by Hristianovic, Zeltov, and Barenblatt is developed by Islinskij [6]. Also included in this first group are a number of interesting general contact theorems which are analogous to Michell's theorem in plane elasticity [4], proven by Dundurs.

In the second group mentioned in the foregoing, Johnson's work [2] combines theory and laboratory experiment to achieve an entirely satisfactory explanation of two hitherto troublesome questions: the effect of friction on the strength of brittle materials as measured in the spherical indenter test and the influence of adhesion on the normal contact of smooth and rough nominally flat surfaces. Archard, et al. [20], and Barwell, et al. [21], describe the measurement and characterization of surface texture, so important in practical engineering problems. Among other papers in this group [22, 23, 25] may be included Schallamach's work on the rolling and sliding friction of rubber [24]. Presentations of fundamental dynamic and thermal contact problems appear [12–16, 17, 26]. Plastic effects in rolling contact are treated by Christoffersen [11].

It is a pleasure here to record that several contributors to these *Proceedings* have been at pains to include extensive bibliographical references. These will be of aid to others doing research in the field. The general format and typography reflect credit upon the editors who, in addition to other onerous duties, have in some cases had to undertake the English translation. There are a few minor typographical errors, but these are not irritating. The work reflects credit also upon the Delft University Press.

At the risk of injecting a personal note, the reviewer would wish to express his regret at the necessity of omitting the stimulating discussion that followed the presentation of these papers, especially the remarks of M. Frémond on the practical application of variational techniques, of J. Willis on the Radon transform, of D. Tabor and, indeed, of many other participants. This element, probably the best excuse for international symposia, must, like the Delft-blue skies of Enschede, remain a privileged recollection of the participants.

Small Elastic Deformations of Thin Shells. By Paul Seide. Noordhoff International Publishing. Leyden. 1975. Pages XIII-654. Price 190 Dfl.

REVIEWED BY R. P. NORDGREN[3]

The book makes an important contribution to shell theory by collecting and uniformly rederiving numerous analytical solutions for shells. About two thirds of the text is devoted to static solutions for shells of revolution under symmetric and asymmetric loads. Solutions are obtained in terms of special functions for cylindrical, conical, and spherical shells. The method of asymptotic integration is applied to general shells of revolution. The derivations are sufficiently detailed and a reasonable quantity of numerical results is presented.

Numerical solution by the finite-element method is briefly discussed for shells of revolution and general shells approximated by triangular plates. However, the mixed-type element with constant stress couples does not seem adequate for the degree of the differential equations involved. The widely used finite-difference method for shells of revolution is only mentioned in passing.

Limited results are presented for shallow shells, thermal loading, anisotropic shells, layered shells, stiffened shells, and shells of non-uniform thickness. The book closes with two chapters on free and forced vibrations of cylindrical, spherical, and conical shells. Reviewer believes that static and dynamic problems of shallow shells deserve more attention.

In the opening chapter of the book the differential geometry of surfaces is reviewed. Then the equations of Love-type shell theory are derived from the theory of elasticity by the usual approximate methods and by minimizing potential energy. The derivations are rather awkward mainly due to the use of expanded notation in lines-of-curvature coordinates. A more serious difficulty arises from the author's hypothesis that the shell has infinite resistance to transverse extension and transverse shear. This hypothesis leads to the same constitutive equations as the Love-Kirchhoff hypothesis and the author considers his hypothesis more plausible. The reviewer disagrees and suggests that an appreciation of the Love-Kirchhoff hypothesis is essential to understanding and having confidence in the theory of shells. Such an appreciation can be gained by examining a few three-dimensional elasticity solutions for plates and shells. Also, recent research on error estimates gives some indication of the accuracy of shell theory under the Love-Kirchhoff hypothesis.

Seide's book can be recommended as a reference on analytical solution techniques. It also could be used as a teaching text in combination with supplementary material on the foundations of shell theory.

[3] Shell Development Company, Bellaire Research Center, Houston, Texas.

