years' effort in teaching the subject at M.I.T. and of associating with the men who founded the physico-mathematical theory—notably, C. E. Shannon, N. Wiener, A. Feinstein, P. Elias, and J. M. Wozencraft. He follows Shannon's School [1], [2], [3], [4], [5], with its emphasis on reliable communication in the presence of noise, rather than Wiener's School [6], [7], [8], with its emphasis on the theory of extrapolation and prediction. Since the book is directed to graduate-level engineers, there is no pretension to the full rigor available in other, more mathematical, treatises, such as those by Khinchin [2], Feinstein [3], and Wolfowitz [4]. Frequently, the author uses refreshing physical insights to motivate the careful proofs of theorems.

The nine chapters of the work, which is reproduced by photo-offset, include such basic topics as: "a measure of information," where the functional form of the entropy function is obtained by using a geometrically oriented proof, in distinction to the arithmetical argument given in Feinstein [3], which uses the unique factorization into prime numbers; "the optimum encoding procedure of D. Huffman"; "the weak and strong laws of large numbers"; "the Sampling Theorem"; "Shannon's Coding Theorem and its weak converse" (Wolfowitz' results [4] are not given); and "various estimates for multinomial distributions" (previously unpublished results from Shannon's 1956 Seminar on Information Theory). Most results are stated for finite probability spaces, and Lebesgue integration is completely ignored even in the continuous cases.

The book terminates with a number of well-chosen problems, which will challenge most first-year graduate students in engineering. Further, it contains a storehouse of inequalities to be generalized.

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1. C. E. Shannon, "A mathematical theory of communication," *Bell System Tech. J.*, v. 27, 1948, pp. 379 and 623.
2. A. I. Khinchin, *Mathematical Foundations of Information Theory*, Dover, New York, 1957.
3. A. Feinstein, *Foundations of Information Theory*, McGraw-Hill, New York, 1957.
4. J. Wolfowitz, *Coding Theorems of Information Theory*, new edition, Springer-Verlag, Berlin, 1964.
5. J. M. Wozencraft & B. Reiffen, *Sequential Decoding*, The M.I.T. Press and Wiley, New York, 1961.
6. N. Wiener, *Extrapolation, Interpolation, and Smoothing of Stationary Time Series*, The M.I.T. Press and Wiley, New York, 1948.
7. N. Wiener, *Nonlinear Problems in Random Theory*, The M.I.T. Press and Wiley, New York, 1958.
8. Y. W. Lee, *Statistical Theory of Communication*, Wiley, New York, 1960.

80[L].—Robert Spira, *Coefficients for the Riemann-Siegel Formula*, Mathematics Research Center, United States Army, Madison, Wisconsin, ms. of 4 typewritten pages, $8\frac{1}{2} \times 11$ in., deposited in UMT file.

The first eight nonzero coefficients in the power-series expansion of

$$\phi(z) = \sec \pi z \sin \pi\{(1 - 4z^2)/8\}$$

are given (multiplied by a factorial) in the form of polynomials in π with integer coefficients, multiplying the numbers $\cos \pi/8$ and $\sin \pi/8$. Numerical values of these coefficients to 10D and 20D, respectively, have been given by Lehmer [1] and

Haselgrove and Miller [2]. The integer coefficients are related to the Euler numbers and were calculated from recurrence relations.

AUTHOR'S SUMMARY

1. D. H. LEHMER, "Extended computation of the Riemann zeta-function," *Mathematika*, v. 3, 1956, pp. 102–108.

2. C. B. HASELGROVE & J. C. P. MILLER, *Tables of the Riemann Zeta Function*, Royal Society Mathematical Tables, v. 6, Cambridge Univ. Press, New York, 1960.

81[L, M].—HENRY E. FETTIS & JAMES C. CASLIN, *Tables of Elliptic Integrals of the First, Second and Third Kind*, Applied Mathematics Research Laboratory Report ARL 64-232, Aerospace Research Laboratories, Wright-Patterson Air Force Base, Ohio, December 1964, iv + 93 pp.

This report contains 10D tables of both complete and incomplete elliptic integrals of all three kinds in Legendre's form. Table I consists of such decimal approximations to $F(\phi, k)$ and $E(\phi, k)$ for $\phi = 5°(5°)90°$ and $k = 0(0.01)1$, while Table II gives similar information for $k^2 = 0(0.01)1$. Table III gives 10D values of $\Pi(\phi, \alpha^2, k) = \int_0^\varphi (1 - \alpha^2 \sin^2 \theta)^{-1}(1 - k^2 \sin^2 \theta)^{-1/2}\, d\theta$ for $\phi = 5°(5°)80°(2.5°)90°$, $k^2 = 0(0.05)0.9(0.02)1$, $\alpha^2 = -1(0.1)-0.1, 0.1(0.1)1$ (except that when $\alpha^2 = 1$, ϕ extends only to 87.5°). The authors' description of the tables contains some minor errors with reference to the ranges of the parameters.

To insure reliability in the final rounded values, the underlying calculations were performed to 16S on an IBM 1620, using a subroutine based on Gauss's transformation [1], which is given for all three integrals in the accompanying explanatory text. A discussion of the several checking procedures applied to the tabular entries is included; however, the problem of interpolating in the tables is not considered.

The authors refer to tables of elliptic integrals of the third kind by Selfridge & Maxfield [2] and by Paxton & Rollin [3], but appear to be unaware of the extensive 7S tables of Beli͡akov, Kravt͡sova & Rappaport [4].

The present tables contain the most accurate decimal approximations to the elliptic integral of the third kind that have thus far been published, and constitute a significant contribution to the tabular literature.

J. W. W.

1. HENRY E. FETTIS, "Calculation of elliptic integrals of the third kind by means of Gauss' transformation," *Math. Comp.*, v. 19, 1965, pp. 97–104.

2. R. E. SELFRIDGE & J. E. MAXFIELD, *A Table of the Incomplete Elliptic Integral of the Third Kind*, Dover, New York, 1959. (See *Math. Comp.*, v. 14, 1960, pp. 302–304, RMT **65.**)

3. F. A. PAXTON & J. E. ROLLIN, *Tables of the Incomplete Elliptic Integrals of the First and Third Kind*, Curtiss Wright Corporation, Research Division, Quehanna, Pennsylvania, 1959. (See *Math. Comp.*, v. 14, 1960, pp. 209–210, RMT **33.**)

4. V. M. BELI͡AKOV, R. I. KRAVT͡SOVA & M. G. RAPPAPORT, *Tablit͡sy elliptiс͡heskikh integralov*, Tom I, Izdat. Akad. Nauk SSSR, Moscow, 1962. (See *Math. Comp.*, v. 18, 1964, pp. 676–677, RMT **93.**)

82[L, Z].—JURGEN RICHARD MANKOPF, *Über die periodischen Lösungen der Van der Polschen Differentialgleichung* $\ddot{x} + \mu(x^2 - 1)\dot{x} + x = 0$, Forschungsberichte des Landes Nordrhein-Westfalen, Nr. 1307, Westdeutscher Verlag, Opladen, 1964, 55 pp., 24 cm. Price DM 41.

This expository monograph analyzes the Van der Pol equation. The work is concerned primarily with the free-vibration equation. The case corresponding to large values of μ is discussed in a very brief section.