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Optimal Control of Partial Differential Equations

Analysis, Approximation, and Applications

Springer

Optimal Control Of Differential Equations

Irwin Yousept

Optimal Control Of Differential Equations:

Optimal Control of Partial Differential Equations Karl-Heinz Hoffmann,Werner Krabs,1984 Optimal Control of Partial Differential Equations Fredi Tröltzsch,2024-03-21 Optimal control theory is concerned with finding control functions that minimize cost functions for systems described by differential equations The methods have found widespread applications in aeronautics mechanical engineering the life sciences and many other disciplines This book focuses on optimal control problems where the state equation is an elliptic or parabolic partial differential equation Included are topics such as the existence of optimal solutions necessary optimality conditions and adjoint equations second order sufficient conditions and main principles of selected numerical techniques It also contains a survey on the Karush Kuhn Tucker theory of nonlinear programming in Banach spaces The exposition begins with control problems with linear equations quadratic cost functions and control constraints To make the book self contained basic facts on weak solutions of elliptic and parabolic equations are introduced Principles of functional analysis are introduced and explained as they are needed Many simple examples illustrate the theory and its hidden difficulties This start to the book makes it fairly self contained and suitable for advanced undergraduates or beginning graduate students Advanced control problems for nonlinear partial differential equations are also discussed As prerequisites results on boundedness and continuity of solutions to semilinear elliptic and parabolic equations are addressed These topics are not yet readily available in books on PDEs making the exposition also interesting for researchers Alongside the main theme of the analysis of problems of optimal control Tr ltzsch also discusses numerical techniques The exposition is confined to brief introductions into the basic ideas in order to give the reader an impression of how the theory can be realized numerically After reading this book the reader will be familiar with the main principles of the numerical analysis of PDE constrained optimization **Optimal Control of Systems Governed by Partial Differential Equations** Jacques-Louis Lions,1971 **Optimal Control of Differential Equations** Nicolae H. Pavel,1994-06-10 Based on the International Conference on Optimal Control of Differential Equations held recently at Ohio University Athens this Festschrift to honor the sixty fifth birthday of Constantin Corduneanu an outstanding researcher in differential and integral equations provides in depth coverage of recent advances applications and open problems relevant to mathematics and physics Introduces new results as well as novel methods and techniques *Nonlinear and Optimal Control Systems* Thomas L. Vincent,Walter J. Grantham,1997-06-23 Designed for one semester introductory senior or graduate level course the authors provide the student with an introduction of analysis techniques used in the design of nonlinear and optimal feedback control systems There is special emphasis on the fundamental topics of stability controllability and optimality and on the corresponding geometry associated with these topics Each chapter contains several examples and a variety of exercises Optimal Control of Partial Differential Equations Involving Pointwise State Constraints: Regularization and Applications Irwin Yousept,2008 **Introduction to Optimal Control Theory** Jack Macki,Aaron Strauss,2012-12-06 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

Nonlinear Optimal Control Theory Leonard David Berkovitz,Negash G. Medhin,2012-08-25 Nonlinear Optimal Control Theory presents a deep wide ranging introduction to the mathematical theory of the optimal control of processes governed by ordinary differential equations and certain types of differential equations with memory Many examples illustrate the mathematical issues that need to be addressed when using optimal control techniques in diverse areas Drawing on classroom tested material from Purdue University and North Carolina State University the book gives a unified account of bounded state problems governed by ordinary integrodifferential and delay systems It also discusses Hamilton Jacobi theory By providing a sufficient and rigorous treatment of finite dimensional control problems the book equips readers with the foundation to deal with other types of control problems such as those governed by stochastic differential equations partial differential equations and differential games Optimal Control of Differential and Functional Equations J. Warga,2014-05-10 Optimal Control of Differential and Functional Equations presents a mathematical theory of deterministic optimal control with emphasis on problems involving functional integral equations and functional restrictions The book reviews analytical foundations and discusses deterministic optimal control problems requiring original approximate or relaxed solutions Original solutions involve mathematicians and approximate solutions concern engineers Relaxed solutions yield a complete theory that encompasses both existence theorems and necessary conditions The text also presents general optimal control problems optimal control of ordinary differential equations and different types of functional integral equations The book discusses control problems defined by equations in Banach spaces the convex cost functionals and the weak necessary conditions for an original minimum The text illustrates a class of ordinary differential problems with examples and explains some conflicting control problems with relaxed adverse controls as well as conflicting control

problems with hyper relaxed adverse controls The book is intended for mature mathematicians graduate students in analysis and practitioners of optimal control whose primary interests and training are in science or engineering **Optimal Control and Partial Differential Equations** José Luis Menaldi,Edmundo Rofman,Agnes Sulem,2001 This volume contains more than sixty invited papers of international wellknown scientists in the fields where Alain Bensoussan s contributions have been particularly important filtering and control of stochastic systems variationnal problems applications to economy and finance numerical analysis In particular the extended texts of the lectures of Professors Jens Frehse Hitashi Ishii Jacques Louis Lions Sanjoy Mitter Umberto Mosco Bernt Oksendal George Papanicolaou A Shiryaev given in the Conference held in Paris on December 4th 2000 in honor of Professor Alain Bensoussan are included **Optimization, Optimal Control and Partial Differential Equations** V. Barbu,J.F. Bonnans,D. Tiba,2013-03-07 This book collects research papers presented in the First Franco Romanian Conference on Optimization Optimal Control and Partial Differential Equations held at lasi on 7 11 september 1992 The aim and the underlying idea of this conference was to take advantage of the new SOCial developments in East Europe and in particular in Romania to stimulate the scientific contacts and cooperation between French and Romanian mathematicians and teams working in the field of optimization and partial differential equations This volume covers a large spectrum of problems and result developments in this field in which most of the participants have brought notable contributions The following topics are discussed in the contributions presented in this volume 1 Variational methods in mechanics and physical models Here we mention the contributions of D Cioranescu P Donato and H I Ene fluid flows in dielectric porous media R Stavre the impact of a jet with two fluids on a porous wall C Lefter and D Motreanu nonlinear eigenvalue problems with discontinuities I Rus maximum principles for elliptic systems and on asymptotic XII properties of solutions of evolution equations R Latcu and M Megan R Luca and R Morozanu R Faure 2 The controllabillty of Inflnlte dimensional and distributed parameter systems with the contribution of P Grisvard singularities and exact controllability for hyperbolic systems G Geymonat P Loreti and V Valente exact controllability of a shallow shell model C **An Introduction to Applied Optimal Control** Knowles,1982-03-18 An Introduction to Applied Optimal Control <u>Optimal Control and the Calculus of Variations</u> Enid R. Pinch,1995 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 *Optimal Control* Bulirsch,Miele,Stoer,Well,2013-03-08 Optimal Control reports on new theoretical and practical advances essential for analysing and synthesizing optimal controls of dynamical systems governed by partial and ordinary differential equations New necessary and sufficient conditions for optimality are given Recent advances in numerical methods are discussed These

have been achieved through new techniques for solving large sized nonlinear programs with sparse Hessians and through a combination of direct and indirect methods for solving the multipoint boundary value problem The book also focuses on the construction of feedback controls for nonlinear systems and highlights advances in the theory of problems with uncertainty Decomposition methods of nonlinear systems and new techniques for constructing feedback controls for state and control constrained linear quadratic systems are presented The book offers solutions to many complex practical optimal control problems *Optimal Control and Differential Equations : Proceedings of the Conference on Optimal Control and Differential Equations, Held at the University of Oklahoma [in] Norman, Oklahoma, March 24-27, 1977* oklahoma university Conference on optimal control and differential equations (1977. s),1978 **Optimal Control Problems for Partial Differential Equations on Reticulated Domains** Peter I. Kogut,Günter R. Leugering,2011-09-09 In the development of optimal control the complexity of the systems to which it is applied has increased significantly becoming an issue in scientific computing In order to carry out model reduction on these systems the authors of this work have developed a method based on asymptotic analysis Moving from abstract explanations to examples and applications with a focus on structural network problems they aim at combining techniques of homogenization and approximation Optimal Control Problems for Partial Differential Equations on Reticulated Domains is an excellent reference tool for graduate students researchers and practitioners in mathematics and areas of engineering involving reticulated domains Calculus of Variations and Optimal Control/Differential Equations Set Alexander Ioffe,Simeon Reich,I Shafrir,1999-07-16 The calculus of variations is a classical area of mathematical analysis yet its myriad applications in science and technology continue to keep it an active area of research Encompassing two volumes this set brings together leading experts who focus on critical point theory differential equations and the variational aspects of optimal control The books cover monotonicity nonlinear optimization the impossible pilot wave the Lavrentiev phenomenon and elliptic problems Constrained Optimization and Optimal Control for Partial Differential Equations Günter Leugering,Sebastian Engell,Andreas Griewank,Michael Hinze,Rolf Rannacher,Volker Schulz,Michael Ulbrich,Stefan Ulbrich,2012-01-03 This special volume focuses on optimization and control of processes governed by partial differential equations The contributors are mostly participants of the DFG priority program 1253 Optimization with PDE constraints which is active since 2006 The book is organized in sections which cover almost the entire spectrum of modern research in this emerging field Indeed even though the field of optimal control and optimization for PDE constrained problems has undergone a dramatic increase of interest during the last four decades a full theory for nonlinear problems is still lacking The contributions of this volume some of which have the character of survey articles therefore aim at creating and developing further new ideas for optimization control and corresponding numerical simulations of systems of possibly coupled nonlinear partial differential equations The research conducted within this unique network of groups in more than fifteen German universities focuses on novel methods of optimization control and identification for problems in

infinite dimensional spaces shape and topology problems model reduction and adaptivity discretization concepts and important applications Besides the theoretical interest the most prominent question is about the effectiveness of model based numerical optimization methods for PDEs versus a black box approach that uses existing codes often heuristic based for optimization   *Optimal Control of Coupled Systems of Partial Differential Equations* Karl Kunisch,Günter Leugering,Jürgen Sprekels,Fredi Tröltzsch,2009-12-03 Contains contributions originating from the Conference on Optimal Control of Coupled Systems of Partial Differential Equations held at the Mathematisches Forschungsinstitut Oberwolfach in March 2008 This work covers a range of topics such as controllability optimality systems model reduction techniques and fluid structure interactions   **Optimal Control of ODEs and DAEs** Matthias Gerdts,2011-12-23 The intention of this textbook is to provide both the theoretical and computational tools that are necessary to investigate and to solve optimal control problems with ordinary differential equations and differential algebraic equations An emphasis is placed on the interplay between the continuous optimal control problem which typically is defined and analyzed in a Banach space setting and discrete optimal control problems which are obtained by discretization and lead to finite dimensional optimization problems The book addresses primarily master and PhD students as well as researchers in applied mathematics but also engineers or scientists with a good background in mathematics and interest in optimal control The theoretical parts of the book require some knowledge of functional analysis the numerically oriented parts require knowledge from linear algebra and numerical analysis Examples are provided for illustration purposes

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