and magnetic tape input and output equipment), were discussed by Dr. Mauchly. This device is of particular interest because, except for input and output equipment, it is entirely electronic.

The Mark III, the latest of the large-scale computers developed under Prof. Aiken's direction, has been designed for greater speed and reliability, more flexible memory facilities, and greater ease of preparation of input data than were found in the earlier computers.

The type 604 electronic calculator described by Mr. Palmer combines an electronic arithmetic element, including a 13-digit electronic counter, with punched-card input and output equipment and additional mechanical storage registers, with the possibility of carrying out automatically a "program" of as many as 20 arithmetic operations.

Dr. Williams treated the electrostatic memory on which he has carried out extensive research. These memories probably show the greatest promise of any of the basic types thus far proposed for computers, since they combine the high reading and writing speed of the delay-line type of memory with a very short "access time."

Dr. Stibitz proposed a new type of computer which combines the more accurate elements of the familiar differential analyzer, such as gears and differentials, with a new type of "function unit," resulting in a computer having the simplicity and low cost of an analogue computer and the higher accuracy of the digital type.

Dr. Shannon discussed the programing of a chess game on a large-scale computer. While the possibility of such applications was early recognized, this probably represents the first serious attempt to analyze the programing of such an operation.

Massachusetts Institute of Technology.—A Special Course in Analogue Computation, designed particularly to meet the needs of users of industrial types of analogue computing machines, was initiated at the Massachusetts Institute of Technology on June 20, 1949, to last for three weeks. The course was presented by Dr. SAMUEL H. CALDWELL, professor of electrical engineering and director of the Institute's Center of Analysis, and dealt especially with the treatment of engineering problems by machines designed for the solution of differential equations. The objective of the course was to provide a broader understanding of the uses and potentialities of analogue computers. The increasing availability of these machines throughout industry makes it important that trained personnel be prepared fully to exploit their benefits. Demonstrations were arranged using the MIT Differential Analyzer, as well as various types of electronic differential analyzers available or under development at the Institute. The course included a unified treatment of the following subject matter: mathematics refresher, basic analogue processes, machine solution of differential equations, calculation of scale factors, and electronic analogue machines.

Swedish State Board for Computing Machinery.—The Swedish State Board for Computing Machinery has recently been formed with Admiral STIG ERICSSON as president and Professors T. LAURENT, E. VELANDER, N. ZEILON (of Lund), and permanent secretary G. A. WIDELL (of Stockholm) as members. The Board's secretary is GÖSTA MALMBERG (Ecklesiastikdepartementet, Stockholm).

The immediate plans for the future include the construction of a relay computer in agreement with a project by Dr. CONNY PALM at Stockholm Institute of Technology. No definite plans exist regarding the design and construction of an electronic computer.

Any inquiries should be addressed to the secretary, or to Dr. C. E. FRÖBERG, Institute of Mechanics and Mathematical Physics, Lund.

OTHER AIDS TO COMPUTATION

BIBLIOGRAPHY Z–VIII

1. SIDNEY G. HACKER, *Arithmetical View Points. An Introduction to Mathematical Thinking.* Pullman, Wash., State College of Washington Bookstore, 1948, x, 144 p. + 14 plates. 21 × 27.4 cm. $1.50. Offset print.

This interesting *potpourri* by a professor of mathematics represents a course of lectures, which might be read with interest by senior undergraduates. There are 6 main headings.

I., p. 3–14, The Art of Reckoning. II., p. 15–46, Mechanical Counting Devices: The subheadings are 1. The Abacus, 2. The semi-automatic desk computing machine; 3. Charles Babbage "engines"; 4. The Harvard IBM automatic sequence controlled calculator (ASCC); 5. The ENIAC; 6. Relative merits of the ASCC and the ENIAC; 7. The differential analyzer. Digital and analogue machines; 8. Establishment of national mathematical laboratories in the United States and Europe; 9. The need for students of numerical analysis. III., p. 47–64, Certain of the Foundations of Arithmetic. IV., p. 65–84. V., p. 85–104, The Rational Numbers. VI., p. 105–123, The Irrational Numbers. P. 126–143 annotated list of literature references. The illustrations admirably reproduced are: The Peruvian knotted calculating cards; Japanese soroban; one of Pascal's computing machines; Leibniz's calculator; Calculating wheels of Babbage's "difference engine"; The mill and printing parts of Babbage's "analytical engine"; The Harvard ASCC, Mark I (4 views); The ASCC, Mark II (Naval Proving Ground, Dahlgren, Va.), (2 views); Graphs in connection with Fermat's last theorem, $x^n + y^n = 1$, $n = 1(1)5$, for positive x and y; A general view of the ENIAC.

A mimeographed errata sheet with 25 entries accompanies the volume.

R. C. A.

2. EDMOND R. KIELY, *Surveying Instruments Their History and Classroom Use.* (National Council of Teachers of Mathematics, *Nineteenth Yearbook.*) New York, Columbia Univ., Teachers College, 1947, xvi, 411 p. 15 × 22.8 cm.

Contents: Beginnings in Egypt, China, and Babylonia (p. 1–17); Developments in Greece and Rome (p. 18–44); Contributions of Medieval Europe, Islam and India (p. 45–100); Advancements in Europe during the Renaissance (p. 101–238); Development of practical geometry in the schools (p. 239–263); Applications of geometry, trigonometry in simple surveying (p. 264–360); Bibliography (p. 377–396) 557 titles; Index (p. 397–411). 270 illustrations and figures.

3. FRITZ REINHARDT, "Der logarithmische Rechenzylinder für komplexe Zahlen," *ETZ, Elektrotech. Z.*, v. 69, 1948, p. 78–82.

TRANSLATED SUMMARY: "By means of the analytic function $w = \ln z$ the Gaussian plane of complex numbers z is conformally mapped on a strip of the w-plane. Thus the polar coordinates A, α of a vector $\mathbf{A} = A \cdot e^{i\alpha} = a_1 + ia_2$, go over into rectangular coordinates of its image in the w-plane, while the rectangular coordinates of the vector with components a_1 and a_2, transform into the parameter values of a family of orthogonal curves. Logarithmic laws apply to complex numbers; consequently the representation of the product or quotient of two plane vectors in the z-plane, is a sum or difference in the w-plane. The image curves in the w-plane repeat themselves periodically in the direction of the ordinate for each 90°, and in the abscissa-direction for every power of 10. Hence it is possible to roll the image plane on a cylinder. Over this is slipped a transparent cylinder with indicators and this cylinder again carries another short movable transparent cylinder with one reading mark. This device allows us to represent every vector and to add it to, or to subtract it from, a second vector. Thus one obtains a logarithmic computing cylinder for complex numbers by means of which we can carry out, not only computations for components, but also multiplication and division of complex numbers similarly to the procedure of an ordinary slide rule for real numbers. The result can be found either in rectangular or in polar coordinates as one may desire.

4[H, I, Z].—F. A. WILLERS, *Practical Analysis, graphical and numerical Methods.* Translated by R. T. BEYER. New York, Dover Publications, 1948, x, 422 p. 15.2 × 23.5 cm. $6.00.

This is a translation of the German edition, *Methoden der praktischen Analysis.* Berlin, 1928, modified in only two sections concerned with the slide rule and desk calculators.

The work is in 6 chapters entitled I. Numerical Calculation and its Aids, II. Interpolation, III. Approximate Integration and Differentiation, IV. Practical Equation Theory, V. Analysis of Empirical Functions, VI. Approximate Integration of Ordinary Differential Equations.

In simply turning over the pages one is struck with the large number of figures. The book contains as many as 132 figures, an average of 1 to every three pages. This is partly due to the fact that there is more space than usual devoted to graphical methods and computational instruments. In the author's foreword we find: "I still believe it necessary to describe the graphical methods, since I am of the opinion that they are of practical importance." Whether or not the reader feels that this opinion has been shaken by the last two decades he will find the treatment of graphical and instrumental subjects very complete and well done. The account of the planimeter is especially good.

There is much space devoted to definite examples. Not only is the numerical work shown in great detail (indicating that in many cases the computer is using merely paper and pencil) but also the numerical problem is often set up *ab initio* from a physical situation.

Each chapter has about 6 sections. Of the 35 sections of the book over such a wide range of topics it is impossible to discuss each one here. They are for the most part unconnected so that a reader may use the book as a sort of an encyclopaedia. Many of the sections are necessarily too short to give a complete account of the particular subject. The author has wisely preferred to illustrate the fundamental ideas and to leave the reader a short bibliography collected at the end of each section with which further to pursue the topic. Here the reader who is unfamiliar with German will be disappointed, since nearly all the references are to works in German. It would have been very useful had the translator supplied additional if not alternative data in English. Also many of the references are out of date, all being at least 20 years old.

Section 3 on the slide rule was rewritten by the translator to deal with American type rules. No mention is made however of the existence of the circular type rules.

Section 6 is written by T. W. SIMPSON and gives a fine account of the three standard American desk calculators and the two dozen different operational techniques not described in the manufacturers' booklets. As might be expected, there are difficulties in nomenclature not encountered elsewhere in the book. These are largely overcome by careful writing. This section contains the only real tables in the book. These are two tables facilitating square and cube rooting. For description of these tables see *MTAC*, v. 1, p. 356–357, v. 2, p. 350–351.

The printing is excellent with the exception of several of the line drawings which have been poorly reproduced.

This book should find its way into many a computing room. Its use as a text in an upper division college course in numerical methods is also clearly indicated. Many of its sections like §16 (Mean value Methods) are excellent lecture material. Others like §22 (GRAEFFE's Method) could be easily amplified to whatever extent the instructor desired.

D. H. L.

NOTES

103. ARNOLD NOAH LOWAN.—In *Scripta Mathematica*, v. 15, p. 33–63, March, 1949, Dr. Lowan has recently presented a detailed account of the work of the Computation Laboratory, which since its foundation in January 1938 has been under the sponsorship of the National Bureau of Standards. During all of this time Dr. Lowan has been the director of the technical planning of this group. Since, after recent reorganization by the NBS, only a very few computers or planners are left in the CL, Dr. Lowan's extraordinarily successful period as director has this month been brought to a close. The wisdom of the NBS procedure in this regard may be doubted.

The great publication output of members of the NBSCL and preceding organizations, 1939–1949, is listed in the article referred to above, and a