Gruppentheorie. By A. G. Kurosch. With a supplement by B. H. Neumann. Berlin, Akademie-Verlag, 1953. 12+418 pp. 28.00 DM.

This is a German translation of the first Russian edition (1944) of Kurosch's *Teoriya Grupp.* Although it appeared after the second Russian edition (1952), it is well worth owning for itself, even for those who read Russian easily. The supplement by B. H. Neumann is particularly valuable.

In a very refreshing way Kurosch frees the study of groups from unnecessary assumptions of finiteness. Free groups, defining relations, and free products appear early and account for chapters 4 and 10. The study of Abelian groups is very extensive and occupies chapters 5, 8, and 9. This includes the theorem of Ulm which completely characterizes countable periodic Abelian groups. Chapter 7 covers solvable and nilpotent groups. This has been an area in which research has been active in recent years, the theory of special groups having been developed by the Russian school. In chapter 11 Kurosch gives most of what was known about subgroup lattices at the time he wrote.

The German edition adds to the 1944 edition in two ways. First the bibliography has been brought up to date and numerous footnotes relate the more recent work to the text. But most notably there is an extensive supplement by B. H. Neumann giving among other topics the theory of amalgamated products. Also three important examples due to Graham Higman are included. One of these is a finitely generated group isomorphic to a proper subgroup. A more complicated example of this was given earlier by Neumann himself. This shows the Hopf conjecture to be false.

Unfortunately, in eliminating finiteness Kurosch has thrown out the baby with the bath and there remain only faint traces of finite groups. He promises another volume on finite groups which will indeed be welcome.

MARSHALL HALL, JR.

Theoretical elasticity. By A. E. Green and W. Zerna. Oxford University Press, 1954. 14+442 pp. $8.00.

This book is mainly concerned with three areas in elasticity: nonlinear elasticity, complex variable methods in linear elasticity, and shell theories. Since even these are not treated comprehensively, it might more aptly be titled "Special Topics in Theoretical Elasticity." On the other hand, no other single work makes as serious an attempt to cover both linear and nonlinear elasticity.

Chapter I is devoted to purely mathematical results which are needed for later analyses. In Chapter II, the theory of stress and strain is discussed and the equations of the general theory are obtained. The authors restrict themselves to convected coordinates, i.e., to moving coordinate systems in which the coordinate surfaces are material surfaces. The reviewer and several other workers in elasticity prefer not to impose this restriction, but this is largely a matter of taste.

In Chapter III, the authors include those general solutions which were available in the literature at the time the book was written. In Chapter IV, the general theory of small deformations superposed on large is developed for isotropic materials and a number of solutions of the resulting equations are given. Aside from some results given in Chapter V concerning the form of the strain energy for anisotropic materials, this constitutes their treatment of nonlinear elasticity. So many results in nonlinear elasticity have since been published that their treatment already seems rather out of date.

Chapter V gives a presentation of the linear theory, and a number of solutions of these equations. On the whole, their work seems quite reliable, but their discussion of boundary value problems and uniqueness theorems on p. 164 is extremely slipshod. According to their remarks, prescribing the surface tractions determines a unique solution of the equations of motion, which is definitely untrue.

Chapter VI is devoted mainly to explaining the use of complex variable methods for plane strain of isotropic and anisotropic materials and Chapter VII extends these methods to two-dimensional problems in plate theory. In Chapters VIII and IX, these methods are applied to obtain numerous solutions. Included are interesting comparisons of solutions for isotropic and anisotropic materials.

The remainder of the book is devoted to shell theories obtainable from the linear theory by approximation. As the authors remark, "The methods used and the approximations which are made differ with almost every writer. . . . " In view of this, it would seem appropriate to make an attempt to give a rigorous justification of the approximations which they use, to give a critical appraisal of existing theories, to indicate how results obtained from different approximate theories compare or to otherwise clarify the situation. Instead, the authors follow the usual procedure of making more or less plausible approximations to obtain tractable equations which are, at least in some cases, different from others which have been proposed. Some solutions are given.

Those interested in the topics covered by this book should find this a useful reference, particularly for solutions of particular problems. It is not simply a rehash of the literature, a number of hitherto unpublished results having been included. The bibliography, while not complete, is sufficiently extensive to be quite useful. At present, it is the only single work which could reasonably serve as an introduction to both linear and nonlinear elasticity. It is perhaps too specialized to be well suited for this purpose, though a comprehensive treatment would fill several volumes.

J. L. ERICKSEN

Ricci-Calculus. An introduction to tensor analysis and its geometrical applications. By J. A. Schouten. 2d ed. Berlin, Springer, 1954. 20+516 pp. 55 DM; clothbound, 58.60 DM.

Since the publication in 1901 of the famous paper on absolute differential calculus by G. Ricci and T. Levi-Civita which established the foundation of the so-called Ricci-Calculus and especially since the publication in 1916 of the theory of general relativity by A. Einstein, the importance of Ricci-Calculus in its geometrical and physical applications has been universally recognized. The first edition of this book, published in German in 1923, covered all the researches made until then and played an important instructive role in this new branch of geometry. But since then tensor calculus was further developed to a great extent and many new notions were introduced, for example, normal coordinates, the symbolism of exterior differential forms, infinitesimal deformations, Lie derivatives, subprojective spaces and their generalizations in Hermitian geometry. To cover these new notions, J. A. Schouten and D. J. Struik published in 1935 and 1938 their *Einführung in die neueren Methoden der Differentialgeometrie* I and II. In this book they introduced the so-called kernel-index method which is a characteristic of Schouten's school.

Since 1935 Ricci-Calculus was again further developed. For example, the projective and conformal geometries have been studied in great detail from various points of view; Finsler and Cartan spaces, general spaces of paths and those of K-spreads were introduced, the motions in these spaces were studied by the use of Lie derivatives; and the ideas of harmonic spaces and of spaces of recurrent curvature were developed by British mathematicians. The book under review was written to cover these new developments in the Ricci-Calculus and the author tries to retain the instructive and the encyclopedic character which "Der Ricci-Kalkül" has. Thus, although the book is entitled "Ricci-Calculus, the second edition," it is an entirely new book.

It consists of eight chapters. The first chapter is devoted to tensor algebra. In the first section, an n-dimensional affine space E_n is