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This best-selling text focuses on the analysis and design of complicated dynamics systems. CHOICE called it "a high-level, concise book that could well be used as a reference by engineers, applied mathematicians, and undergraduates. The format is good, the presentation clear, the diagrams instructive, the examples and problems helpful...References and a multiple-choice examination are included.

This is one of the best books on optimal control. It covers a wide range of interesting material including parameter optimization, optimization for systems with constraints, feedback control and singular solutions of optimization. The book can be useful in teaching courses in control theory. There are plenty of exercises included in the text.

A focused presentation of how sparse optimization methods can be used to solve optimal control and estimation problems.

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This is the first book on the optimal estimation that places its major emphasis on practical applications, treating the subject more from an engineering than a mathematical orientation. Even so, theoretical and mathematical concepts are introduced and developed sufficiently to make the book a self-contained

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source of instruction for readers without prior knowledge of the basic principles of the field. The work is the product of the technical staff of The Analytic Sciences Corporation (TASC), an organization whose success has resulted largely from its applications of optimal estimation techniques to a wide variety of real situations involving large-scale systems. Arthur Gelb writes in the Foreword that "It is our intent throughout to provide a simple and interesting picture of the central issues underlying modern estimation theory and practice. Heuristic, rather than theoretically elegant, arguments are used extensively, with emphasis on physical insights and key questions of practical importance." Numerous illustrative examples, many based on actual applications, have been interspersed throughout the text to lead the student to a concrete understanding of the theoretical material. The inclusion of problems with "built-in" answers at the end of each of the nine chapters further enhances the self-study potential of the text. After a brief historical prelude, the book introduces the mathematics underlying random process theory and state-space characterization of linear dynamic systems. The theory and practice of optimal estimation is then presented, including filtering, smoothing, and prediction. Both linear and non-linear systems, and continuous- and discrete-time cases, are covered in considerable detail. New results are described concerning the application of covariance analysis to non-linear systems and the connection between observers and optimal estimators. The final chapters treat such practical and often pivotal issues as suboptimal structure, and computer loading considerations. This book is an outgrowth of a course given by TASC at a number of US Government facilities. Virtually all of the members of the TASC technical staff have, at one time and in one way or another, contributed to the material contained in the work.

Want to know not just what makes rockets go up but how to do it optimally? Optimal control theory has

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become such an important field in aerospace engineering that no graduate student or practicing engineer can afford to be without a working knowledge of it. This is the first book that begins from scratch to teach the reader the basic principles of the calculus of variations, develop the necessary conditions step-by-step, and introduce the elementary computational techniques of optimal control. This book, with problems and an online solution manual, provides the graduate-level reader with enough introductory knowledge so that he or she can not only read the literature and study the next level textbook but can also apply the theory to find optimal solutions in practice. No more is needed than the usual background of an undergraduate engineering, science, or mathematics program: namely calculus, differential equations, and numerical integration. Although finding optimal solutions for these problems is a complex process involving the calculus of variations, the authors carefully lay out step-by-step the most important theorems and concepts. Numerous examples are worked to demonstrate how to apply the theories to everything from classical problems (e.g., crossing a river in minimum time) to engineering problems (e.g., minimum-fuel launch of a satellite). Throughout the book use is made of the time-optimal launch of a satellite into orbit as an important case study with detailed analysis of two examples: launch from the Moon and launch from Earth. For launching into the field of optimal solutions, look no further!

Geared toward advanced undergraduate and graduate engineering students, this text introduces the theory and applications of optimal control. It serves as a bridge to the technical literature, enabling students to evaluate the implications of theoretical control work, and to judge the merits of papers on the subject. Rather than presenting an exhaustive treatise, *Optimal Control* offers a detailed introduction that fosters careful thinking and disciplined intuition. It develops the basic mathematical background, with a coherent formulation of the control problem and discussions of the necessary conditions for

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optimality based on the maximum principle of Pontryagin. In-depth examinations cover applications of the theory to minimum time, minimum fuel, and to quadratic criteria problems. The structure, properties, and engineering realizations of several optimal feedback control systems also receive attention. Special features include numerous specific problems, carried through to engineering realization in block diagram form. The text treats almost all current examples of control problems that permit analytic solutions, and its unified approach makes frequent use of geometric ideas to encourage students' intuition.

From the very beginning in the late 1950s of the basic ideas of optimal control, attitudes toward the topic in the scientific and engineering community have ranged from an excessive enthusiasm for its reputed capability of solving almost any kind of problem to an (equally) unjustified rejection of it as a set of abstract mathematical concepts with no real utility. The truth, apparently, lies somewhere between these two extremes. Intense research activity in the field of optimization, in particular with reference to robust control issues, has caused it to be regarded as a source of numerous useful, powerful, and flexible tools for the control system designer. The new stream of research is deeply rooted in the well-established framework of linear quadratic gaussian control theory, knowledge of which is an essential requirement for a fruitful understanding of optimization. In addition, there appears to be a widely shared opinion that some results of variational techniques are particularly suited for an approach to nonlinear solutions for complex control problems. For these reasons, even though the first significant achievements in the field were published some forty years ago, a new presentation of the basic elements of classical optimal control theory from a tutorial point of view seems meaningful and contemporary. This text draws heavily on the content of the Italian language textbook "Con trollo ottimo" published by Pitagora and used in a number

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of courses at the Politec nico of Milan.

Upper-level undergraduate text introduces aspects of optimal control theory: dynamic programming, Pontryagin's minimum principle, and numerical techniques for trajectory optimization. Numerous figures, tables. Solution guide available upon request. 1970 edition.

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