of the same length; but the subject is smaller and has been clearly delimited. The author is able to deal adequately with the processes of conduction, convection and radiation, and to give a brief but satisfactory treatment of such matters as the difference in temperature between the surface of a wall and the layer of air in contact with it. The reader is assumed to have a knowledge of calculus, including the simpler differential equations, but Bessel functions, etc., are not introduced. This book can be recommended to engineers and architects who may be concerned with the heating of buildings. It would also be helpful to honours students in physics, who may gain from it both a good summary of matters of theoretical interest and an understanding of the relation between laboratory work on heat and some problems of practical importance. A translation of this book would be very welcome. R. W. DITCHBURN

16/-

MATHEMATICAL THEORY OF ELASTICITY

Mathematical Theory of Elasticity

By Prof. I. S. Sokolnikoff, with the collaboration of Asst. Prof. R. D. Specht. Pp. xi+373. (New York and London: McGraw-Hill Book Co., Inc., 1946.) 22*s*. 6*d*.

THE appearance of a treatise in English upon the mathematical theory of elasticity is an event the potential importance of which may be judged by the fact that the author, in his frequent suggestions for collateral reading, refers to only three such, those of Southwell, Timoshenko, and Love. In spirit and content Sokolnikoff's book differs greatly from each and all of these. It may be described by a possible sub-title: "A pure mathematician surveys topics related to certain problems in the mathematical theory of elasticity". It is symptomatic of the change in outlook of American mathematics over the past few decades.

The book falls naturally into three sections. The first (Chapters 1–3, pp. 1–96) is devoted to analyses of stress and strain, the stress-strain relation, and the equations of equilibrium. The main feature of this section is the systematic use of the tensor notation. The second section (Chapter 4, pp. 97–276) is mostly concerned with the extension, torsion and flexure of beams, while the third section (Chapter 5, pp. 277–345) deals with variational and associated methods, illustrated mainly as applied to the torsion problem. Frequent suggestions for collateral reading and sets of exercises are excellent features, and the appendix —a collection of important formulæ—is very useful.

From the above it will be seen that this book contains matter not to be found in the other treatises already mentioned—but the converse is also true. Only a small group of elastic problems is solved, namely, those reducible to two-dimensional boundary problems for Laplace's or Poisson's equation. Biharmonic analysis does not find a place; but we are promised a companion volume containing a systematic treatment of plates and shells based on the fundamental differential equations.

In the first section the tensors are cartesian; the suffixes are all subscript and the ideas of covariance and contravariance do not occur. (Formulæ for polar co-ordinates are derived in Chapter 4, and are there given in extended notation.) Upon the conciseness of the tensor notation there can be no question. But it is open to question whether the physical ideas must first be grasped in a familiar notation before the more compact symbolism can be really useful, and also whether the difficulties of new ideas and new symbolism are likely to be simultaneously overcome by the average student. When one has mastered the ideas expressed in the extended notation, then the advantages in succinctness of the tensor notation become evident. The remainder of the volume is, however, independent of tensor notation, for, as the author realizes and indeed explicitly states, this symbolism loses its magic when confronted by specific problems.

The second section first covers much familiar ground using familiar notation, but includes also modern ideas, such as Stevenson's specification of the flexure functions, and the use of complex variable methods for solving torsion and flexure problems. In making available the work of the Russian school along the latter lines the author has rendered a service. The emphasis throughout this section is upon exact formal solutions as ends in themselves with little regard to their suitability for technical calculations.

In Chapter 5 the author concerns himself with approximate methods, both formal (like those of Rayleigh–Ritz) and numerical (the finite difference approximation). Although applications are limited to a few cases of the torsion problem, the survey is valuable, especially the account of methods of delimiting exact values between upper and lower bounds.

As has been implied already, the outlook is that of a mathematician, of a man of science rather than a technician. Emphasis is upon method rather than result—rightly so, in the sense that it is for methods that the technician consults the mathematician. But we fear that the technician will not find this book easy reading. Although the author from time to time makes a conscious effort to take the reader behind the scenes and show him how the mathematical effects are produced, he cannot entirely escape the mathematician's habit of asking one to 'consider the expression . . .' which appears rather like the rabbit out of the conjurer's hat. Again, the engineer may well ask how the mathematician knows which method to use upon any problem—and in particular why the complex variable method be not applied to the torsion or flexure of either the elliptic cylinder or the rectangular prism. In what should be one of the most telling sections of the book, where the complex variable method is applied to the cardioid section, the essential simplicity of the method is masked by analysis which seems clumsy and is not easy to follow.

There is much repetition, both in the text and in the references. In the text it may possibly be justified, but it is surely unnecessary and wasteful to give full bibliographic references to (for example) Love's "Treatise" every time it is mentioned, or, in two footnotes on the same page, to repeat title and reference in full to a paper cited. Choice of notation is not always happy, for example, the use of σ for a complex variable after its use for Poisson's ratio. Misprints are more frequent than one likes to see, although they should cause little trouble to an intelligent reader.

But it is clear that, although only a small field has been tilled, there is, for those who can winnow the grain from the chaff, a harvest to be reaped in this book. W. G. BICKLEY