

Optimal Control Applications and Methods

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Optimal Control With Engineering Applications

Hans F. Ravn, René Victor Valqui Vidal

Optimal Control With Engineering Applications:

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Optimal Control with Aerospace Applications James M Longuski, José J. Guzmán, John E. Prussing, 2013-11-04 Want to know not just what makes rockets go up but how to do it optimally Optimal control theory has 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

Optimal Control Michael Athans, Peter L. Falb, 2013-04-26 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

Optimal Control Theory for Applications

David G. Hull,2013-03-09 Mechanical engineering an engineering discipline born of the needs of the industrial revolution is once again asked to do its substantial share in the call for industrial renewal The general call is urgent as we face profound issues of productivity and competitiveness that require engineering solutions among others The Mechanical Engineering Series is a series featuring graduate texts and research monographs intended to address the need for information in contemporary areas of mechanical engineering The series is conceived as a comprehensive one that covers a broad range of concentrations important to mechanical engineering graduate education and research We are fortunate to have a distinguished roster of consulting editors each an expert in one of the areas of concentration The names of the consulting editors are listed on page ii of this volume The areas of concentration are applied mathematics biomechanics computational mechanics dynamic systems and control energetics mechanics of materials processing thermal science and tribology Austin Texas Frederick F Ling Preface Optimization is an area of mathematics that is concerned with finding the best points curves surfaces and so on Best is determined by minimizing some measure of performance subject to equality and inequality constraints Points are constrained by algebraic equations curves are constrained by ordinary differential equations and algebraic equations surfaces are constrained by partial differential equations ordinary differential equations and algebraic equations

Optimal Control Zoran Gajic,Myo-Taeg Lim,Dobrila Skataric,Wu-Chung Su,Vojislav Kecman,2018-10-03 Unique in scope Optimal Control Weakly Coupled Systems and Applications provides complete coverage of modern linear bilinear and nonlinear optimal control algorithms for both continuous time and discrete time weakly coupled systems using deterministic as well as stochastic formulations This book presents numerous applications to real world systems from various industries including aerospace and discusses the design of subsystem level optimal filters Organized into independent chapters for easy access to the material this text also contains several case studies examples exercises computer assignments and formulations of research problems to help instructors and students

Optimal Control Applications in Electric

Power Systems G.S. Christensen,M.E. El-Hawary,S.A. Soliman,2013-11-21 Significant advances in the field of optimal control have been made over the past few decades These advances have been well documented in numerous fine publications and have motivated a number of innovations in electric power system engineering but they have not yet been collected in book form Our purpose in writing this book is to provide a description of some of the applications of optimal control techniques to practical power system problems The book is designed for advanced undergraduate courses in electric power

systems as well as graduate courses in electrical engineering applied mathematics and industrial engineering It is also intended as a self study aid for practicing personnel involved in the planning and operation of electric power systems for utilities manufacturers and consulting and government regulatory agencies The book consists of seven chapters It begins with an introductory chapter that briefly reviews the history of optimal control and its power system applications and also provides an outline of the text The second chapter is entitled Some Optimal Control Techniques its intent is to introduce fundamental concepts of optimal control theory that are relevant to the applications treated in the following chapters Emphasis is given to clear methodical development rather than rigorous formal proofs Topics discussed include variational calculus Pontryagin's maximum principle and geometric methods employing functional analysis A number of solved examples are included to illustrate the techniques

Nonlinear Approaches in Engineering Application Liming Dai, Reza N.

Jazar, 2022-04-27 Nonlinear Approaches in Engineering Applications Design Engineering Problems examines the latest applications of nonlinear approaches in engineering and addresses a range of scientific problems Chapters are authored by world class scientists and researchers and focus on the application of nonlinear approaches in different disciplines of engineering and scientific applications with a strong emphasis on application physical meaning and methodologies of the approaches Topics covered are of high interest in engineering and physics and an attempt has been made to expose engineers and researchers to a broad range of practical topics and approaches This book is appropriate for researchers students and practicing engineers who are interested in the applications of engineering physics and mathematics in nonlinear approaches to solving engineering and science problems

Optimization in Control Applications Guillermo

Valencia-Palomo, Francisco Ronay López-Estrada, 2019-01-10 This book is a printed edition of the Special Issue Optimization in Control Applications that was published in MCA

Complex System Modelling and Control Through Intelligent Soft Computations Quanmin Zhu, Ahmad Taher Azar, 2014-11-29 The book offers a snapshot of the theories and applications of soft computing in the area of complex systems modeling and control It presents the most important findings discussed during the 5th International Conference on Modelling Identification and Control held in Cairo from August 31 September 2 2013 The book consists of twenty nine selected contributions which have been thoroughly reviewed and extended before their inclusion in the volume The different chapters written by active researchers in the field report on both current theories and important applications of soft computing Besides providing the readers with soft computing fundamentals and soft computing based inductive methodologies algorithms the book also discusses key industrial soft computing applications as well as multidisciplinary solutions developed for a variety of purposes like windup control waste management security issues biomedical applications and many others It is a perfect reference guide for graduate students researchers and practitioners in the area of soft computing systems modeling and control

Optimal Control of Thermal Systems Eric André Müller, 2006

Optimal Control Theory Suresh P. Sethi, 2018-11-28 This fully revised 3rd edition offers an introduction to optimal

control theory and its diverse applications in management science and economics. It brings to students the concept of the maximum principle in continuous as well as discrete time by using dynamic programming and Kuhn Tucker theory. While some mathematical background is needed the emphasis of the book is not on mathematical rigor but on modeling realistic situations faced in business and economics. The book exploits optimal control theory to the functional areas of management including finance production and marketing and to economics of growth and of natural resources. In addition this new edition features materials on stochastic Nash and Stackelberg differential games and an adverse selection model in the principal agent framework. The book provides exercises for each chapter and answers to selected exercises to help deepen the understanding of the material presented. Also included are appendices comprised of supplementary material on the solution of differential equations the calculus of variations and its relationships to the maximum principle and special topics including the Kalman filter certainty equivalence singular control a global saddle point theorem Sethi Skiba points and distributed parameter systems. 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 author has applied to business management problems developed from his research and classroom instruction. The new edition has been completely refined and brought up to date. Ultimately this should continue to be a valuable resource for graduate courses on applied optimal control theory but also for financial and industrial engineers economists and operational researchers concerned with the application of dynamic optimization in their fields.

Optimal Control in Thermal Engineering Viorel Badea, 2017-03-14 This book is the first major work covering applications in thermal engineering and offering a comprehensive introduction to optimal control theory which has applications in mechanical engineering particularly aircraft and missile trajectory optimization. The book is organized in three parts. The first part includes a brief presentation of function optimization and variational calculus while the second part presents a summary of the optimal control theory. Lastly the third part describes several applications of optimal control theory in solving various thermal engineering problems. These applications are grouped in four sections heat transfer and thermal energy storage solar thermal engineering heat engines and lubrication. Clearly presented and easy to use it is a valuable resource for thermal engineers and thermal system designers as well as postgraduate students.

[Harnessing AI for Control Engineering](#) Mellal, Mohamed Arezki, 2025-04-25 In the field of control engineering the integration of artificial intelligence AI has opened new avenues for innovation and efficiency. By leveraging machine learning neural networks and advanced optimization algorithms AI can enhance system performance improve decision making and enable real time adaptive control. These technologies empower engineers to design more robust efficient and autonomous systems that can respond to complex dynamic environments with precision. Further research of AI and control engineering may address challenges of traditional methods and pave the way for smarter more sustainable industrial processes. Harnessing AI for Control Engineering delves into the transformative integration of artificial intelligence AI within the domain of control

engineering It navigates the landscape of AI applications from classical control methods to cutting edge machine learning algorithms and nature inspired optimization techniques This book covers topics such as civil engineering fault detection and diagnosis and robotics and is a useful resource for engineers business owners academicians researchers and scientists

Optimal Impulsive Control Aram Arutyunov, Dmitry Karamzin, Fernando Lobo Pereira, 2018-12-17 Optimal Impulsive Control explores the class of impulsive dynamic optimization problems that stem from the fact that many conventional optimal control problems do not have a solution in the classical setting which is highly relevant with regard to engineering applications The absence of a classical solution naturally invokes the so called extension or relaxation of a problem and leads to the notion of generalized solution which encompasses the notions of generalized control and trajectory in this book several extensions of optimal control problems are considered within the framework of optimal impulsive control theory In this framework the feasible arcs are permitted to have jumps while the conventional absolutely continuous trajectories may fail to exist The authors draw together various types of their own results centered on the necessary conditions of optimality in the form of Pontryagin's maximum principle and the existence theorems which shape a substantial body of optimal impulsive control theory At the same time they present optimal impulsive control theory in a unified framework introducing the different paradigmatic problems in increasing order of complexity The rationale underlying the book involves addressing extensions increasing in complexity from the simplest case provided by linear control systems and ending with the most general case of a totally nonlinear differential control system with state constraints The mathematical models presented in Optimal Impulsive Control being encountered in various engineering applications this book will be of interest to both academic researchers and practising engineers

Engineering Applications of Discrete Time Optimal Control Hans F. Ravn, René Victor Valqui Vidal, 1988 *Optimal Control with a Worst-Case Performance Criterion and Applications* M. Bala Subrahmanyam, 2014-03-12 Theory and Applications of Optimal Control in Aerospace Systems I. P. Kant, 1981 Modern control theory has for a long time been largely the domain of mathematicians and control theoreticians Engineering applications were rare and partial for a part due to the inaccessibility of the theory to the practical engineer but mainly because of the lack of computing power available to process the estimation and control algorithms resulting from the theory In the course of the sixties and especially in the seventies the digital computer made enormous advances resulting in a reduction in size power and cost by several magnitudes Moreover successful attempts were made to develop efficient algorithms which could be implemented in moderate size onboard computers As a result of these developments realisation of the potential benefits of modern control has come within grasp and several applications in the aerospace field can be witnessed to day The present Agardograph is an attempt to present a picture of the advances in modern control as applied to aerospace system design The Agardograph is divided into three parts Part one deals with some basic concepts of control theory part two contains a number of chapters on practical design techniques developed from the theory and finally part

three describes a number of design examples and practical applications in real systems Optimal Control Theory with Aerospace Applications Joseph Z. Ben-Asher, 2010 Optimal control theory is a mathematical optimization method with important applications in the aerospace industry This graduate level textbook is based on the author's two decades of teaching at Tel Aviv University and the Technion Israel Institute of Technology and builds upon the pioneering methodologies developed by H J Kelley Unlike other books on the subject the text places optimal control theory within a historical perspective Following the historical introduction are five chapters dealing with theory and five dealing with primarily aerospace applications The theoretical section follows the calculus of variations approach while also covering topics such as gradient methods adjoint analysis hodograph perspectives and singular control Important examples such as Zermelo's navigation problem are addressed throughout the theoretical chapters of the book The applications section contains case studies in areas such as atmospheric flight rocket performance and missile guidance The cases chosen are those that demonstrate some new computational aspects are historically important or are connected to the legacy of H J Kelley To keep the mathematical level at that of graduate students in engineering rigorous proofs of many important results are not given while the interested reader is referred to more mathematical sources Problem sets are also included *Journal of Basic Engineering* ,1964

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