Book Reviews

Discrete Linear Control: The Polynomial Equation Approach—V. Kučera (Chichester, England, and New York: Wiley-Chichester and Halstead, in coedition with Academia, Prague, 1979, 208 pp.). *Reviewed by Jaroslav Doležal, Institute of Information Theory and Automation, Czechoslovak Academy of Sciences, Prague, Czechoslovakia.*

This book is a somewhat reduced version of the recent Czech edition of *Algebraic Theory of Discrete Linear Control*, (Academia, Prague, 1978). However the material covered is almost identical. The chapter on noninteracting control has been omitted, and also several subsections concerned with preliminary discussions in terms of single-variable systems, where, in the spirit of up-to-date presentation, the development is based on multivariable systems from the outset. Also some parts have been regrouped in the English version.

This monograph summarizes some of the author's results. The objective is to present a recent, polynomial equation approach to the synthesis of discrete optimal controls for multivariable systems which are linear, constant, and finite dimensional. Attention is restricted exclusively to real systems to keep the mathematical level straightforward and accessible to most control engineers. The emphasis is placed on elucidating the key role played by polynomial equations in control system design and on algorithmization of the resulting synthesis procedures. Thus the book is addressed to graduate students of control engineering, to scientists and engineers engaged in control system research and development, and to mathematicians interested in the area of control systems.

It is necessary to agree with the author insofar as the merits of the described approach are concerned. Namely, only the realistic input–output model of the plant is assumed available. Further, the synthesis procedure, reduced to the solution of polynomial equations, unifies the design methodology for a number of control strategies. And what nowadays seems most important is the fact that this approach is simple in nature and computationally attractive.

When reading the book no special prerequisites are necessary because the mathematics involved is based on polynomial algebra. Only elementary knowledge of polynomials and matrices is assumed. For convenience all background mathematics is briefly reviewed in the introductory chapters, and this makes the book to a great extent self-contained.

A short Chapter 1 provides an introduction and gives a brief survey of the existing approaches to discrete linear control problems. In Chapter 2 most of the background mathematics is discussed, mainly standard material on polynomials, sequences, and matrices. Chapter 3 presents, with respect to the further development, important theory on linear Diophantine equations in both polynomials and polynomial matrices.

Chapter 4 is concerned with deterministic control problems, e.g., time-optimal and least-squares control strategies. A systematic study of structure and the stability of feedback systems is presented in Chapter 5. Stochastic control is investigated in Chapter 6 together with a comparison with the LQG approach. Chapter 7 is devoted to computational aspects of the polynomial equation approach.

The book contains a large number of simple illustrative examples which aid in providing a better understanding of the main text and bring out some interesting features of the particular technique. This will be highly appreciated when using the book for classroom use or for self-study. The book will surely be of great interest for a wide class of students, engineers, and researchers in the field of optimal control of linear discrete systems.

Modern Control Systems—Richard C. Dorf (Reading, MA: Addison-Wesley, 1980, 3rd ed., 493 pp.). *Reviewed by Naresh K. Sinha, Department of Electrical and Computer Engineering, McMaster University, Hamilton, Ontario, Canada L8S 4L7.*

This new edition of *Modern Control Systems* is an updated version of a senior-level introductory undergraduate text which has been widely used in the past. Like the earlier editions, it is concerned primarily with linear, time-invariant control systems; and an attempt has been made to put together topics from classical as well as modern control theory in an integrated manner. The eleven chapters of the book provide an excellent introduction to diverse topics like transfer function and frequency response methods as well as the s-plane and the state-variable approaches, and digital control systems. While discussing such a wide array of subjects, the author has endeavored to keep the material up-to-date. For example as far as this reviewer is aware, this is the only text that describes the recent work of Wakeland (1976) and Mitchell (1977) which replaces the tedious trial-and-error approach to the Bode design of lead and lag compensators by a straightforward analytical procedure.

A very good feature of this book is the collection of a large number of very interesting problems at the end of each chapter. These problems have been selected not only to illustrate the theory but also to motivate the student by demonstrating the large number of practical applications of control theory to many diverse fields. Some fascinating problems added to the third edition include the pitch-rate control of the space shuttle, regulating the pupillary aperture in the human eye, a control scheme for a chemical reactor, closed-loop control of a remote manipulator, a remote waste-bag collector, a paper servo design for a high-speed printer, and the control system of a driverless vehicle.

In the reviewer's opinion, this is an excellent undergraduate text for students in all engineering disciplines.