This is characteristic of mixed-boundary-value problems, which are solved by the Wiener-Hopf technique. In order to obtain the third case we must relax our boundary conditions at infinity. Thus the method used may, for some loadings, prevent one from recovering the flat-sheet behavior from that of the curved sheet. For these reasons, and as discussed orally during the presentation, the problem of a shallow spherical shell containing a finite crack has now been solved using a different mathematical approach (E. S. Folias, "The Stresses in a Spherical Shell Containing a Crack," GALCIT SM 63-20, November, 1963, doctorate dissertation).

In closing, the authors wish to again emphasize the distinction between the Kirchhoff and Reissner type bending boundary conditions [Refs. [3] and [7] of the paper) and urge caution in the use of stress-intensity factors which, in contrast to the extensional solution, have been deduced from a local (bending) stress distribution incorporating incomplete boundary conditions.

The Influence of the Equilibrium Dissociation of a Diatomic Gas on Brayton-Cycle Performance[1]

R. SABERSKY.[2] This paper is an extension of the authors' previous work in which they analyzed the effect of changes in specific heat of the working substance on the efficiency of the Brayton cycle. The results of the present paper show that the effect of chemical equilibrium on this efficiency may, under certain conditions, be significant. The effect comes about, presumably, by the dissociation causing changes in the heat capacity in such a way that the Brayton cycle approaches the Carnot cycle more closely.

The range in which significant improvements are indicated is limited, however, to very low overall temperature ratios (T_3/T_1), and to a restricted range of the initial temperatures. In order to estimate whether or not the indicated improvement in efficiency is of practical significance, it will be necessary to carry out the indicated calculations for specific substances and to compute the actual temperatures which would occur in the cycle.

Furthermore, one may also point out that if the temperature ratios in question are small, changes in component efficiency also lead to large percentage changes in efficiency. Facts of this type will have to be taken into account in any optimization study, particularly as one could imagine that the component efficiency might be affected by the initial temperature T_1, which has to be selected within certain limits in order to take advantage of the shifting chemical equilibrium.

F. A. WILLIAMS.[3] This is the second of two papers concerning the maximum theoretical thermal efficiency of the Brayton cycle for a working substance with a variable specific heat. The first paper dealt with an ideal gas with partially excited vibrational modes; this paper concerns Lighthill's model of an ideal dissociating diatomic gas. It may be worth emphasizing that chemical and thermodynamic equilibrium is postulated throughout the cycle in both analyses. The thermal efficiency is maximized, subject to given compressor and turbine efficiencies, a given turbine-inlet temperature and given compressor-inlet conditions. This maximum efficiency is compared with the maximum efficiency obtainable by utilizing an ideal gas with a constant specific heat as a working substance. It is shown that, for low turbine-inlet temperatures, the maximum thermal efficiency can be increased by more than a factor of 2 by choosing a dissociating gas with an optimum value of the dissociation energy. However, it is, of course, found that this higher efficiency is achieved only at the expense of employing considerably higher pressure ratios. Although the thermal efficiency is not the only parameter of importance in heat-engine design, the authors have certainly justified their conclusion that the dissociating working fluid merits further study with a view toward application.

[1] By T. A. Jacobs and J. R. Lloyd, published in the June, 1963, issue of the Journal of Applied Mechanics, vol. 30, Trans. ASME, vol. 85, Series E, pp. 288–290.

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Force Singularities of Shallow Cylindrical Shells[1]

W. FLÜGGE[2] and D. A. CONRAD.[3] The author is to be congratulated for his success in finding a solution for the concentrated force in terms of integrals of products of cylindrical and circular functions. We attempted several years ago to find such a solution, but were unsuccessful. The author, referring to our paper[4] states that we concluded "that unlike the thermal singularities, the force singularities are not expressible in terms of moderately simple solutions of field equations." In actuality, we developed a particular set of singular solutions to the shallow-shell equations, interpreted two of them as thermal singularities, and showed that the force singularity was not included among them. It was not implied or stated that other sets of solutions, perhaps containing the force singularities, did not exist. Our only conclusion was that we did not find such a solution and were therefore forced to use other methods in dealing with the concentrated force.

In a later note,[5] we called attention to a convenient method for the calculation of shallow shells in general and presented a solution for the concentrated force on the cylinder. It would have been of interest to see comparable numerical results using the new solution. It would appear that the series approach is more convenient for direct calculation, but that the author's solution may provide some advantages for use as a Green's function.

Author's Closure

I thank Professor Flügge and Dr. Conrad for their kind comments and remarks. I would like to point out that partly what I had hoped to be emphasized in the paper was the organic relation between the singular solutions, that is, the fact that once a singular solution of a partial differential equation is known in general, other singularities can be identified by differentiation or integration.

[1] By A. Jahanshahi, published in the September, 1963, issue of the Journal of Applied Mechanics, vol. 30, Trans. ASME, vol. 85, Series E, pp. 342–346.

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[4] W. Flügge and D. A. Conrad, "Thermal Singularities for Cylindrical Shells," *Proceedings of the Third U. S. National Congress of Applied Mechanics*, 1958, p. 321.

[5] W. Flügge and D. A. Conrad, "A Note on the Calculation of Shallow Shells," Journal of Applied Mechanics, vol. 26, Trans. ASME, vol. 81, Series E, 1959, p. 683.