incompletely given work conditions," is a very brief sketch of a new minimization algorithm.

2. G. Häuslein, "J. P. Roth's method of cubical complexes for the minimization of switching functions," provides a good, concise outline of Roth's extraction algorithm.

3. G. Hotz, "On the reduction of systems of switching polynomials," describes original work on the synthesis of circuits, such as adders, by means of Boolean algebra; this is one of the few papers I have seen that employs the algebraic properties of Boolean algebra.

4. C. Hackel, "On the logic of NOR and NAND switching circuits," surveys the application of the Karnaugh map to NOR and NAND circuits.

5. J. Neander, "Fundamental ideas of Theodor Fromme's equivalence-calculus," outlines in some detail the basic ideas of the calculus developed by the late Theodor Fromme for the representation of combinational and sequential switching circuits.

6. K. H. Böhling, "On the reduction of sequential switching circuits," presents a survey of sequential switching circuit theory, with emphasis on state diagrams and Ginsburg's state reduction method.

7. P. Deussen, "On the synthesis of automata," is a survey of sequential circuit theory, with emphasis on feedback, Huffman's method, and transition matrices.

8. W. Zoberbier, "The practical application of minimization algorithms in the systems planning of combinational and sequential switching circuits," provides a discussion, by means of a completely worked out example, of the problems involved in applying minimization algorithms to real problems.

9. W. H. Rein, "A calculus for combinational and sequential switching circuits with many-valued signals," gives a formal and pictorial calculus for the description of switching circuits employing multi-level (many-valued) components.

10. W. Händler, "On the use of graphs in combinational and sequential switching theory," is a survey of graphical methods, such as Karnaugh maps, for circuit minimization; it includes the author's own work (M^n-graphs).

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31[Z].—R. VICHNEVETSKY, Editor, *Analogue Computation Applied to the Study of Chemical Processes*, Gordon & Breach, New York, 1962, 170 p., 30 cm. Price $10.50.

This book contains articles presented at a seminar in Brussels, Belgium sponsored by the International Association for Analog Computation. The articles, with the discussion they evoked, survey the state of the art of analog computation in the Western European chemical industry at the time of the seminar in late 1960. To describe the book, we shall devote one sentence to each of the twenty-two contributions.

J. F. Coales (Computers in the design and control of chemical plants) suggests that "the most urgent requirement, if computers and self-optimising or learning systems are to be applied successfully to the control of complex plants, is for some workers in this field to acquire an understanding of the behavior of multivariable systems with random inputs and to develop reasonably simple methods for optimising them." B. Messikommer (Die Optimierung eines Halbkontinuierlichen

Chemischen Reaktors mittels Dynamischer Programmierung) uses Lagrange multipliers to reduce a two-dimensional dynamic programming problem to a unidimensional one, employing an analog computer for the calculations. J. Rissanen (Control system synthesis by analogue computer based on the "Generalized Linear Feedback" concept) extends the work of Kalman, and shows how to match actual to desired output, using an analog computer. G. Gau (Optimisation d'une unité de fabrication chimique par calculateur numérique industriel) reviews gradient methods for attaining an optimum in the presence of constraints. A. W. O. Firth (The use of an analogue computer for the solution of linear and non-linear programming problems and its further application as an automatic optimization system) discusses mechanical and electronic analogues to the Hitchcock-Koopmans transportation problem. J. K. Lubbock (Mathematical models of plants) surveys linear and nonlinear models with and without memory, automatically or manually adjusted to remove interaction between the input variables. R. Peretz (Asservissement conditionnel des processus industriels) asks why many controllers are bypassed in practice, and proposes a "conditional" controller whose behavior is altered automatically as disturbances change in character.

Shapiro, Harris, Lapidus, and Lee (Simulation of chemical processes on a combined analog-digital computer) and J. I. Archibald (Analogue-digital computing methods) describe their experiences with experimental hybrid computers. The articles of J. G. Thomason (Some analogue studies of boiler control system performance) and S. Wajc (Comportement transitoire d'un plateau de colonne de distillation) would be of more interest to chemical engineers than mathematicians.

A. M. Terlinden (Petits calculateurs analogiques en ligne introduits dans les processus industriels) describes four simple applications of on-line analogue computation in the process industries. T. B. Jawor (Estimation of error in on-line computing) gives a useful technique for estimating the propagation of errors in analogue systems, complete with table of errors encountered on conventional components. D. J. Wilde and A. Acrivos (Control of overdetermined systems) discuss the adjustment of many inventory variables simultaneously by manipulating only one parameter. M. James (Process control by computer) describes his company's on-line computer. J. P. Bromley and C. Storey (Some analogue studies of process control systems) discuss their experiences with simulation of control systems for a distillation column, a pressure electrolyser, and for concentration of acid in a liquid stream. D. S. Townsend (The application of an analogue computer to a stock control problem with discontinuous supply and continuous demand) describes the simulation of an inventory problem and its results.

Five papers on analog solution of partial differential equations (distributed parameter systems) should be of particular interest to applied mathematicians. T. Hennig and S. Naevdal (On errors due to lumping of a system with distributed parameters) shows how to use an analogue computer to calculate such errors in linear, steady-state problems. J. E. Rijnsdrop, R. Vichnevetsky, and J. G. van de Vusse (Application of the analogue computer in the study of the esterification of terephthalic acid) reduced the partial differential equations to ordinary ones by ignoring variations with respect to time; iterative computations are required. V. Broida (Mèthode simplifiée de simulation d'un échangeur de chaleur simple ou complexe; Extension possible aux problemes à deux variables et aux équations aux

dérivées partielles) describes an analogue system with relays which approximates a distributed system by a lumped system. J. Girerd (L'analyseur différentiel à reseaux DELTA 600, son application à la résolution des équations aux dérivées partielles) discusses his company's resistance network differential analyzer. A Gadola, V. Gervasio, and C. Zaffiro (The use of standard analogue techniques in solving propagation problems) outlines two methods for handling a distributed system; first, by finite-difference approximation, and second, by expanding in a Fourier series with odd terms only, and then using analogue simulation on each mode.

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32[Z].—R. W. WILLIAMS, *Analogue Computation*, Academic Press, Inc., New York, 1962, 271 p., 21.5 cm. Price $9.50.

The scope of Dr. Williams' book is confined to the electronic and electromechanical techniques and components of analog computers instead of complete computers and their applications.

The book, written as an introduction to the subject, consists of nine chapters. Chapter 1 gives a brief account of historical points of interest in analog computers. Chapter 2 covers one of the important components, the potentiometer; the treatment is quite extensive. Chapter 3 deals with operational amplifiers. It presents both functional and design aspects, as well as automatic drift-correction. Chapter 4 is an interesting and unique chapter on a.c. analog technique. The subject of servomechanisms is treated in Chapter 5 for both position and rate servos. The treatment is concise and includes three a.c. components: tachometers, motors, and amplifiers. Chapter 6 covers another phase of a.c. analog technique: trigonometric functions and triangle solving, as well as the resolver component. Function generators and multipliers are presented, respectively, in Chapters 7 and 8. These include the function generator using non-ohmic resistor, the Hall multiplier, and the time division multiplier. The last chapter, on transistor application, mainly discusses d.c. transistor amplifiers and the problems of transistorizing operational amplifiers.

The reviewer has found that the book introduces much information available in British literature. This valuable book for students and designers interested in analog technique is quite readable and is illustrated with many figures.

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