(Continued from page 962)

layer, are incomplete. What is there is partly wrong. The error lies in stating that the boundary-layer velocity component along the boundary reaches the free stream value at infinity. The incompleteness is the absence of conditions on the velocity component normal to the boundary.

3. Although this is a book on boundary layers, nowhere is the basic notion of a boundary-layer approximation explained, not even for the simple case of a laminar boundary layer. The turbulent case is, of course, more complicated. (See, for example, Section 5.2 of A.A. Townsend's book "The Structure of Turbulent Shear Flow," Cambridge Press, 1956.) The approximate balance equations for energy, momentum, and mass fluxes are simply written down without justification. Under some conditions these forms are probably correct.

4. It is assumed that the static pressure fluctuations have no significant effect on density fluctuations, even at high Mach numbers. No reference or justification for this is offered by either the "authors" or the "translator," even though there is enough known about pressure fluctuations in turbulent boundary layers at subsonic speeds to permit a theoretical estimate of this point. A hasty look at the question would probably show that, when the temperature fluctuations are entirely due to the local compression of the gas, the pressure fluctuations must be included at all Mach numbers; when the temperature fluctuations are associated with general heat transfer, and with velocity fluctuations in the presence of a mean temperature gradient, the pressure fluctuation effect on density fluctuation must be included above some appropriate Mach number.

5. On page 5 the concept of a turbulent viscosity is introduced without any warning to the reader that, although it has value when used in certain flows, it is a notion which is wrong in principle because turbulent transport is not local.

6. It is suggested that the "turbulent Prandtl number" is almost always less than unity. This is certainly true for wakes and jets, but regions with values as large as 1.4 are found in turbulent wall flows.

7. In discussing the definitions of integral boundary-layer thicknesses, the authors momentarily forget, as they do in other sections also, that they are discussing the boundary layer on a generally curved body, not the boundary layer on a semi-infinite plate. They say that it makes very little difference whether the upper limit of the integral is at the outer edge of the boundary layer or at infinity.

8. Although the authors properly emphasize the point that Reynolds numbers based on boundary-layer thickness may be more useful than those based on distance from the front of the body, they employ the kinematic viscosity of the fluid outside the layer. The weakness of this choice can be seen easily at low speeds by putting a small circular wire normal to an airstream in a wind tunnel, at a Reynolds number of perhaps 50, so that a well-defined Kármán vortex street is shed. If we heat the wire, we can make the vortex street vanish; we have obviously lowered the effective Reynolds number. It is likely that the principal relevant effect of the heating is to raise the effective kinematic viscosity for the phenomenon, although the free stream value is unchanged.

9. Although this is allegedly a book on compressible boundary layers, Equations (1.47) and (1.48), which indicate that the skin friction and heat transfer coefficients will be variable, show dependence only on Reynolds number, not on Mach number. The foregoing are all from the first chapter.

The book is still useful as a practical reference for those who have some prior indoctrination. Many of its formulas show reasonable agreement with experiment, as demonstrated in an assortment of figures. On the other hand, the reader should feel insecure about applying these formulas outside the parametric range of explicitly demonstrated agreement.

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Advances in Cryogenic Engineering—Volume 10, Plenum Press, New York (1965). 438 pages, $17.50.

This book contains sixty-two of the papers presented at the Tenth National Cryogenic Engineering Conference, held August 18-21, 1964, at the University of Pennsylvania, Philadelphia, Pennsylvania.

Eight of the papers deal with the behavior of metallic materials. Fatigue behavior, tensile properties, elastic moduli, and shear strength of several alloys of aluminum, nickel, stainless steel, and titanium are reported from temperatures ranging from room to liquid hydrogen temperature. Evaluations of stainless steel and aluminum castings for use in liquid hydrogen bubble chambers and space vehicle fabrication are presented.

Four papers are concerned with the flow and fracture of metallic materials at cryogenic temperatures. The various criteria for evaluating resistance to low-ductibility fracture are reviewed and commented upon for usefulness.

The results of tests to determine the effects of specimen configuration and testing variables on crack propagation on types 301 and 310 stainless steels and 2014–T6 aluminum alloy are reported. The flow and fracture behavior of tantalum and the creep properties of 18-10 and 25-20 stainless steels are presented.

There is considerable interest in the use of plastic and glass fiber materials for components in space vehicles. This is indicated in some of the seven papers which deal with the behavior of these and other nonmetallic materials at low temperatures.

There are four papers each on cryogenic insulations, instrumentation, safety, seals, and miniature refrigerators.

Of the nine papers which are concerned with fluid phenomena, three are concerned with two-phase flow of hydrogen, and several report on investigations of cryogenic transfer lines.

The remainder of the papers deal with a wide variety of subjects which include ortho-parahydrogen catalysts, cryopumping, cryogenic heat exchanger design, and the development of a cryosurgical probe small enough to be applied to the structures of the inner ear.

International Advances in Cryogenic Engineering—Volume 10, Plenum Press, New York (1965). 524 pages, $17.50.

This book contains forty-two of the papers presented at the Tenth National Cryogenic Engineering Conference, held August 18-21, 1964, at the University of Pennsylvania, Philadelphia, Pennsylvania.

Fifteen of the papers report on advances made outside the U.S.A. in the cryogenic field. These papers, which are from European sources, concentrate on cryogenic machinery for use in producing refrigeration, report on cryogenic equipment development in air separation and helium refrigerators, and superconductivity.

Seven papers report on the applications of superconductivity. The applications range from small laboratory devices to the feasibility of a superconducting magnet system large enough to shield an Agena space vehicle from radiation.

The field of thermodynamics attracted eight papers. Phase equilibrium data are presented for the systems helium-oxygen, methane-hydrogen, argon-helium, argon-hydrogen, hydrogen-methane, and argon-oxygen-nitrogen. Binary adsorption is discussed in one paper and the systems hydrogen—nitrogen and hydrogen-carbon dioxide are investigated in relation to the predicted adsorption.

Six papers report developments on work being done on fluid pressurization and stratification. The major effort on this subject went into studies involving liquid hydrogen.

There are significant and extensive reports on heat transfer of liquid oxygen, nitrogen, hydrogen, and helium which will prove interesting to all engineers and scientists.

Any engineer or scientist working the field of cryogenics will find both of these books interesting, helpful, and idea generators. Those outside the cryogenic field may find some of the papers to be quite fascinating, if not of immediate practical value.

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ERRATUM

In "Heat Transfer in a Fuel Cell Battery" by Dimitri Gidaspow and Bernard S. Baker (**11**, No. 5, pp. 825-831), an error in Equation (17) appears. Numerically, the error is insignificant for the applications discussed in the paper. Both the old and the corrected result reduce to the same thing for small values of a dimensionless group, a Peclet number used in the paper, and will therefore not lead any user of the formula far astray. The coefficient A_{nm} should be as follows

$$A_{nm} = \frac{8\,n\,(-1)^m}{\left(n^2\pi^2 + \frac{1}{4}N^2_{Pe}\right)(2m+1)\cosh p_{nm}} \left\{ \left[Q - \frac{4\,N_{Pe}}{4n^2\pi^2 + N^2_{Pe}} \right] \cdot \left[1 - (-1)^n \exp\left(-\frac{1}{2}N_{Pe}\right) \right] + R\left[1 - (-1)^n \exp\left(\frac{1}{2}N_{Pe}\right) \right] + (-1)^n \exp\left(-\frac{1}{2}N_{Pe}\right) \right\}$$