any appreciable material added over the 1972 book, has no literature references. We would like to have seen, at least brief mentioning of some newer technologies such as CCDs, erasable memories, microprocessors, digital or sampled data filters. For example, the 10-line discussion of the dynamic MOS memory does not give justice to its importance in the field of electronic applications. Furthermore, we are missing the role of bipolar circuits in LSI. In particular, we would prefer a discussion of I^2L, if necessary, at the expense of DTL or RTL.

In summary, it all depends on what you are looking for in a textbook. If you are not looking for the latest advances in electronics and for the impact of integrated circuit technology on electronic applications, but for good device and circuit fundamentals, clearly and concisely written, with a top-notch supplement of examples, review questions, and problems, including answer book—here it is!

Reprinted from the *IEEE Trans. Circuits Syst.*, Oct. 1976.

System Dynamics: A Unified Approach—D. C. Karnopp and R. C. Rosenberg (New York: Wiley, 1975, 400 pp., $19.95). *Reviewed by G. C. Andrews, University of Waterloo, Waterloo, Ont., Canada N2L 3G1.*

This text is an extremely good introduction to bond-graph theory which is, indeed, a unified approach to systems dynamics. Bond-graph theory was originated in the 1950's by H. L. Paynter (M.I.T.) who published the theory in lecture-note form in 1960. The authors have been involved in further development of the theory in collaboration with Paynter and published an advanced text on bond-graph theory in 1968.

There are two obvious benefits from bond-graph theory: first, it gives the engineering student greater ability (and greater confidence) since analysis techniques learned for one system are seen to be applicable for other systems which, to the uninformed, appear to be totally dissimilar. Second, it is possible to write a computer program based on bond-graph techniques which will generate the response of a dynamic system, given only the description of the bond-graph as input. One such "self-formulating" program, called ENPORT is discussed very briefly in the text and a user's manual written by one of the authors (Rosenberg) is available from the same publisher.

Bond-graph theory is based on observing the flow of energy in the physical system and constructing a graph which shows the flow schematically. The graph is composed of "junctions" (points which represent system elements) and "power bonds" (lines which show the flow of energy between elements). Associated with each element are two variables: the "effort" variable, such as voltage, pressure or force, and the "flow" variable, such as current, volume flow-rate or velocity. For each element there is a "constitutive" equation which relates these effort and flow variables. At each junction, the power must balance; that is, the products of effort and flow for power bonds incident on the junction must sum to zero when due account is taken of the direction of energy flow. Although the resulting graphs are different, bond-graph theory is equivalent and complementary to linear-graph theory in electrical network analysis.

Using the basic elements introduced in Chapters 2 and 3, it is possible to create models for a wide range of dynamic systems. Moreover, the construction technique is remarkably easy to master, at least for simple systems. Chapter 4 illustrates the procedure for constructing bond-graphs for electrical networks, mechanical translational systems, rotational systems, hydraulic systems and systems involving simple transducers. Chapter 5 shows how the state equations of a system can be obtained from the system's bond-graph. Standard techniques for solving differential equations are discussed in Chapter 6. In the last three chapters, advanced applications of the technique involve transducers (for which the modelling technique appears particularly appropriate), two-dimensional mechanical systems, magnetic circuits, thermodynamic and fluid-dynamic systems.

The text has many example problems, some worked out on ENPORT and each chapter has about 15 assignment problems. Both metric and English units are defined, and the text appears suitable for use with either set of units. Matrix and vector manipulations are kept to a minimum and the text could therefore be used for junior, senior, or first-year post-graduate level courses. The only serious criticism of the text is the use of force as the effort variable and velocity as the flow variable for mechanical systems. This convention is equivalent to the mass-inductance analogy which has been shown to be an imperfect concept and is the opposite of the convention adopted in linear-graph theory. The variables can be reversed simply by exchanging the 0- and 1-junctions; however, this can lead to confusion if one is not careful.

In summary, the text is an interesting and well-written introduction to a useful and powerful modelling technique.

Reprinted from the *IEEE Trans. Circuits Syst.*, Oct. 1976.

BOOK ALERT

The following descriptions of recent books were prepared by the staff of the Engineering Societies Library, 345 East 47 Street, New York, N.Y. 10017. These books are available in the Library, not through the IEEE.

The User's Handbook of D/A and A/D Converters—Eugene R. Hnatek (New York: Wiley, 1976, 472 pp., $24.95).

This reference book identifies the various popular types of digital-to-analog and analog-to-digital converters, specifies their advantages and disadvantages, defines converter specifications and converter codes, discusses the causes of converter errors, provides a variety of converter applications and presents the emerging integrated-circuit D/A converter, showing what it can do for the user. It includes detailed coverage of high-speed comparators, binary counters, precision IC operational amplifiers, gates, flip-flops, sample-and-hold circuits, shift and storage registers, multiplexers, thin-film resistor ladder networks and quad switches. Also included is in depth treatment of complex electronic circuit techniques. Chapter 4 presents the design of six different monolithic D/A converters and Chapter 5, the design of an IC A/D converter, providing an understanding of how the basic converter components are integrated, and how IC processing techniques, combined with circuit integration, yield the desired performance characteristics.

Noise in Measurements—Aldert Van der Ziel (New York: Wiley, 1976, 228 pp., $14.95).

Chapter 1 is a short introduction, and Chapter 2 develops the method of distribution functions for calculating averages, autocorrelations, and cross-correlation functions. Chapter 3 considers a few simple applications. Chapter 4 concentrates on binomial, Poisson and normal distribution functions, and develops the variance theorem. In Chapter 5, there is a discussion of Fourier analysis methods and a demonstration of how spectral intensities are calculated. Noise characterization in two two-terminal and four-terminal devices is discussed in Chapter 6. Chapter 7 examines flicker noise and generation-recombination noise. Chapters 8 through 17 concern applications. Chapter 8 covers measurements of small currents, voltages and charges. Chapter 9 considers thermal radiation detectors. Chapter 10 investigates photoemissive, photodiode, and the classical detector types. Photoconductive detectors are the topic of Chapter 11 and pyroelectric detectors and capacitive bolometers are considered in Chapter 12. Chapter 13 covers noise in television pick-up tubes. Chapter 14 investigates photomixing. Chapter 15 deals with light amplification with electroluminescence. Chapter 16 is a discussion of Josephson junction devices, and Chapter 17 briefly covers high-energy quantum and particle detectors. The appendix derives formula of the theory of ferroelectrics.

Microprocessors: Technology, Architecture, and Applications—Daniel R. McGlynn (New York: Wiley, 1976, 207 pp., $11.95).

This book describes the computer elements and electronic semiconductor technologies that characterize microprocessors. In addition, it presents an overview of the architecture and operations of various popular commercial microprocessors. Useful, actual applications of microprocessors are given in examples that include: a low-cost home computer, automotive applications, and telecommunication applications (such as satellite communication systems). The book also covers