Robust Control Design An Optimal Control Approach Hardcover

Optimal Control TheoryFoundations of Optimal Control TheoryAn Introduction to Optimal Control TheoryEssentials of Optimal ControlOptimal ControlElements of Optimal ControlOptimal ControlOptimal Control SystemsOptimal Control TheoryOptimal ControlPrinciples of Optimal Control TheoryOptimal ControlIntroduction to Optimal Control TheoryApplied Optimal ControlOptimal Control TheoryOptimal Control TheoryOptimal Control Theory and Static Optimization in EconomicsFoundations of optimal control theoryOptimal Control and the Calculus of VariationsIntroduction to Control Theory, Including Optimal Control Donald E. Kirk Ernest Bruce Lee Aaron Strauss Pierre Naslin Michael Athans Stephen J. Citron Frank L. Lewis D. Subbaram Naidu Suresh P. Sethi Leslie M. Hocking R. Gamkrelidze Arturo Locatelli Jack Macki A. E. Bryson Zhongjing Ma Robert Pallu de La Barri⬚re Daniel L⬚onard Enid R. Pinch David N. Burghes Optimal Control Theory Foundations of Optimal Control Theory An Introduction to Optimal Control Theory Essentials of Optimal Control Optimal Control Elements of Optimal Control Optimal Control Optimal Control Systems Optimal Control Theory Optimal Control Principles of Optimal Control Theory Optimal Control Introduction to Optimal Control Theory Applied Optimal Control Optimal Control Theory Optimal Control Theory Optimal Control Theory and Static Optimization in Economics Foundations of optimal control theory Optimal Control and the Calculus of Variations Introduction to Control Theory, Including Optimal Control Donald E. Kirk Ernest Bruce Lee Aaron Strauss Pierre Naslin Michael Athans Stephen J. Citron Frank L. Lewis D. Subbaram Naidu Suresh P. Sethi Leslie M. Hocking R. Gamkrelidze Arturo Locatelli Jack Macki A. E. Bryson Zhongjing Ma Robert Pallu de La Barri⬚ Daniel L⬚onardEnid R. Pinch David N. Burghes

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

this paper is intended for the beginner it is not a state of the art paper for research workers in the field of control theory its purpose is to introduce the reader to some of the problems and results in control theory to illustrate the application of these re sults and to provide a guide for his further reading on this subject i have tried to motivate the results with examples especial ly with one canonical simple example described in 3 many results such as the maximum principle have long and difficult proofs i have omitted these proofs in general i have included only the proofs which are either 1 not too difficult or 2 fairly enlightening as to the nature of the result i have however usually attempted to draw the strongest conclusion from a given proof for example many existing proofs in control theory for compact targets and uniqueness of solutions also hold for closed targets and non uniqueness finally at the end of each section i have given references to generalizations and origins of the results discussed in that section i make no claim of completeness in the references however as i have often been content merely to refer the reader either to an exposition or to a paper which has an extensive bibliography iv these lecture notes are revisions of notes i used for aseries of nine lectures on control theory at the international summer school on mathematical systems and economics held in varenna italy june 1967

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 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

it is the purpose of this text to provide in introduction to the development and utilization of techniques applicable to the solution of optimal control problems such problems are within the domain of system optimization theory it is felt that the text is a suitable beginning point for the engineering reader interested in the fields of optimal control and system optimization no prerequisites in control theory are required and use of the text is not limited to any one special field of engineering several methods of formulating and solving deterministic optimal control problems are presented preface

a new edition of the classic text on optimal control theory as a superb introductory text and an indispensable reference this new edition of optimal control will serve the needs of both the professional engineer and the advanced student in mechanical electrical and aerospace engineering its coverage encompasses all the fundamental topics as well as the major changes that have occurred in recent years an abundance of computer simulations using matlab and relevant toolboxes is included to give the reader the actual experience of applying the theory to real world situations major topics covered include static optimization optimal control of discrete time systems optimal control of continuous time systems the tracking problem and other lqr extensions final time free and constrained input control dynamic programming optimal control for polynomial systems output feedback and structured control robustness and multivariable frequency domain techniques differential games reinforcement learning and optimal adaptive control

the theory of optimal control systems has grown and flourished since the 1960 s many texts written on varying levels of sophistication have been published on the subject yet even those purportedly designed for beginners in the field are often riddled with complex theorems and many treatments fail to include topics that are essential to a thorough grounding in the various aspects of and approaches to optimal control optimal control systems provides a comprehensive but accessible treatment of the subject with just the right degree of mathematical rigor to be complete but practical it provides a solid bridge between traditional optimization using the calculus of variations and what is called modern optimal control it also treats both continuous time and discrete time optimal control systems giving students a firm grasp on both methods among this book s most outstanding features is a summary table that accompanies each topic or problem and includes a statement of the problem with a step by step solution students will also gain valuable experience in using industry standard matlab and simulink software including the control system and symbolic math toolboxes diverse applications across fields from power engineering to medicine make a foundation in optimal control systems an essential part of an engineer s background this clear streamlined presentation is ideal for a graduate level course on control systems and as a quick reference for working engineers

optimal control methods are used to determine optimal ways to control a dynamic system the theoretical work in this field serves as a foundation for the book which the authors have applied to business management problems developed from their research and classroom instruction sethi and thompson have provided management science and economics communities with a thoroughly revised edition of their classic text on optimal control theory the new edition has been completely refined with careful attention to the text and graphic material presentation chapters cover a range of topics including finance production and inventory problems marketing problems machine maintenance and replacement problems of optimal consumption of natural resources and applications of control theory to economics the book contains new results that were not available when the first edition was published as well as an expansion of the material on stochastic optimal control theory

systems that evolve with time occur frequently in nature and modelling the behaviour of such systems provides an important application of mathematics these systems can be completely deterministic but it may be possible too to control their behaviour by intervention through controls the theory of optimal control is concerned with determining such controls which at minimum cost either direct the system along a given trajectory or enable it to reach a given point in its state space this textbook is a straightforward introduction to the theory of optimal control with an emphasis on presenting many different applications professor hocking has taken pains to ensure that the theory is developed to display the main themes of the arguments but without using sophisticated mathematical tools problems in this setting can arise across a wide range of subjects and there are illustrative examples of systems from as diverse fields as dynamics economics population control and medicine throughout there are many worked examples and numerous exercises with solutions are provided

in the late 1950 s the group of soviet mathematicians consisting of l s pontryagin v g boltyanskii r v gamkrelidze and e f mishchenko made fundamental contributions to optimal control theory much of their work was collected in their monograph the mathematical theory of optimal processes subsequently professor gamkrelidze made further important contributions to the theory of necessary conditions for problems of optimal control and general optimization problems in the present monograph professor gamkrelidze presents his current view of the fundamentals of optimal control theory it is intended for use in a one semester graduate course or advanced undergraduate course we are now making these ideas available in english to all those interested in optimal control theory west lafayette indiana usa leonard d berkovitz translation editor vll preface this book is based on lectures i gave at the tbilisi state university during the fall of 1974 it contains in essence the principles of general control theory and proofs of the maximum principle and basic existence theorems of optimal control theory although the proofs of the basic theorems presented here are far from being the shortest i think they are fully justified from the conceptual view point in any case the notions we introduce and the methods developed have one unquestionable advantage they are constantly used throughout control theory and not only for the proofs of the theorems presented in this book

from the reviews the style of the book reflects the author s wish to assist in the effective learning of optimal control by suitable choice of topics the mathematical level used and by including numerous illustrated examples in my view the book suits its function and purpose in that it gives a student a comprehensive coverage of optimal control in an easy to read fashion measurement and control

this monograph is an introduction to optimal control theory for systems governed by vector ordinary differential equations it is not intended as a state of the art handbook for researchers we have tried to keep two types of reader in mind 1 mathematicians graduate students and advanced undergraduates in mathematics who want a concise introduction to a field which contains nontrivial interesting applications of mathematics for example weak convergence convexity and the theory of ordinary differential equations 2 economists applied scientists and engineers who want to understand some of the mathematical foundations of optimal control theory in general we have emphasized motivation and explanation avoiding the definition axiom theorem proof approach we make use of a large number of examples especially one simple canonical example which we carry through the entire book in proving theorems we often just prove the simplest case then state the more general results which can be proved many of the more difficult topics are discussed in the notes sections at the end of chapters and several major proofs are in the appendices we feel that a solid understanding of basic facts is best attained by at first avoiding excessive generality we have not tried to give an exhaustive list of references preferring to refer the reader to existing books or papers with extensive bibliographies references are given by author s name and the year of publication e g waltman 1974

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 book focuses on how to implement optimal control problems via the variational method it studies how to implement the extrema of functional by applying the variational method and covers the

extrema of functional with different boundary conditions involving multiple functions and with certain constraints etc it gives the necessary and sufficient condition for the continuous time optimal control solution via the variational method solves the optimal control problems with different boundary conditions analyzes the linear quadratic regulator tracking problems respectively in detail and provides the solution of optimal control problems with state constraints by applying the pontryagin s minimum principle which is developed based upon the calculus of variations and the developed results are applied to implement several classes of popular optimal control problems and say minimum time minimum fuel and minimum energy problems and so on as another key branch of optimal control methods it also presents how to solve the optimal control problems via dynamic programming and discusses the relationship between the variational method and dynamic programming for comparison concerning the system involving individual agents it is also worth to study how to implement the decentralized solution for the underlying optimal control problems in the framework of differential games the equilibrium is implemented by applying both pontryagin s minimum principle and dynamic programming the book also analyzes the discrete time version for all the above materials as well since the discrete time optimal control problems are very popular in many fields

optimal control theory is a technique being used increasingly by academic economists to study problems involving optimal decisions in a multi period framework this textbook is designed to make the difficult subject of optimal control theory easily accessible to economists while at the same time maintaining rigour economic intuitions are emphasized and examples and problem sets covering a wide range of applications in economics are provided to assist in the learning process theorems are clearly stated and their proofs are carefully explained the development of the text is gradual and fully integrated beginning with simple formulations and progressing to advanced topics such as control parameters jumps in state variables and bounded state space for greater economy and elegance optimal control theory is introduced directly without recourse to the calculus of variations the connection with the latter and with dynamic programming is explained in a separate chapter a second purpose of the book is to draw the parallel between optimal control theory and static optimization chapter 1 provides an extensive treatment of constrained and unconstrained maximization with emphasis on economic insight and applications starting from basic concepts it derives and explains important results including the envelope theorem and the method of comparative statics this chapter may be used for a course in static optimization the book is largely self contained no previous knowledge of differential equations is required

a paperback edition of this successful textbook for final year undergraduate mathematicians and control engineering students this book contains exercises and many worked examples with complete solutions and hints making it ideal not only as a class textbook but also for individual study the intorduction to optimal control begins by considering the problem of minimizing a function of many variables before moving on to the main subject the optimal control of systems governed by ordinary differential equations

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