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book reviews

STABILITY CRITERIA FOR LINEAR DYNAMICAL SYSTEMS, by Brian Porter, Academic Press, 1968, 195 pp.

REVIEWED BY E. F. INFANTE[1]

This book is a short text primarily concerned with a description of those stability criteria which are most useful in the analysis of linear systems and with the mathematical developments of these criteria. It is directed to engineering students, especially mechanical engineers at the senior level and does not presume any deep mathematical background.

This text is extremely well written, with an interesting style, and has a large set of good problems with each chapter.

The contents of this book are, in brief, as follows: (i) the Laplace transform, transients in linear systems and the concept of stability; (ii) the encirclement criteria of Nyquist and Leonhard; (iii) Routh's criterion; (iv) Hurwitz's criterion; (v) the root locus method; (vi) methods of D-partition; (vii) methods for differential-difference equations, including Pontryagin's criteria; and (viii) stability of differential equations with periodic coefficients.

As this description of the contents indicate, this book is rather complete in its study of the classical methods of linear stability and analysis. It is very thorough and complete, as well as accessible, in the description of the encirclement theorems and the Routh and Hurwitz criteria. For example, a proof of Sturm's theorem is given as well as a detailed construction of the Routh array. On the other hand, the later topics are discussed rather briefly and in most cases are presented without proof; hence, Pontryagin's criteria is given in detail, but is not proved, and the details of the stability of the Mathieu equation are rather sketchy.

This text is definitely written for mechanical engineers; the great preponderance of the examples are of a mechanical engineering nature and are extremely well selected.

In placing this book in relation with other available texts, it must be pointed out that it deals with topics that, in general, are only sketched in standard introductory control texts, and never discussed in advanced texts. Perhaps, it can be compared with *Mathematics of Automatic Control* by T. Takahashi, Holt, Reinhardt and Winston, Inc., 1966 and with *Stability Theorems for Linear Motions* by S. H. Lehnigk, Prentice-Hall, 1966. In relation with the first, Porter's text is more detailed and much more restricted in that it only deals with stability. In comparison with the second, this text is much more accessible and less mathematical, and will appeal much more to engineering students who do not have, or wish to have, a terribly deep knowledge of the subject.

In conclusion, this text is a valuable contribution to the expository literature in control and dynamical systems. It will be undoubtedly used as a reference, and perhaps as a text, by those engineering students who wish to develop a better, but not too profound understanding of the mathematical underpinning of the classical methods of linear stability analysis.

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PROCESS-COMPUTER SYSTEMS IN THE PROCESS INDUSTRY: MODELLING, SYSTEMS THEORY AND APPLICATIONS, by A. Schoene, Carl Hanser Verlog, Munchen, 1969 (in German).

REVIEWED BY R. WAGER[2]

Although the practical use of digital computers for optimal process control is spreading, the literature does not provide adequate system-analytical and programing tools. Only a few application oriented books are known in this field. This book deals with the problems of planning, scaling, programing and execution of process computer systems for a practical viewpoint.

The prerequisities for an optimal control of a process are the determination of a mathematical model and its experimental verification with the process itself. These are presented in two sections of the book.

The main emphasis of the book is on direct digital control (DDC). The optimum sampling frequency of a control loop is determined theoretically and the selection criteria for a suitable control algorithm are indicated. After that, the problems of shock-free commutation, back-up systems, decoupling of perturbations, data filtering, set-point output and programing are discussed. The advantages of such a control are demonstrated on a control system with dead-time and a multiloop control system.

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