57) may populate the dream-world of the scientist, but in the cold light of day they are linguistic monstrosities. The only scientific faulting to be recorded relates to Fig. 32. There, some isotopes of elements 100-102 are shown which are not referred to at all in the text, and for the production of which it would appear that, at present, there is no reasonable likelihood. But these are matters of minute detail, indeed.

Variation Methods for the Study of Nonlinear Operations. By M. M. Vainberg. With a Chapter on Newton's Method, by L. V. Kantorovich and G. P. Akilov. Transl. from Russian by Amiel Feinstein. 323 pp. Holden-Day, San Francisco, 1964. $12.95.
Reviewed by T. Teichmann, General Dynamics Corporation.

Nonlinear operators have been receiving an increasing amount of attention in the pure and applied mathematical literature, because of their vastly greater (potential) generality, and, in many cases, because of some highly desirable practical characteristics. Unfortunately general techniques for dealing with them are rare, and expositions of those that exist even rarer. Vainberg's book fills an important gap by providing a precise but readable description of the mathematical framework needed to treat nonlinear operators in a general way, as well as a relatively extended discussion of the most general method (Newton's) available for such problems.

After a description of some of the basic ideas of functional analysis (supplemented by an appendix on Banach spaces), the author gives an illuminating discussion of the notions of Gateaux and Frechet differentials of operators, and the corresponding derivatives. The Gateaux (or weak) differential of an operator F is defined as

$$VF(x,h) = \lim_{\epsilon \to 0} \frac{1}{\epsilon} [F(x+\epsilon h) - F(x)],$$

where x, h belong to E, the domain of F, provided of course the quantity cited exists. The Frechet differential is slightly stronger. The properties of these operators are discussed, and on them are built the notions of potential vector fields in infinitely dimensional spaces, extreme and critical points of functionals, and proper functions and branch points of nonlinear operators. A number of special operators and functionals are introduced (in particular relating to square roots of operators), which are then applied to variational proof of the existence and uniqueness of solutions of various nonlinear integral equations. In the final chapter (due to L. Kantorovich and G. Akilov) many of the concepts introduced are applied to the solution of nonlinear operator equations using the analog of Newton's method. This is done both in general and in a number of special cases.

Although there is, of necessity, much abstract discussion, the language, notation, and logical presentation tend to follow that of ordinary vector spaces, and as a result it is relatively easy to follow and illuminates the underlying concepts very well.

Progress in Solid Mechanics, Volume 3. I. N. Sneddon and R. Hill, eds. 256 pp. (North-Holland, Amsterdam) Interscience Publishers, Inc., New York, 1963.
Reviewed by E. H. Dill, University of Washington.

This volume contains one article, "Dynamical Problems in Elasticity", by V. D. Kupradze of the USSR. The intellectual level is of a monograph for the research specialist, and it is a very important work. It is not only a rigorous mathematical treatment of great interest to the theorist but, in view of the current advances in digital computers, the basis for numerical calculations will prove of great practical value.

The equations of the classical linear theory of elasticity are considered: In the case of the static equilibrium and steady-state harmonic motion, the equations of motion subject to certain boundary conditions form a boundary-value problem. The author shows how the problem can be treated by the method of potentials, based on the theory of singular integral equations. Uniqueness and existence theorems, and methods of solution by reduction to sets of linear algebraic equations are treated in a rigorous mathematical manner. New re-

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sults in the theory of multidimensional singular integral equations are included. The first seven chapters are identical to the book *Methody Potentsiala v Teorii Uprugosti* (Moscow, 1963) by the same author. This latter book contains additional chapters which present another method of approximate solution of the integral equations.

Cryogenics. By Michael McClintock. 270 pp. Reinhold, New York, 1964. $10.75. *Reviewed by R. P. Hudson, National Bureau of Standards.*

The author of this book aims to give the noncryogenics scientist or engineer and the educated nonscientist "a qualitative understanding of the basic aspects and some of the representative applications of cryogenics". In a Foreword, the book is recommended as "an easy-to-read treatise" for the nonspecialist and as enjoyable and informative for the specialist too. The publisher presents it as a comprehensive survey for the education of scientists, engineers, and managers who are, so to speak, on the verge. How well, one is thereupon led to ask, are these aims met and the literature-void filled?

The subject matter is extensive and ranges over engineering topics such as refrigeration, insulation, mechanical properties, and applications; and over the physics of liquid helium, superconductivity, transport properties, magnetic phenomena, and thermometry. The discussion is nonmathematical, generally lucid and readable, and up-to-date. The chapter on mechanical properties, the author's specialty, is particularly well done.

This much said, the reviewer finds it to be open to a number of criticisms. To a certain extent, it falls at times squarely between the two stools of simplicity and discussion-in-detail, presumably alternately distressing the questing "verge-stander" and the bedtime reader. (A minor but not entirely insignificant annoyance rises from the pertinent diagram or tabulation lying, as often as not, over the page from the text.) The author makes due acknowledgment to Mendelssohn's *Cryophysics* and Scott's *Cryogenic Engineering* and, indeed, the present book is essentially a fusion and condensation of these works. One feels it should be mentioned that, present aims notwithstanding, the former contains rather more of the physics and the latter far, far more engineering information, while both together may be purchased for the price of *Cryogenics*. Occasional lapses into whimsicality do lighten the tone but are hardly needed; one especially questions the value, even propriety, of reproducing such comic-strip suggestions as magnetic-field shielding of spacecraft against charged particles or "tapping a supercurrent" to propel an automobile.

Detailed faults come to eye most readily in the physics portions. In discussing the Dewar vessel the important role played by the effluent gas is not recorded, although the point is referred to off-handedly in a later discussion of "support members". Possibly the greatest drawback to the use of semiconductor thermometers at low temperatures is their electric power dependence and extreme sensitivity to unscreened rf radiations. This is not mentioned, but these thermometers are quite erroneously maligned as being nonreproducible after severe thermal cycling. The discussion of magnetic cooling gives the impression, at least, that the temperature drops as a result of heat being extracted from the paramagnet's lattice, rather than the converse—an incorrect concept that has, unfortunately, been presented not infrequently in the past. It is due, perhaps, to a similar lack of clarity that nuclear magnetic moments appear to be being ascribed to a simple pairing-off of the constituent nucleon moments and the term "asymmetrical nuclei" may mislead further. The reader might well develop an unduly rosy picture of the quality of the commercial cyclic magnetic refrigerator, or the mistaken notion that cooling by adiabatic magnetization of superconductors is something more than an intellectual divertissement.

Turning to thermocouples, the disadvantage of using a room-temperature reference for low-temperature thermometry is properly emphasized, while the particular usefulness of the dilute copper alloys in minimizing this effect is not. Loose statements