of the book that are substantially independent of any particular programming language and those that are MAD-oriented. To those in the first category, comprising, say, 60% of the first ten chapters, the author has brought the full power of a talent for vivid, thorough exposition. Here we find rapport with the reader established at once, along with the clear impression that the writer is sympathetically aware of the difficulties that face the novice in the field. As by-products we have little introductory essays on certain topics, as, for example, arithmetic congruence, random numbers, sorting, switching functions, and the solution of systems of equations—gems in their own right and skillfully set into the main structure.

However, the author's inclination toward hucksterism is manifested not only in naming the book, as already noted, but in titling his chapters as well. One feels that the material under "The Secret-code Problem" was contrived to fit the title rather than included because of its intrinsic suitability, and to call his excellent ninth chapter "A Program to Produce Programs" instead of "A Program to Produce Network Descriptions" smacks of hypocrisy, which the opening remarks of that chapter fail to mitigate.

One's estimate of the success of the portions of the book in which MAD is described or used will naturally be colored by his own bias as to the merits of MAD vis-à-vis alternative languages. Under "Other Computer Languages" we find FORTRAN and ALGOL briefly treated, and there are appendices giving a feature-by-feature translation from MAD to each of these insofar as translation is possible.

We are entering an era of books about programming in specific programming languages, and those who are building libraries of such books will want to have MAD represented by this interesting, well executed work.

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94[Z].—G. M. HARTLEY, *An Introduction to Electronic Analog Computers*, John Wiley & Sons, New York, 1963, vii + 155 p., 19.5 cm. Price $4.50.

The analog computer is presented in its simplest form, as a tool to solve linear differential equations with constant coefficients. As a result, the operational amplifier is the only active device on which the book concentrates. The fact that the author is an engineer is apparent because the bulk of the material analyzes the characteristics of d.c. amplifiers, while comparatively little material is spent on the application of equipment.

The level of the book is such that it could easily be understood by a junior in electrical engineering. With prerequisites of differential equations and a course in electronics, the material in the book could be covered in eight one-hour lectures.

The first two chapters are background in nature; the first deals with the history of the analog and digital computers, while the second is a general survey of applications for various types of computers. The essence of the book is contained in the next four chapters. Chapter 3 illustrates the role of the operational amplifier in performing mathematical operations. Chapter 4 describes in detail the programming, scaling, and wiring of a second-order differential equation with constant coefficients for a typical computer. This chapter also touches on time scaling, ampli-

fier balancing, and potentiometer loading. Chapter 5 and 6, which comprise roughly half of the book, give a relatively simple but comprehensive coverage of vacuum tube and transistorized d.c. amplifiers. The operation of vacuum tubes and transistors as amplifiers is described, and gain equations are derived. Included are descriptions of typical operational amplifier circuits and the derivation of equations of errors resulting from finite open-loop gain and from some drift sources. On the other hand, the dynamics of the amplifier (stability, bandwidth, etc.) are not investigated. The final chapter is a very short survey of some nonlinear computing equipment, including multipliers and function generators. It also includes a discussion of analog-to-digital and digital-to-analog conversion. No breakdown, however, is given of the various types of errors (bias, gain error, dynamic lag, etc.), nor is the use of multipliers to perform division discussed.

The book contains no new material, and has comparatively little value as a reference book. While the book does not cover a large number of topics such as error detecting techniques, recording equipment, and proper balance of computing elements, it does describe the central role played by the higher-gain amplifier in an analog computer.

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