create for themselves and hopefully to extend, mechanics. The book under review not only falls to nurture invention in mechanics but it makes it difficult to comprehend why such work is necessary at all.

DIGITAL CIRCUITS AND DEVICES, by Teuvo Kohonen, Prentice-Hall, 1972, 466 pp.

REVIEWED BY ARTHUR I. LARKY[3]

Although intended for use in an "independent course in computer engineering," Kohonen has written, not a text, but a reference work. The coverage of the field of digital design is quite broad, but thin. The general impression is of one gallon of paint being spread out to cover the whole house. While all the proper topics are included, thier development is sparse, with little attempt to relate the material to practical problems.

One cannot hope to understand the motivation behind digital design techniques without an appreciation of the role of minicomputers in digital systems; yet Kohonen dismisses machine language programming in nine pages while devoting a whole chapter to transmission lines. Minicomputers, peripherals, interfaces, don't even rate an entry in the index.

It is clear that the author has presumed a broader background for his readers than he attests to. Someone familiar with programming and the elements of digital computer design will find this an interesting and useful reference work; those outside the mainstream of computer science will find it not to their liking at all.

DISCRETE-TIME SYSTEMS, by James A. Cadzow, Prentice-Hall, Inc., 1973, 440 pp.

REVIEWED BY DAVID JORDAN[4]

One of the fundamental problems of introducing undergraduate students to the basic concepts in system theory is the necessity for a fairly high level of mathematical maturity. Dr. Cadzow's basic premise is that such a level of mathematical attainment is not necessary when restricting the study to discrete time systems. Thus, he has developed a text which is essentially an introduction to discrete system theory that requires only a high school mathematics background.

In evaluating a text which introduces a new concept in presentation of material in a given subject area it is important to answer several questions. Among them are:

(*a*) Does the book reach the audience for which it is intended?
(*b*) Is the material cohesive and complete?
(*c*) How might this approach interface with other portions of a curriculum?

Dr. Cadzow states that the book is primarily intended as an introduction to quantitatively based ideas and the systems approach at the freshman or sophomore level. It appears that the first eight chapters do satisfy this objective. The material in these chapters is written clearly and completely. For the audience intended, however, it would be necessary to supplement the material with lectures and/or recitations to demonstrate the meaning of the concepts presented. Unfortunately, the remainder of the book (Chapters 9–12) requires a significantly higher level of mathematical maturity. The result is that the student is left hanging at the point of wanting to apply the introductory material. It appears that there will be a singificant time gap between the time a student would take a course using this text and the time he would continue his study of general system theory and filtering. For this reason, while the book achieves its objectives quite well, I feel that it would be difficult to interface a course using this text with other courses in the systems area in a manner that benefits the student. Thus the text would be better suited to a more advanced student as a lead-in to continuous systems.

The physical presentation of this book is very good. The style of writing is clear and concise. Many examples and problems are presented to illustrate the material. These appear to be very well conceived and broad enough to interest a wide variety of students. Editorially, the book has very few typographical or mathematical errors.

In summary, I believe Dr. Cadzow has presented a very interesting and complete introduction to discrete system theory and that the book would serve as an excellent text on this subject. My main reservation is that there appear to be difficulties in interfacing a course using this text with other courses in the introductory electrical engineering or systems curriculum.

LINEAR OPTIMAL CONTROL SYSTEMS, by Huibert Kwakernaak and Raphael Sivan, John Wiley & Sons, Inc., 1972, 575 pp.

REVIEWED BY BJOR N D. TYREUS[5]

About half of the material in this book is presented in unmarked sections. These sections are intended to form a textbook for a two-semester first course on control theory at the senior or first year graduate level. In my mind this is not the right place for the book. It should rather be used in a second course on control theory, preferably at the graduate level, because the book does not teach enough classical control techniques.

However, to the reader who is already familiar with classical control theory (and its limitations in multivariable control), the book will offer a different approach to the problem, namely that of designing linear optimal controllers.

The book contains six chapters. The first chapter, dealing with linear systems theory, is rather condensed and a first course on linear systems is required. Such topics as stability, controllability, observability, and duality are presented in fair detail. The last two sections of the first chapter are devoted to description and representation of stochastic processes, and here again it is necessary to have some previous knowledge as the authors point out. Chapter 2 presents the basic ideas of feedback control and some methods for design. Being far from a complete description of classical control theory, the chapter provides an intuitive feel for the benefits of state feedback. Chapter 3 is the heart of the book. Here the control law for the deterministic linear optimal regulator is derived and the result presented as the solution of the matrix Riccati equation. Numerical solutions to this equation are discussed. The stochastic linear optimal regulator and tracking problems are also solved. Of special interest to process engineers are the sections on regulators with constant disturbances and nonzero set points.

Since implementations of the results from chapter 3 are in general unrealistic for all but simple systems, (the full state vector is required), it is reassuring to see an entire chapter (chapter 4) devoted to the problem of optimal reconstruction of the state, leading to the use of the so-called Kalman-Bucy filter.

A combination of the results from chapters 3 and 4 is made in chapter 5, and the optimal linear *output* feedback controller

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