Book Reviews

Distribution Management—Mathematical Modelling and Practical Analysis—Samuel Eilon, C. D. T. Watson-Gandy, and Nicos Christofides (London: Griffin, 1971, 240 pp.). *Reviewed by Richard de Neufville, Institute of Transportation and Traffic Engineering, University of California, Berkeley, Calif. 94720.*

Despite the extensive advances that have been made over the last twenty years in network analysis, our ability to design optimal networks in practical situations is often extremely limited. For some problems, in particular for transportation and logistics, this capability has, in fact, been almost nonexistent. To be sure, our accumulated experience in transport planning does enable us to avoid the most ineffective kinds of networks. However, this is quite different from knowing what kinds of networks are truly optimal.

For many modes of transport, we do not even know which of significantly different networks are better. In air transport, for example, a major argument is now taking place in Europe over whether a more connected or (as in the United States) a less connected network is to be preferred, and a similar debate is also taking place in the United States over whether the connectivity of the operational network on the railroads ought to be changed by the introduction of more through trains. Finally, there is continuous disagreement among those interested in urban goods movement about whether consolidation or similar warehouses are desirable. Curiously enough, these discussions are generally carried on without the benefit of any analysis, let alone of the kind of mathematical network analyses that have been so successfully perfected.

The book by Eilon, Watson-Gandy, and Christofides is a significant contribution in this context. At last we have a reference that clearly describes and contrasts the different kinds of approaches that are available, that assesses their relative usefulness for practical problems, and that provides some clues as to what kinds of solutions are desirable. As a further advantage, the exposition is clear, and the book is easy to read.

The authors write with authority, justly due to their extensive academic and practical experience. They are all on the faculty at Imperial College in London, the premier technical center in the United Kingdom, and have been teaching distribution and logistics for many years. In addition, their work there has been combined with extensive consulting work so that they have been able to develop a direct sense of what kinds of problems arise in practice and what analytic approaches are most useful.

The first half of the book focuses on the depot location problem. It features an extensive review of the literature (much along the same lines as that published as a short article by ReVelle, Liebman, and Marks), coupled with a critical review of the relative modeling and computational advantages of the competitive approaches. This is illustrated through a case study of an actual large-scale problem.

The second half covers the associated problems of vehicle scheduling, loading, and the determination of fleet size. The nature of the presentation is similar to that of the first half. The major difference is that the state of the art in these areas does not allow such definitive statements as for depot location. Thus, while the treatment is inherently somewhat inconclusive, it appears to be the best that I have yet encountered for practical problems.

In general, the text is an excellent introduction to practical analysis of networks for logistics and distribution management. Supplemented by descriptions of recent interesting advances, such as those of David Marks' group on garbage collection or of Nigel Wilson *et al.* on consolidation terminals for urban goods movements (all available through the M.I.T. Civil Engineering Systems Laboratory, Cambridge, Mass. 02139), this text is a good basis for a course in distribution. It also provides a first-rate reference for operation researchers practicing in this area. The book is highly recommended for both purposes.

It is unfortunate that this worthwhile work is unfamiliar to the U.S. public. This is possibly due to the fact that the U.K. publisher is relatively unknown in North America. If this is the case, one would hope that he, along with other publishers of good texts, would coventure their work with transatlantic distributors so as to facilitate the dissemination of such works.

Reguleringsteknikk (Control Engineering), vols. 1 and 2—Jens G. Balchen, vol. 3—Jens G. Balchen, Magne Fjeld, and Ole A. Solheim (Trondheim, Norway: Tapir; 1973, 1971, 1970; 274 pp., 331 pp., 392 pp.). *Reviewed by Odd Pettersen, Department of Electrical Engineering, Technical University, Trondheim, Norway; Visiting Professor, Department of Electrical and Computer Engineering, University of Wisconsin, Madison, Wis. 53706.*

These three books cover different topics within the area of control engineering and may well be read separately. Together they constitute a complete set of courses on the undergraduate and partly graduate level. As such, they are used as main textbooks in courses at the Technical University of Norway, where the authors are professors and pioneers of automatic control, not only in theoretical aspects but also a wide range of areas of industrial application. The books are widely read and have gained a high reputation throughout Scandinavia, where the Norwegian language is easily understood. As a former student of Professor Balchen and a colleague of all three authors for several years, the reviewer is, perhaps, somewhat biased in favor of the books. On the other hand, he knows the books fairly well and has witnessed their effective use in teaching for many years.

Volume One was originally published in 1965, based upon earlier lecture notes. It was later revised and reprinted several times, its last edition being the sixth reprint. The two other volumes are newer, which is easily verified by noticing the notation and the use of "modern control theory" with emphasis on vector-matrix formulation. Particularly, this approach is adopted in Volume Three.

Volume One is organized into 12 chapters and covers the main parts of an elementary two-credit course. Because of its historical evolution through more than 15 years, Volume One is mainly concerned with the tranditional approach to control theory, based upon the Laplace transform. The book is updated, however, and state space analysis has been included as a separate chapter at the end of the book.

Chapter 1 explains, in a very elementary and almost nonmathematical way, the nature and some important aspects and applications of automatic control and cybernetics, with examples from technical applications, biology, and other areas of man's activity and environment. Chapter 2 gives a mathematical basis for linear control systems, with basis in the Laplace transform. Chapters 3 and 4 start with an Introduction to the concept of block diagrams, and show how to derive time responses with the help of the inverse Laplace transform. Furthermore, poles and zeros and their effects are explained, with a brief view of the root locus method. Chapters 5–7 deal with frequency analysis and stability; whereas Chapters 8 and 9 apply that theory in the synthesis of feedback control systems, with the mention of feedforward for the elimination of certain kinds of noise.

Chapter 10 explains some aspects of mutually-coupled systems, with the Laplace-transform and transfer-function approach. Several examples of two-variable systems are explained in some detail. Chapter 11 deals with the limitations inherent in linear systems, and chapter 12 gives the basic theory of state space analysis. In an appendix, the inverse Laplace transform is derived, and another appendix gives some "cook book" methods for the practical application and construction of frequency diagrams. At the end of the book is included a bibliography, with some reference to chapters in the book.

Volume Two covers four distinct areas of control theory above the fundamental level: discrete control systems, nonlinear control systems, methods for statistical analysis, and experimental determination of system parameters. Chapter 1, covering discrete systems, gives an easily understood engineer-oriented mathematical description of the