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L. D. Berkovitz

# Optimal Control Theory



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# Optimal Control Theory Applied Mathematical Sciences

**Jack Macki, Aaron Strauss**



## **Optimal Control Theory Applied Mathematical Sciences:**

**Optimal Control Theory** L.D. Berkovitz, 2013-03-14 This book is an introduction to the mathematical theory of optimal control of processes governed by ordinary differential equations. It is intended for students and professionals in mathematics and in areas of application who want a broad yet relatively deep, concise and coherent introduction to the subject and to its relationship with applications. In order to accommodate a range of mathematical interests and backgrounds among readers, the material is arranged so that the more advanced mathematical sections can be omitted without loss of continuity. For readers primarily interested in applications, a recommended minimum course consists of Chapter I, the sections of Chapters II, III and IV so recommended in the introductory sections of those chapters, and all of Chapter V. The introductory section of each chapter should further guide the individual reader toward material that is of interest to him. A reader who has had a good course in advanced calculus should be able to understand the definitions and statements of the theorems and should be able to follow a substantial portion of the mathematical development. The entire book can be read by someone familiar with the basic aspects of Lebesgue integration and functional analysis. For the reader who wishes to find out more about applications, we recommend references 2, 13, 33, 35 and 50 of the Bibliography at the end of the book. **An Introduction to Optimal**

**Control Problems in Life Sciences and Economics** Sebastian Anița, Viorel Arnăutu, Vincenzo Capasso, 2011-05-05 Combining control theory and modeling, this textbook introduces and builds on methods for simulating and tackling concrete problems in a variety of applied sciences. Emphasizing learning by doing, the authors focus on examples and applications to real world problems. An elementary presentation of advanced concepts, proofs to introduce new ideas, and carefully presented MATLAB programs help foster an understanding of the basics but also lead the way to new independent research. With minimal prerequisites and exercises in each chapter, this work serves as an excellent textbook and reference for graduate and advanced undergraduate students, researchers, and practitioners in mathematics, physics, engineering, computer science, as well as biology, biotechnology, economics, and finance. *Geometric Optimal Control* Heinz Schättler, Urszula

Ledzewicz, 2012-06-26 This book gives a comprehensive treatment of the fundamental necessary and sufficient conditions for optimality for finite dimensional deterministic optimal control problems. The emphasis is on the geometric aspects of the theory and on illustrating how these methods can be used to solve optimal control problems. It provides tools and techniques that go well beyond standard procedures and can be used to obtain a full understanding of the global structure of solutions for the underlying problem. The text includes a large number and variety of fully worked out examples that range from the classical problem of minimum surfaces of revolution to cancer treatment for novel therapy approaches. All these examples, in one way or the other, illustrate the power of geometric techniques and methods. The versatile text contains material on different levels, ranging from the introductory and elementary to the advanced. Parts of the text can be viewed as a comprehensive textbook for both advanced undergraduate and all level graduate courses on optimal control in both

mathematics and engineering departments The text moves smoothly from the more introductory topics to those parts that are in a monograph style were advanced topics are presented While the presentation is mathematically rigorous it is carried out in a tutorial style that makes the text accessible to a wide audience of researchers and students from various fields including the mathematical sciences and engineering Heinz Sch tler is an Associate Professor at Washington University in St Louis in the Department of Electrical and Systems Engineering Urszula Ledzewicz is a Distinguished Research Professor at Southern Illinois University Edwardsville in the Department of Mathematics and Statistics

*Primer on Optimal Control Theory* Jason L. Speyer, David H. Jacobson, 2010-05-13 A rigorous introduction to optimal control theory which will enable engineers and scientists to put the theory into practice

**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

Solutions Manual for Optimal Control Theory Suresh P. Sethi, Gerald L. Thompson, 1981-04-30

**Optimal Control** Leslie M. Hocking, 1991 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

*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

**Optimization and Dynamics with Their Applications** Akio Matsumoto, 2017-05-23 This book presents a variety of advanced research papers in optimization and dynamics written by internationally recognized researchers in these fields As an example of applying optimization in sport it introduces a new method for finding the optimal bat sizes in baseball and softball The book is divided into three parts operations research dynamics and applications The operations research section deals with the convergence of Newton type iterations for solving nonlinear equations and optimum problems the limiting properties of the Nash bargaining solution the utilization of public goods and optimizing lot sizes in the automobile industry The topics in dynamics include special linear approximations of nonlinear systems the dynamic behavior of industrial clusters adaptive learning in oligopolies periodicity in duopolies resulting from production constraints and dynamic models of love affairs The third part presents applications in the fields of reverse logistic network design for end of life wind turbines fuzzy optimization of the structure of agricultural products water resources management in the restoration plans for a lake and also in groundwater supplies In addition it discusses applications in reliability engineering to find the optimal preventive replacement times of deteriorating equipment and using bargaining theory to determine the best maintenance contract The diversity of the application areas clearly illustrates the usefulness of the theory and methodology of optimization and dynamics in solving practical problems

*Introduction to Optimal Control Theory* Jack Macki, Aaron Strauss, 1982

*Stochastic Linear-Quadratic Optimal Control Theory: Differential Games and Mean-Field Problems* Jingrui Sun, Jiongmin Yong, 2020-06-29 This book gathers the most essential results including recent ones on linear quadratic optimal control problems which represent an important aspect of stochastic control It presents results for two player differential games and mean field optimal control problems in the context of finite and infinite horizon problems and discusses a number of new and

interesting issues Further the book identifies for the first time the interconnections between the existence of open loop and closed loop Nash equilibria solvability of the optimality system and solvability of the associated Riccati equation and also explores the open loop solvability of mean field linear quadratic optimal control problems Although the content is largely self contained readers should have a basic grasp of linear algebra functional analysis and stochastic ordinary differential equations The book is mainly intended for senior undergraduate and graduate students majoring in applied mathematics who are interested in stochastic control theory However it will also appeal to researchers in other related areas such as engineering management finance economics and the social sciences

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**Optimization And Optimal Control** Panos M Pardalos, Ider Tsevendorj, Rentsen Enkhbat, 2003-09-25 This volume gives the latest advances in optimization and optimal control which are the main part of applied mathematics It covers various topics of optimization optimal control and operations research

**Foundations of Optimal Control Theory** Ernest Bruce

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**Calculus of Variations with Applications** George McNaught Ewing, 1985-01-01 Applications oriented introduction to variational theory develops insight and promotes understanding of specialized books and research papers Suitable for advanced undergraduate and graduate students as a primary or supplementary text 1969 edition     **Optimization and Approximation** Pablo Pedregal, 2017-09-07 This book provides a basic initial resource introducing science and engineering students to the field of optimization It covers three main areas mathematical programming calculus of variations and optimal control highlighting the ideas and concepts and offering insights into the importance of optimality conditions in each area It also systematically presents affordable approximation methods Exercises at various levels have been included to support the learning process

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