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BOOKS

Control and Dynamic Systems, Y. Takahashi, M. J. Rubins, and D. A. Auslander, Addison-Wesley Publishing Co. (1970). 800 pages, $17.50.

This is a well-thought-out and well-executed book. However, as the preface indicates, "this is a book for mechanical engineers, although it is also applicable for electrical and chemical engineers." Thus, most of the examples and discussions deal with systems and problems that are not, except from a conceptual point of view, of direct interest to chemical engineers. Nevertheless, there are sufficient ideas and developments in this work to suggest that the chemical engineer would find the book worthwhile, at least as an excellent secondary reference.

The book is divided into four main sections. These are (1) linear system theory, (2) formulation of dynamic systems, (3) control of linear systems, and (4) nonlinear, stochastic, optimal control and logic systems. Section (1) is really a state vector approach to the representation of lumped-parameter systems. It includes material on signal-flow diagrams, Laplace- and z-transforms, diagonalization method, difference equations, the matrix exponential, controllability and observability, and all aspects of stability of linear systems including Liapunov theory. All in all, this is an excellent section on most aspects of linear systems and their analysis.

Section (2) then proceeds to the development or identification of models of lumped- and distributed-parameter systems via many physical processes. Of specific interest to the chemical engineer is the material on heat exchanger and percolation systems. The latter, in particular, has application to flow in packed beds and is extremely well done. The whole chapter on distributed-parameter systems is, in fact, well developed and of more than passing interest.

Section (3) deals with linear control systems and includes many aspects of classical process control and frequency response techniques. It also develops the theory of feed-forward control, of decoupling techniques for linear systems, and of computer directed control. Special interest lies in model control of distributed-parameter systems and of linear-quadratic control as developed through the Liapunov formulation rather than standard minimum principle techniques.

Section (4) covers a variety of topics such as the analysis of oscillating nonlinear systems (limit cycles), nonlinear stability via the Liapunov formulation, minimum time control and dynamic programming, Kalman filtering, and switching algebra.

It is apparent from this brief analysis of the contents that the book contains a wealth of information. Coupled with excellent examples and problems (a solution manual is available) and the comparatively nonrigorous mathematical developments is a very large set of excellent drawings and flow diagrams.

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If one can choose examples for chemical engineers from other sources, this book is highly recommended to anyone teaching a systems oriented course.

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Process Analysis by Statistical Methods, D. M. Himmelblau, John Wiley & Sons, Inc., New York (1970). 463 pages. $19.95.

In spite of the fact that the analysis of chemical processes by mathematical statistical techniques is a relatively new subject, the results of numerous experimental and theoretical investigations have been appearing in the literature during the past five years. This book systematically puts together these investigations on process analysis. It has the distinction of being the first book in this area. It is carefully written, authentic, and well documented.

The first three chapters introduce the fundamental, but indispensable, knowledge of mathematical statistics which are used repeatedly in the later sections of the text. These chapters are not sufficiently detailed for a newcomer and should be supplemented by other suitable text books. The discussions of linear models with one independent variable in Chapter 4 and linear models with several independent variables in Chapter 5 are well organized. The next three chapters describe the various kinds of modern techniques which are useful in building nonlinear mathematical models. The techniques include those in the domain of the estimation of nonlinear parameters and the discrimination and identification of rival models. Chapters 9 through 12 discuss how to estimate the parameters within the models, which are related to transport processes. These models are those represented by ordinary and partial differential equations and transfer equations.

This excellent text will be of interest to both experts and beginners. Experts will be able to use it as a quick search for theoretical analyses and experimental information presently existing. Beginners, such as graduate students and postdoctorates entering this field, will find it extremely useful in obtaining the present status of affairs without being baffled by the numerous research papers. A large number of footnotes and references given throughout the textbook will prove helpful.

To summarize, Professor Himmelblau has done a commendable job in providing the mathematical statistical background needed to treat many problems of modeling in chemical engineering. Ample and pertinent examples are included in the text. It belongs in the library of anyone who is seriously interested in this subject.

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Hackh's Chemical Dictionary, 4th Ed., Julius Grant, editor. McGraw-Hill Book Co., New York, San Francisco, Toronto, London, Sydney (1969). 738 + xi pages. $29.50.

This fourth edition of "Hackh's Chemical Dictionary" reflects the tremendous advances in science in general and in chemistry in particular that have occurred during the 25 years since the publication of the third edition. The dictionary includes terms representing all the branches of chemistry and its related sciences—physics, astrophysics, mineralogy, pharmacy, agriculture, biology, medicine, engineering, and the like. In addition, it brings in the collateral vocabulary of industry and commerce, including product names and trademarks. It also includes brief biographies of men who have contributed to the progress of chemistry and its related sciences; states clearly and precisely all important theories, laws, and rules; covers the significant reactions, processes, and methods; and describes chemical apparatus, processes, and methods.

The editor has successfully added most new words of any importance that have appeared since 1944, while carefully retaining the old and even many obsolete terms, indicating that they are obsolete. In the matter of chemical nomenclature and notations, he has adhered to the rulings of the International Union of Pure and Applied Chemistry. For other terms, he has followed the guidelines established by current procedures and by existing and accepted international standards or relied on customary usage.

In almost 200 fewer pages than in the third edition, he has incorporated 23,000 more entries, primarily by offering more concise definitions, but also by eliminating photographs of eminent scientists and many illustrations and diagrams. This reviewer has not counted the number of words defined, but the editor in his preface claims nearly 55,000 although 80,000 are claimed on the front flap of the jacket. In this new edition the defined terms stand out more clearly and the type font is easier to read.

The emphasis on accuracy, current usage, and conciseness indicates that this dictionary will maintain the authoritative position that it has occupied for many years and will contribute to the current demand for interdisciplinary knowledge.

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