Books

Control System Design, by Stanley M. Shinners.

Published (1964) by John Wiley and Sons, Inc., New York, N. Y. 460 pages+13 index pages+xiv+12 appendixes+37 pages of problems.

This book is an extensive but, at times, shallow treatment of control system design beginning with a short discussion of elementary control systems and the tools that are required to analyze these systems. After a proper introduction of the subject, design of linear, nonlinear, and sampled-data systems is discussed. An adequate treatment of statistical design of control systems is included. The closing chapters of the book discuss some of the more recent advances in optimum and adaptive control systems. A representstive set of problems in included in the text.

The first five chapters of the book provide a good introduction to the understanding of control systems and includes chapters on the general concept of control system design, mathematical tools for the control engineer, transfer function representation of physical systems, performance criteria, and stability criteria. Proper understanding of the material in these five chapters can be obtained with a background in differential equations and physical systems. Laplace transforms of commonly encountered transfer functions and a good discussion of signal flow graphs are included.

Chapter six is entitled "Linear Feedback System Design," and discusses many of the classical approaches that can be used for this purpose, such as root locus, Bode diagram, and Nichols chart. A particularly useful section of the chapter is Shinner's discussion of the best approach, in his opinion, of linear system design, depending upon the order of the system.

Chapter seven provides a discussion of nonlinear feedback control system design. It includes phase plane analysis, describing functions, and Liapunov's first and second method for determining the stability of nonlinear systems. Though nonlinear feedback systems are adequately introduced, the author frequently refers to other references for discussions of a particular topic in greater depth.

Statistical design of feedback control systems is treated in Chapter eight. A review of probability theory is included, and basic statistical relationships for linear systems is discussed. The design of an optimum theoretical filter and the limitations of the root-mean-square error criterion are adequately discussed for a text of this type.

Chapter nine is concerned with sampled-data control systems. A good introduction to this topic is included, and the concept of z transforms is introduced. Stability criterion of sampled-data systems are treated in some detail, including the modified Routh-Hurwitz, the Schur-Cohn method, and Jury's technique.

Chapter ten discusses optimal control systems with a proper introduction to state space concepts. The concept of dynamic programming is briefly introduced, and Pontryagin's maximum principle for analyzing problems in optimal control is included.

Chapter eleven discusses adaptive control systems, including an explanation of the difference between optimal and adaptive systems. Adaptive systems are categorized as either model reference, nonlinear, impulse-response, or digital-computer-controlled adaptive control systems. The design philosophy of typical adaptive systems is discussed. In this chapter, the reader is frequently referred to other sources for additional treatement of a topic.

References are given at the end of each chapter, and a representative tet of problems is included to illustrate the princiiples set forth in each chapter.

This book on control system design is a broad treatment of the subject as it covers some of the more elementary aspects of control system fundamentals as well as the more advanced topics that are of interest today. At times, a lack of depth in a topic is evident. This book is one that can be of value to many control system engineers and can be used as a textbook for classroom teaching, if one is not interested in treating some of the more advanced topics in control system design in detail.

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Electromagnetic Theory and Geometrical Optics, by Morris Kline and Irvin W. Kay

Published (1965) by John Wiley & Sons, Inc., 605 Third Ave., New York, N. Y. 504 text pages+5 index pages+vii pages+4 selected reference pages +14 appendix pages+references by chapter. Illus. 6×9. $15.00.

The book starts with some relevant history of the geometrical optics and its link to electromagnetic theory. It points out the deficiencies of some of the earlier approaches.

The principal topics of discussion in the book are several modern approaches to geometrical optics from the standpoint of electromagnetic theory. The first approach describes the geometrical optics field in terms of singularities of the EM fields as functions of time t. The vector transport equations are derived from the geometrical optics fields along a ray. Next, the reflection and refraction of wave fronts at the discontinuity in the medium are discussed, both for isotropic and anisotropic media. A coherent mathematical foundation for relating the geometric optics fields to Maxwell's equation is established via this approach.

Series expansions are derived for the time-dependent EM fields in which the geometrical optics field is the first term and coefficients of expansion are obtainable from the transport equations along the ray.

The second half of the book begins with the subject of asymptotic series solution of time-harmonic fields expressed as a power series of λ or ω^{-1}. This is an alternative method chosen by the author for relating the geometrical optics field to the exact solution of the EM problem.

A complex integral is next introduced for the representation of the fields. This representation is based on the knowledge of the unit pulse solution. It is shown that an asymptotic series expansion for the time-harmonic fields may then be obtained from the foregoing integral.

The subject of diffraction, including the theory of incoherent diffraction optics, is discussed next. Some applications of the theory developed in the book are presented in the last chapter.

The reviewer found the book very readable. The presentation is logical and coherent. The older theories are adequately discussed. Many new concepts are introduced which make the book a very modern one. The book seems very suitable as a text for an advanced course in EM theory. It should also serve well as a reference book on geometrical optics.

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Network Analysis: Second Edition, by M. E. Van Valkenburg

Published (1964) by Prentice-Hall, Inc., Englewood Cliffs, N. J. 456 text pages+6 index pages +viii pages+5 biblio. pages+24 appendix pages. Illus. 6×9. $13.00.

This book is a revision of the original published in 1955, and readers will find the new edition as readable and easy to understand as the first. The first edition was designed to be used as an introduction to the study of electric networks using the "pole-zero" approach. Because of this approach, the book was a departure from most introductory texts of the time, and, as a result, the first edition found effective use as a "second course" in networks in most undergraduate schools. The first edition was well-received and influenced changes in the undergraduate networks sequence in many instances.

At present, the pole-zero approach has become established in the undergraduate curriculum, and the changes which appear in the second edition reflect this fact. The new edition is truly an introduction to network analysis and is being used for the first course in network theory in many schools (usually in the sophomore year). The philosophy underlying this book is that an introduction to network analysis should begin with the transient case and then proceed to the sinusoidal steady state. The inverse order has been the pedagogical rule in the past, and, as a result, there is much debate as to which is the more basic route. Be that as it may, it is of little importance here because the author has proceeded excellently along the route he has chosen.