is always something new to learn where so much material is so well presented. EDWIN BIDWELL WILSON.

Theorie der elliptischen Funktionen. Von M. KRAUSE unter Mitwirkung von E. NAETSCH. Leipzig, B. G. Teubner, 1912. vi+186 pp.

ANOTHER text in Jahnke's series for engineers and students. Its object is to give a brief development of elliptic functions for the sake of rendering intelligible those formulas, figures, and tables which relate to elliptic functions in Jahnke and Emde's Funktionentafeln. The titles of the chapters are: Introduction, General theory of Jacobi's functions, Special theory for the real domain, Legendre's normal integrals, Weierstrass's functions, Representation of the general doubly periodic function by means of the foregoing types, Reduction of the general elliptic integral to normal forms. The development is based on the ϑ-functions, and makes relatively little use of the theory of functions of a complex variable. The prominent place given to the ϑ-functions is commendable. In most cases these series converge with extraordinary rapidity and are readily available for computation. The attention to the functions *sn, cn, dn* is also advantageous; in physical problems where the trigonometric functions offer a first approximation, these elliptic functions are the most natural to use. The p-function is admirably discussed, and especial mention should be made of the reduction of the p-function with conjugate imaginary periods to the related p-function with real and pure imaginary periods. It is noteworthy that the authors use a plain p, and not $\wp$; perhaps this latter contortion is on the road to abandonment.

From some points of view it might have been better to assume and use a greater, even a great, amount of the theory of functions of a complex variable; the work would not have been so elementary, but it would have been more instructive. We note with regret that Jahnke has not announced in his series a text on the theory of functions. Such a text, properly executed in the interest of physicists and engineers, would be a welcome addition to his series. Perhaps Lewent's Konforme Abbildung will supply much of the lack; for it is in connection with conformal representation (and elliptic functions) that the function theory becomes most vital to the student of applied mathematics. Whether such a student will

get as much out of Krause's work as he would out of one constructed more along the lines of Greenhill's Elliptic Functions is a matter of considerable doubt, but at any rate we have a neat and reasonably short exposition which admirably serves its announced purpose of orienting the reader in the corresponding part of Jahnke's tables. E. B. WILSON.

An Introduction to Thermodynamics. By JOHN MILLS. Boston, Ginn and Co., 1910. viii+136 pp.

The brief text on thermodynamics by Mills shows that the author has read and digested a large number and a large variety of works on the subject, and that he knows how to select from this diversity the elements he needs and combine them into a carefully coordinated sequence which shall serve to lead the pupil from his elementary work on heat through so much of thermodynamics as may be necessary for the ordinary student of engineering. The simpler notions and notations of the calculus are constantly used; a large number of numerical practical problems are worked in the text, and a set of miscellaneous exercises for the reader is furnished at the end. The style is concise, but clear, and the various physical concepts are defined with the accuracy of the physicist rather than with the frequent inaccuracy of the engineer. The titles of the chapters are: Fundamental concepts and laws, Gases, Water and its saturated vapor, Superheated steam, Flow of steam and gases. The page has that attractive appearance which generally goes with the imprint of the Athenæum Press. E. B. WILSON.

Annuaire du Bureau des Longitudes pour l'An 1913. Paris, Gauthier-Villars. 16mo.

THE editors of the Annuaire have clearly decided that it should be kept fully up to date. Several of the tables of constants are again improved, some by a recasting of the contents, others by the addition of new matter, and still others by the adoption of the latest and best values obtainable. Any one interested in its use will find these changes briefly but clearly set forth in the preface. The information is easy to find with the help of the full index. The main defect is a minor one and perhaps a matter of opinion: the edges are uncut and there are some 800 pages.

The Notices contain, besides the speeches made at the