tween calculus and advanced calculus, between "intuitive" and "rigorous" mathematics.

The treatment is based on set theory; it includes rigorous proofs of theorems, and it maintains a high degree of precision in notation and in the statements of axioms, definitions, and theorems. The treatment is detailed and abstract; the entire book contains only five figures. There are 394 exercises; they are collected in sets at the ends of the seven chapters. The following chapter titles indicate the range of topics treated: "Elements of set theory," "The real number system," "Finite and infinite sets," "Sequences and convergence of real-valued sequences," "Sequential limit theory in the extended real number system," "Definition by induction," and "Functions of a real variable: Limits and continuity."

Chapter 1 contains a partial development of set theory; although somewhat deeper than most elementary treatments, the subject is not developed axiomatically. Chapter 1 includes also a treatment of ordered pair, relation, and function; a function is a special type of relation and thus a set of ordered pairs. Chapter 2 characterizes the real numbers, but it does not construct them; it is assumed that they exist already. Chapter 3 treats finite and infinite sets in general, and sets of real numbers in particular; it contains a proof of the Bolzano-Weierstrass theorem. Chapter titles describe the topics treated in the remaining chapters.

G. Baley Price
Department of Mathematics, University of Kansas, Lawrence

Electron Spin Resonance

Electron Paramagnetic Resonance. S. A. Al'tshuler and B. M. Kozyrev. Translated from the Russian edition (Moscow, 1961) by Scripta Technica. Charles P. Poole, Jr., Ed. Academic Press, New York, 1964. x + 372 pp. Illus. $13.50.

Electron spin resonance has become highly sophisticated during its 20-year life span and a vast amount of literature has accumulated on the subject. This volume, a translation from the Russian edition, is an excellent compilation of early literature. Presentations of theoretical results by Al'tshuler and of experimental results by Kozyrev are well integrated and organized for easy reference. It is unfortunate, however, that the book was translated 3 years after it was first published in Russian and apparently 6 years after the manuscript was completed. As a result, the material must be taken in the context of electron spin resonance as it was 6 years ago. Some of the work has been superseded, and some of the concepts, particularly those related to organic free radicals and to masers, have advanced considerably beyond those presented here. For example, in the chapter on free radicals, the confusion of early 1958 between electron density and electron spin density is evident, and often the two densities are incorrectly used interchangeably. The student who uses this book as a guide to electron spin resonance must be cautious in some respects. He must realize that most of the unsolved problems evident throughout the book are no longer problems. In passing, it should be noted that the historical introduction to this volume finally gives Zavoisky his deserved credit for the discovery of the spin resonance phenomenon.

The subjects treated touch all phases of electron spin resonance. It is apparent, however, that most emphasis has been placed on those areas in which the authors have personal interest. For example, discussion of the theoretical developments in free radicals is not accorded the detailed presentation that is given crystal field ions. The discussion of crystal field spectra, relaxation phenomena, metals and semiconductors, and the early theories of nuclear polarization are exemplary. The literature references (1083), perhaps one of the most complete sets of references in electron spin resonance in print, are particularly useful. The complete reference is also cited in each chapter or table in which it is mentioned. This procedure provides rapid identification of the author and the publication without searching through the book for a reference made in earlier chapters. Another notable feature is the myriad of experimental results on transition and rare earth ions presented in easy-to-read tabular form.

There are remarkably few typographical errors (I have counted 11), particularly for a translation, and only rarely does peculiar grammatical usage result from too literal translation. A detailed table of contents is unfortunately offset by a too brief and virtually useless subject index. Also on the negative side are the tables of equations. Although these tables are complete and potentially extremely useful, they are poorly reproduced. Apparently the publisher reproduced them directly from the original Russian text, and in my copy blemishes and light impressions have obscured some of the vital symbols contained therein.

There are a number of mathematical equations presented as a statement of fact without derivation or reference. Perhaps derivation of these equations can be found in related references, but this is not always obvious. Some of these equations may be the result of private work of the authors and their derivation therefore unavailable to the scientific community.

Those minor deficiencies do not detract from the general excellence of this book, which I highly recommend as a review of the first 14 years of electron spin resonance.

Howard Jarrett
E. I. duPont de Nemours and Co., Inc., Wilmington, Delaware

Science and Engineering

Non-Linear Wave Propagation. With applications to physics and magnetohydrodynamics. A. Jeffrey and T. Taniuti. Academic Press, New York, 1964. x + 369 pp. Illus. $12.

This book consists of two parts, the first of which will be of interest to most physicists and mathematicians who are concerned with the dynamics of continuous media; the second half will be of interest largely to specialists in magnetohydrodynamics. The first half gives a detailed treatment of the general theory of hyperbolic partial differential equations—in particular, of quasi-linear first order systems in several variables. The method of characteristics is developed, starting from first principles, and the conservation laws and generalized Rankine-Hugoniot relations are deduced. Shock waves are introduced as "weak" solutions (solutions that may be discontinuous on sets of zero measure), and an "evolutionary condition," involving only some very plausible restrictions on the manner of dependence of solutions on their initial data, is proposed as a selection principle for discriminating against unphysical weak solu-