured from the pitot pressure source and δ_u is the angular displacement of the upper source. Equation (2) has the further advantage of being somewhat more linear for $\alpha < 10°$ than Keener's result. When δ_u and δ_l are 45°, for example, Eq. (2) becomes simply

$$(P_l - P_u)/P_{90} = 2\tan\alpha \tag{3}$$

It may be of interest to note that a similar relation has been found to give good agreement with experimental results for an angle sensor made from a spherically capped cone with a small pitot source in the nose. It also was found that, to account for the change in pressure distribution with change in Mach number, one could replace α by $\alpha/(1 + 1/M^2)$ with generally good results. This may prove to be a more direct method than that suggested by Keener, i.e., generalizing the exponent in Eqs. (1) and (2), if $\alpha > 20°$. Keener's method of using a pressure difference to normalize $p_l - p_u$ apparently makes the result insensitive to changes in M for $1.5 \leq M \leq 3$ and $\alpha < 20°$, which the present method does not.

Finally, it might be pertinent to mention that recent wind-tunnel experience has indicated that Keener's estimate of the accuracy attainable (within $\pm 1°$) may be too conservative. With carefully calibrated pressure gages of high quality, data scatter has been kept to $\pm\frac{1}{2}°$ or less in most cases.

References

[1] Keener, E. R., "Angle of attack and sideslip from pressure measurements on a fixed hemispherical nose," J. Aerospace Sci. **29**, 1129–1130 (1962).

[2] Smetana, F. O. and Headley, J. W., "A further study of angle-of-attack, angle-of-sideslip, pitot-static tubes," Wright Air Dev. Center, WADC TR 57-234 (June 1958).

Received by IAS October 31, 1962.
* Associate Professor, Department of Mechanical Engineering; also Consultant, Litton Systems Inc., Canoga Park, Calif.

Blast-Hypersonic Flow Analogy

J. LUKASIEWICZ*
ARO Inc., Tullahoma, Tenn.

IN view of the recently published erratum,[1] the footnote on p. 1342 of Ref. 2 should be disregarded, Eqs. (5-8) of Ref. 2 being correct.

References

[1] Jones, D. L., "Erratum: strong blast waves in spherical, cylindrical and plane shocks," Phys. Fluids **5**, 637 (1962).

[2] Lukasiewicz, J., "Blast-hypersonic flow analogy theory and applications," ARS J. **32**, 1341–1346 (1962).

Received by ARS December 5, 1962.
* Chief, von Kármán Gas Dynamics Facility.

Comment on "Heat Transfer in Planetary Atmospheres at Super-Satellite Speeds"

ROBERT M. NEREM*
Ohio State University, Columbus, Ohio

Nomenclature

h = enthalpy, ft²/sec²
u_1 = velocity at outer edge boundary layer, fps
ρ_w = density, slug/ft³
$\dot{q}_w$ = stagnation point heat transfer rate, Btu/ft²-sec
μ_w = viscosity, slug/sec-ft
β = external velocity gradient, du_1/dx sec^{-1}
Nu = $[\dot{q}_w x c_{p_w}/k_w(h_0 - h_w)]$
Re_x = $u_1 x/\nu_w$

HOSHIZAKI[1] has shown that the dependence of the stagnation point heat transfer rate on flow field properties is the same both at low speeds, on the order of 5 to 10,000 fps,

Received by ARS December 6, 1962.
* Research Associate, Aerodynamic Laboratory. Associate Member AIAA.