Hopf, and Alexandrov in connection with the later development of the subject. In Chapter I the notion of a simplicial complex is introduced, and the homology groups of a finite simplicial complex are defined, using an arbitrary abelian group for coefficients. In Chapter II, it is proved that the homology groups are topological invariants, i.e. independent of the choice of a simplicial decomposition. The proof of invariance involves the use of simplicial mappings, the simplicial approximation theorem, and invariance under barycentric subdivision. In Chapter III, homology theory is applied to the study of continuous mappings and fixed points. It is proved that the homomorphism induced by a continuous map is invariant under homotopies. It is also proved that if the "Lefschetz number" of a mapping of a polyhedron into itself does not vanish, then the mapping has a fixed point.

There are a couple of results included which are digressions from the main line of development. In Chapter I it is proved that any $n$-dimensional compact metric space can be imbedded in Euclidean $(2n+1)$-space, and in Chapter II Sperner's Lemma is proved, and then used to demonstrate that the topological dimension of an $n$-simplex is actually $n$, and the Brouwer fixed point theorem.

Several topics which other authors might consider important are completely omitted from this small book. Examples of such topics are homology theory for general spaces (e.g., the singular or Čech homology theory), relative homology groups, cohomology theory, products, and duality theorems.

W. S. MASSEY

*Bessel functions*. Part II. *Functions of positive integer order*. Ed. by W. G. Bickley, L. J. Comrie, J. C. P. Miller, D. H. Sadler, and A. J. Thompson. (British Association for the Advancement of Science, Mathematical Tables, vol. 10.) Cambridge University Press, 1952. 40+255 pp. $11.00.

This is the tenth and final volume of the *British Association Mathematical Tables*. The Mathematical Tables Committee of the "B.A." has a long and honorable history; a brief account is included in the final report which has been reprinted in Mathematical Tables and Other Aids to Computation vol. 3 (1949) pp. 333–340. For many years this Committee represented probably the only organized effort to plan and compute in a systematic manner mathematical tables, and its work entailed cooperation between professional computers, mathematicians, and amateurs, between paid and voluntary workers. That this intricate system worked at all might be thought a minor miracle; that it worked as well as it did is entirely due to the selfless devotion to this task of a succession of highly qualified enthusiasts. In 1948 the Committee was dissolved, and its activities were taken over by the newly-established Mathematical Tables Committee of the Royal Society which has started a new series of tables (the first of which was reviewed in this Bulletin vol. 57 (1951) pp. 325–326). Several projects of the B.A. Committee were taken over by the new organization, and among these was the completion of certain tables of Bessel functions. It was a happy idea to publish as a final volume of a famous series this "fulfilment of a long-standing promise and the completion of a task."

Volume One of the B.A. Bessel function tables appeared in 1937 and was reviewed in this Bulletin (vol. 44, p. 766). It contains functions of order zero and one. At the time of publication of the first volume it was stated that the second volume is "in an advanced state of preparation," and in the final report of the B.A. Mathematical Tables Committee the volume is stated to have passed for press. Since the computation of the present tables several important tables of Bessel functions (mainly of the first kind) appeared. Of these, Cambi's tables and the monumental Harvard tables of Bessel functions (this Bulletin vol. 55 (1949) pp. 78, 79) were compared with the tables contained in the volume under review.

In spite of the very large number of available tables of Bessel functions, the B.A. tables are likely to become the standard work for general use. In two handy volumes they contain about all the tables of Bessel functions one needs in general practice: they contain Bessel functions of the first and second kind and modified Bessel functions of the first and third kind, their reliability is notorious, and the the physical appearance of the volumes most satisfactory. For special purposes (larger number of digits, high or fractional orders, complex variable, zeros, special combinations, etc.) one can always fall back on the more specialized tables. In the Preface, W. G. Bickley remarks, without committing his Committee to any promises, that further work on Bessel functions is proceeding.

The first four of the eight tables contained in this volume give values of

$$J_n(x),\ Y_n(x) \text{ or } x^n Y_n(x),\ x^{-n} I_n(x) \text{ or } e^{-x} I_n(x),\ x^n K_n(x) \text{ or } e^x K_n(x)$$

for $n=2$ (1) 20, $x=0$ (.1 or .01) 10 (.1) 20 or 25. 8 decimals are given for $J_n$, 8 significant figures for the other functions. Second central differences (often modified) are included. The second quartet of tables contains 10 decimal or 10 figure values of $J_n(x)$, $Y_n(x)$,

$I_n(x)$, $K_n(x)$ for $n=0$ (1) 20, $x=0$ (.1) 20 or 25. The arrangement of the tables resembles that of volume 1. Welcome innovations are catch headings in large type showing the function tabulated ($J$, $Y$, $I$, or $K$) on every page, the argument range on right-hand pages, and the range of orders on left-hand pages; and a tabular page index to the first four tables. The introductory material contains a preface, the tabular page index, description of the tables and an account of their preparation, instructions for interpolation, acknowledgments, a bibliography, a useful comparison between the notations used in the present volume and other notations of Bessel functions, and a 10 page list of definitions of and formulas relating to Bessel functions. The notations used in this book are the standard notations as in Watson's *Bessel functions*.

The arrangement, outward appearance, and printing of these tables is superb, and no higher compliment can be paid to the production than by saying that the late Dr. Comrie, had he lived to see these tables, would have been pleased.

The tables are a joint effort of several distinguished computers and mathematicians and it would seem invidious to single out any of them for praise; yet it is appropriate to express special thanks of the mathematical community to the chief editor of this volume, Professor Bickley, who in face of physical handicaps, and at a period of considerable distress, devoted much effort and loving care to this enterprise. The result is such as even he could wish.

A. ERDÉLYI

## NEW JOURNAL

Journal of Rational Mechanics and Analysis. Volume 1. Bloomington, Indiana, The Graduate Institute for Applied Mathematics, Indiana University, 1952. 4+652 pp. $18.00; $6.00 to individuals engaged in research or teaching.

The aims of this journal are stated by its editors as follows. "The Journal of Rational Mechanics and Analysis nourishes mathematics with physical applications, aiming especially to close the rift between 'pure' and 'applied' mathematics and to foster the discipline of mechanics as a deductive, mathematical science in the classical tradition. Its scope comprises those parts of pure mathematics or other theoretical sciences which contribute to mechanics; among the included fields are all branches of analysis, differential geometry, analytical dynamics, elasticity, fluid dynamics, plasticity, thermodynamics, relativity, and statistical mechanics. Engineering applica-