Numerical Mathematics

Introduction to the Constructive Theory of Functions. John Todd. Academic Press, New York, 1963. 127 pp. Illus. $6.

This is the first volume in a new series of monographs, the *International Series of Numerical Mathematics,* which is printed by Birkhäuser in Basel, Switzerland. The printing is excellent, the book seems to be relatively free of errors, and its overall appearance is attractive.

The volume is primarily aimed at graduate students of mathematics. The author's goals are to present selected topics from the classical analysis of approximation, interpolation, and orthogonal polynomials and to provide mild propaganda for numerical analysis without actually doing anything really hard. Todd has given considerable attention to learning through doing, and to this end, he has provided about 100 problems. These, together with their solutions, take up all of 50 pages.

The book deals entirely with continuous real functions $f(x)$ defined on an interval $a \leq x \leq b$. In chapter 1 Todd reviews a few basic properties of roots of polynomials, continuity, and infinite series. In chapter 2 he presents the fundamental Weierstrauss theorem that each such function may be approximated uniformly by polynomials. Several proofs are sketched, and S. Bernstein's probabilistic proof is given in detail.

Chebyshev's theory of best polynomial approximations is presented in the third chapter. This and the short fourth chapter, on the Markoffs' theorems on bounds on the derivative, are most elegant. In the next chapter, Todd discusses the classical orthogonal polynomials of Chebyshev, Legendre, Laguerre, and Hermite; this chapter as well as chapter 6, on interpolation, and the final chapter, on approximate integration, should appeal to scientists. In chapter 7 the Bernoulli polynomials and the Euler summation formula are presented. Chapter 8, which is written in a different spirit, has the briefest possible introduction to the (modern) abstract space methods of analysis, with an application to Borel's main existence theorem in the Chebyshev theory discussed in chapter 3. There are many references in the text to induce the reader to go to the literature for further material.

In my opinion, the author has made a valuable contribution to the literature. The material is well chosen and exciting to read; one might only wish there were more of it. The problems that are provided will be invaluable to the serious student who wants to master the subject.

HARLEY FLANDERS
Department of Mathematics, Purdue University

Symmetry Principles

Representations of the Rotation and Lorentz Groups and Their Applications. I. M. Gel'fand, R. A. Minlos, and Z. Ya. Shapiro. Translated from the Russian edition (Moscow, 1958) by G. Cummins and T. Boddington. Pergamon, London; Macmillan, New York, 1963. xviii + 366 pp. Illus. $10.

It is hardly an exaggeration to say that the bulk of our knowledge of physical theories rests on the proper interpretation of symmetry principles of one sort or another. Although the group SU3 has lately come in to prominence for the study of nuclei and elementary particles, the rotation group has played a dominant role in the interpretation of atomic and molecular spectra, while the Lorentz group and the ideas of relativistic invariance have given their present forms not only to electromagnetic field theory but also to a large portion of high energy physics.

Although the applications of these two groups have been extensive, the publication of several articles by Gel'fand, Shapiro, and Yaglom, and the subsequent appearance of the English translation of this book that is based on those earlier articles, fills a badly felt need for a comprehensive and accurate account of these particular groups, an account which would follow the spirit of the contemporary mathematical theory of semisimple Lie groups, but which nevertheless would be sufficiently detailed with respect to practical matters. These latter include an analysis of the actual matrix representations with their generators and matrix elements, recursion relations, Clebsch-Gordan coefficients, and similar topics. It is a testimony to the extent of this subject that in more than 350 pages of concrete results concerning these groups, the authors can barely hint at the extensive mathematical lore underlying their treatment, nor do they venture very far into such aspects as the *n-j* coefficients. One judges that the application which most interests them is the determination of the possible differential equations which possess rotational or Lorentz invariance; in fact their treatment of the transformation properties of vector and tensor fields was one of the novel features of their original papers.

With regard to the mechanics of publication, the translation is quite readable and in keeping with English terminology, although on page 269 the "Klein-Gordon" equation became the "Clebsch-Gordan" equation. The bibliography lists "M. Rouse, Multipole Fields" (undoubtedly this should be M. Rose), and no publisher is mentioned. The overall quality of the printing is a bit poor, and this is bound to detract from the otherwise warm regard in which this book will certainly be held.

HAROLD V. MCINTOSH
Department of Chemistry, University of Florida, Gainesville

Politics and Water Resources

The Politics of Water in Arizona. Dean E. Mann. University of Arizona Press, Tucson, 1963. xviii + 317 pp. Illus. $6.50.

Arizona is a state in which development has proceeded sufficiently rapidly relative to the available water supply that its water problems are as acute as those of nearly any other state in the Union. Owing to the fact that, in the past, the principal use of water was for irrigation, and that the areas where the water has been utilized were geographically separated from the mountain zones where the water originated, surface water resources were developed fairly early in the state's history.

As irrigation expanded in the fertile valley and desert portions of the state, and far more arable land became available than there was water to serve it, intensive ground water development ensued. This resulted in a total draft on the ground water reserve which was far in excess of recharge, a situation which still persists and one for which no completely satisfactory solution has appeared on the horizon.

Many of the problems developed be-