Optimal Estimation With An Introduction To Stochastic Control Theory

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Introduction to Stochastic Search and Optimization James C. Spall 2005-03-11 A unique interdisciplinary foundation for real-world problemsolving Stochastic search and optimization techniques are used in a vastnumber of areas, including aerospace, medicine, transportation, andfinance, to name but a few. Whether the goal is refining the designof a missile or aircraft, determining the effectiveness of a newdrug, developing the most efficient timing strategies for trafficsignals, or making investment decisions in order to increaseprofits, stochastic algorithms can help researchers andpractitioners devise optimal solutions to countless real-worldproblems. Introduction to Stochastic Search and Optimization: Estimation,Simulation, and Control is a graduate-level introduction to theprinciples, algorithms, and practical aspects of stochasticoptimization, including applications drawn from engineering,statistics, and computer science. The treatment is both rigorousand broadly accessible, distinguishing this text from much of thecurrent literature and providing students, researchers, andpractitioners with a strong foundation for the often-daunting taskof solving real-world problems. The text covers a broad range of today's most widely usedstochastic algorithms, including: Random search Recursive linear estimation Stochastic approximation Simulated annealing Genetic and evolutionary methods Machine (reinforcement) learning Model selection Simulation-based optimization Markov chain Monte Carlo Optimal experimental design The book includes over 130 examples, Web links to software anddata sets, more than 250 exercises for the reader, and an extensivelist of references. These features help make the text an invaluableresource for those interested in the theory or practice ofstochastic search and optimization.

Optimal Control and Estimation Robert F. Stengel 2012-10-16 Graduate-level text provides introduction to optimal control theory for stochastic systems, emphasizing application of basic concepts to real problems.

Stochastic Models, Estimation, and Control Peter S. Maybeck 1982-08-25 This volume builds upon the foundations set in Volumes 1 and 2. Chapter 13 introduces the basic concepts of stochastic control and dynamic programming as the fundamental means of synthesizing optimal stochastic control laws.

Introduction to Stochastic Programming John R. Birge 2006-04-06 This rapidly developing field encompasses many disciplines including operations research, mathematics, and probability. Conversely, it is being applied in a wide variety of subjects ranging from agriculture to financial planning and from industrial engineering to computer networks. This textbook provides a first course in stochastic programming suitable for students with a basic knowledge of linear programming, elementary analysis, and probability. The authors present a broad overview of the main themes and methods of the subject, thus helping students develop an intuition for how to model uncertainty into mathematical problems, what uncertainty changes bring to the decision process, and what techniques help to manage uncertainty in solving the problems. The early chapters introduce some worked examples of stochastic programming, demonstrate how a stochastic model is formally built, develop the properties of stochastic programs and the basic solution techniques used to solve them. The book then goes on to cover approximation and sampling techniques and is rounded off by an in-depth case study. A well-paced and wide-ranging introduction to this subject.

Stochastic Systems P. R. Kumar 2015-12-15 Since its origins in the 1940s, the subject of decision making under uncertainty has grown into a diversified area with application in several branches of engineering and in those areas of the social sciences concerned with policy analysis and prescription. These approaches required a computing capacity too expensive for the time, until the ability to collect and process huge quantities of data engendered an explosion of work in the area. This book provides succinct and rigorous treatment of the foundations of stochastic control; a unified approach to filtering, estimation, prediction, and stochastic and adaptive control; and the conceptual framework necessary to understand current trends in stochastic control, data mining, machine learning, and robotics.

Bayesian Filtering and Smoothing Simo Särkkä 2013-09-05 A unified Bayesian treatment of the state-of-the-art filtering, smoothing, and parameter estimation algorithms for non-linear state space models.

Robust Estimation and Failure Detection Rami S. Mangoubi 2012-12-06 This book introduces robust estimation and failure detection, with a thorough presentation of Kalman filtering and H-infinity filtering theory. These estimation techniques make it possible for engineers to design estimators that are more general and robust. The book also reviews the likelihood ratio method for failure detection and demonstrates how to design failure detectors that are sensitive to failures but insensitive to model variations. This book will give engineers a concise presentation of these important techniques, as well as an overview of important robust control developments of the last fifteen years.

Linear Stochastic Control Systems Goong Chen 1995-07-12 Linear Stochastic Control Systems presents a thorough description of the mathematical theory and fundamental principles of linear stochastic control. Both continuous-time and discrete-time systems are thoroughly covered. Reviews of the modern probability and random processes theories and the Itô stochastic differential equations are provided. Discrete-time systems theory, optimal estimation and Kalman filtering, and optimal stochastic control theory are studied in detail. A modern treatment of these same topics for continuous-time stochastic control systems is included. The text is written in an easy-to-understand style, and the reader needs only to have a background of elementary real analysis and linear deterministic systems theory to comprehend the subject matter. This graduate textbook is also suitable for self-study, professional training, and as a handy research reference. Linear Stochastic Control Systems is self-contained and provides a step-by-step development of the theory, with many illustrative examples, exercises, and engineering applications.

Optimal Control of Stochastic Difference Volterra Equations Leonid Shaikhet 2014-11-27 This book showcases a subclass of hereditary systems, that is, systems with behaviour depending not only on their current state but also on their past history; it is an introduction to the mathematical theory of optimal control for stochastic difference Volterra equations of neutral type. As such, it will be of much interest to researchers interested in modelling processes in physics, mechanics, automatic regulation, economics and finance, biology, sociology and medicine for all of which such equations are very popular tools. The text deals with problems of optimal control such as meeting given performance criteria, and stabilization, extending them to neutral stochastic difference Volterra equations. In particular, it contrasts the difference analogues of solutions to optimal control and optimal estimation problems for stochastic integral Volterra equations with optimal solutions for corresponding problems in stochastic difference Volterra equations. Optimal Control of Stochastic Difference Volterra Equations commences with an historical introduction to the emergence of this type of equation with some additional mathematical preliminaries. It then deals with the necessary conditions for optimality in the control of the equations and constructs a feedback control scheme. The approximation of stochastic quasilinear Volterra equations with quadratic performance functionals is then considered. Optimal stabilization is discussed and the filtering problem formulated. Finally, two methods of solving the optimal problem for partly observable linear stochastic processes, also with quadratic performance functionals, are developed. Integrating the author's own research within the context of the current state-of-the-art in research in difference equations, hereditary systems theory and optimal control, this book is addressed to specialists in mathematical optimal control theory and to graduate students in pure and applied mathematics and control engineering.

Applied Optimal Estimation The Analytic Sciences Corporation 1974-05-15 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 sound 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 them 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.

Introduction to Stochastic Control Theory Karl J. Åström 2012-05-11 Exploration of stochastic control theory in terms of analysis, parametric optimization, and optimal stochastic control. Limited to linear systems with quadratic criteria; covers discrete time and continuous time systems. 1970 edition.

Optimal and Robust Estimation with an Introduction to Stochastic Lewis Frank L Staff 2007-08

Optimization based on Non-Commutative Maps Jan Feiling 2022-01-20 Powerful optimization algorithms are key ingredients in science and engineering applications. In this thesis, we develop a novel class of discrete-time, derivative-free optimization algorithms relying on gradient approximations based on non-commutative maps–inspired by Lie bracket approximation ideas in control systems. Those maps are defined by function evaluations and applied in such a way that gradient descent steps are approximated, and semi-global convergence guarantees can be given. We supplement our theoretical findings with numerical results. Therein, we provide several algorithm parameter studies and tuning rules, as well as the results of applying our algorithm to challenging benchmarking problems.

Applied Mechanics Reviews 1987

Stochastic Processes and Filtering Theory Andrew H. Jazwinski 2013-04-15 This unified treatment of linear and nonlinear filtering theory presents material previously available only in journals, and in terms accessible to engineering students. Its sole prerequisites are advanced calculus, the theory of ordinary differential equations, and matrix analysis. Although theory is emphasized, the text discusses numerous practical applications as well. Taking the state-space approach to filtering, this text models dynamical systems by finite-dimensional Markov processes, outputs of stochastic difference, and differential equations. Starting with background material on probability theory and stochastic processes, the author introduces and defines the problems of filtering, prediction, and smoothing. He presents the mathematical solutions to nonlinear filtering problems, and he specializes the nonlinear theory to linear problems. The final chapters deal with applications, addressing the development of approximate nonlinear filters, and presenting a critical analysis of their performance.

Uncertainty in Complex Networked Systems Tamer Başar 2018-12-14 The chapters in this volume, and the volume itself, celebrate the life and research of Roberto Tempo, a leader in the study of complex networked systems, their analysis and control under uncertainty, and robust designs. Contributors include authorities on uncertainty in systems, robustness, networked and network systems, social networks, distributed and randomized algorithms, and multi-agent systems—all fields that Roberto Tempo made vital contributions to. Additionally, at least one author of each chapter was a research collaborator of Roberto Tempo's. This volume is structured in three parts. The first covers robustness and includes topics like time-invariant uncertainties, robust static output feedback design, and the uncertainty quartet. The second part is focused on randomization and probabilistic methods, which covers topics such as compressive sensing, and stochastic optimization. Finally, the third part deals with distributed systems and algorithms, and explores matters involving mathematical sociology, fault diagnoses, and PageRank computation. Each chapter presents exposition, provides new results, and identifies fruitful future directions in research. This book will serve as a valuable reference volume to researchers interested in uncertainty, complexity, robustness, optimization, algorithms, and networked systems.

Nonlinear Filters Peyman Setoodeh 2022-04-12 NONLINEAR FILTERS Discover the utility of using deep learning and (deep) reinforcement learning in deriving filtering algorithms with this insightful and powerful new resource Nonlinear Filters: Theory and Applications delivers an insightful view on state and parameter estimation by merging ideas from control theory, statistical signal processing, and machine learning. Taking an algorithmic approach, the book covers both classic and machine learning-based filtering algorithms. Readers of Nonlinear Filters will greatly benefit from the wide spectrum of presented topics including stability, robustness, computability, and algorithmic sufficiency. Readers will also enjoy: Organization that allows the book to act as a stand-alone, self-contained reference A thorough exploration of the notion of observability, nonlinear observers, and the theory of optimal nonlinear filtering that bridges the gap between different science and engineering disciplines A profound account of Bayesian filters including Kalman filter and its variants as well as particle filter A rigorous derivation of the smooth variable structure filter as a predictor-corrector estimator formulated based on a stability theorem, used to confine the estimated states within a neighborhood of their true values A concise tutorial on deep learning and reinforcement learning A detailed presentation of the expectation maximization algorithm and its machine learning-based variants, used for joint state and parameter estimation Guidelines for constructing nonparametric Bayesian models from parametric ones Perfect for researchers, professors, and graduate students in engineering, computer science, applied mathematics, and artificial intelligence, Nonlinear Filters: Theory and Applications will also earn a place in the libraries of those studying or practicing in fields involving pandemic diseases, cybersecurity, information fusion, augmented reality, autonomous driving, urban traffic network, navigation and tracking, robotics, power systems, hybrid technologies, and finance.

Optimal Control and Stochastic Estimation Michael J. Grimble 1988-06-17 Two volumes, which together present a modern and comprehensive overview of the field of optimal control and stochastic estimation.

Regression Estimators Marvin H. J. Gruber 2010-06-30 Praise for the first edition –

Introduction to Stochastic Dynamic Programming Sheldon M. Ross 2014-07-10 Introduction to Stochastic Dynamic Programming presents the basic theory and examines the scope of applications of stochastic dynamic programming. The book begins with a chapter on various finite-stage models, illustrating the wide range of applications of stochastic dynamic programming. Subsequent chapters study infinite-stage models: discounting future returns, minimizing nonnegative costs, maximizing nonnegative returns, and maximizing the long-run average return. Each of these chapters first considers whether an optimal policy need exist—providing counterexamples where appropriate—and then presents methods for obtaining such policies when they do. In addition, general areas of application are presented. The final two chapters are concerned with more specialized models. These include stochastic scheduling models and a type of process known as a multiproject bandit. The mathematical prerequisites for this text are relatively few. No prior knowledge of dynamic programming is assumed and only a moderate familiarity with probability— including the use of conditional expectation—is necessary.

Handbook of Probabilistic Models Pijush Samui 2019-10-05 Handbook of Probabilistic Models carefully examines the application of advanced probabilistic models in conventional engineering fields. In this comprehensive handbook, practitioners, researchers and scientists will find detailed explanations of technical concepts, applications of the proposed methods, and the respective scientific approaches needed to solve the problem. This book provides an interdisciplinary approach that creates advanced probabilistic models for engineering fields, ranging from conventional fields of mechanical engineering and civil engineering, to electronics, electrical, earth sciences, climate, agriculture, water resource, mathematical sciences and computer sciences. Specific topics covered include minimax probability machine regression, stochastic finite element method, relevance vector machine, logistic regression, Monte Carlo simulations, random matrix, Gaussian process regression, Kalman filter, stochastic optimization, maximum likelihood, Bayesian inference, Bayesian update, kriging, copula-statistical models, and more. Explains the application of advanced probabilistic models encompassing multidisciplinary research Applies probabilistic modeling to emerging areas in engineering Provides an interdisciplinary approach to probabilistic models and their applications, thus solving a wide range of practical problems

Stochastic Models: Estimation and Control: Maybeck 1979-07-17 Stochastic Models: Estimation and Control: v. 1

Lectures on Stochastic Programming Alexander Shapiro 2009-01-01 Optimization problems involving stochastic models occur in almost all areas of science and engineering, such as telecommunications, medicine, and finance. Their existence compels a need for rigorous ways of formulating, analyzing, and solving such problems. This book focuses on optimization problems involving uncertain parameters and covers the theoretical foundations and recent

advances in areas where stochastic models are available. Readers will find coverage of the basic concepts of modeling these problems, including recourse actions and the nonanticipativity principle. The book also includes the theory of two-stage and multistage stochastic programming problems; the current state of the theory on chance (probabilistic) constraints, including the structure of the problems, optimality theory, and duality; and statistical inference in and risk-averse approaches to stochastic programming.

Handbook of Reinforcement Learning and Control Kyriakos G. Vamvoudakis 2021-06-23 This handbook presents state-of-the-art research in reinforcement learning, focusing on its applications in the control and game theory of dynamic systems and future directions for related research and technology. The contributions gathered in this book deal with challenges faced when using learning and adaptation methods to solve academic and industrial problems, such as optimization in dynamic environments with single and multiple agents, convergence and performance analysis, and online implementation. They explore means by which these difficulties can be solved, and cover a wide range of related topics including: deep learning; artificial intelligence; applications of game theory; mixed modality learning; and multi-agent reinforcement learning. Practicing engineers and scholars in the field of machine learning, game theory, and autonomous control will find the Handbook of Reinforcement Learning and Control to be thought-provoking, instructive and informative.

Optimal Estimation of Dynamic Systems, Second Edition John L. Crassidis 2011-10-26 Optimal Estimation of Dynamic Systems, Second Edition highlights the importance of both physical and numerical modeling in solving dynamics-based estimation problems found in engineering systems. Accessible to engineering students, applied mathematicians, and practicing engineers, the text presents the central concepts and methods of optimal estimation theory and applies the methods to problems with varying degrees of analytical and numerical difficulty. Different approaches are often compared to show their absolute and relative utility. The authors also offer prototype algorithms to stimulate the development and proper use of efficient computer programs. MATLAB® codes for the examples are available on the book's website. New to the Second Edition With more than 100 pages of new material, this reorganized edition expands upon the best-selling original to include comprehensive developments and updates. It incorporates new theoretical results, an entirely new chapter on advanced sequential state estimation, and additional examples and exercises. An ideal self-study guide for practicing engineers as well as senior undergraduate and beginning graduate students, the book introduces the fundamentals of estimation and helps newcomers to understand the relationships between the estimation and modeling of dynamical systems. It also illustrates the application of the theory to real-world situations, such as spacecraft attitude determination, GPS navigation, orbit determination, and aircraft tracking.

Optimal and Robust Estimation Frank L. Lewis 2017-12-19 More than a decade ago, world-renowned control systems authority Frank L. Lewis introduced what would become a standard textbook on estimation, under the title Optimal Estimation, used in top universities throughout the world. The time has come for a new edition of this classic text, and Lewis enlisted the aid of two accomplished experts to bring the book completely up to date with the estimation methods driving today's high-performance systems. A Classic Revisited Optimal and Robust Estimation: With an Introduction to Stochastic Control Theory, Second Edition reflects new developments in estimation theory and design techniques. As the title suggests, the major feature of this edition is the inclusion of robust methods. Three new chapters cover the robust Kalman filter, H-infinity filtering, and H-infinity filtering of discrete-time systems. Modern Tools for Tomorrow's Engineers This text overflows with examples that highlight practical applications of the theory and concepts. Design algorithms appear conveniently in tables, allowing students quick reference, easy implementation into software, and intuitive comparisons for selecting the best algorithm for a given application. In addition, downloadable MATLAB® code allows students to gain hands-on experience with industry-standard software tools for a wide variety of applications. This cutting-edge and highly interactive text makes teaching, and learning, estimation methods easier and more modern than ever.

Discrete-time Stochastic Systems Torsten Söderström 2002-07-26 This comprehensive introduction to the estimation and control of dynamic stochastic systems provides complete derivations of key results. The second edition includes improved and updated material, and a new presentation of polynomial control and new derivation of linear-quadratic-Gaussian control.

Discrete-time Stochastic Systems Torsten Söderström 2012-12-06 This comprehensive introduction to the estimation and control of dynamic stochastic systems provides complete derivations of key results. The second edition includes improved and updated material, and a new presentation of polynomial control and new derivation of linear-quadratic-Gaussian control.

Optimal Estimation of Dynamic Systems John L. Crassidis 2004-04-27 Most newcomers to the field of linear stochastic estimation go through a difficult process in understanding and applying the theory.This book minimizes the process while introducing the fundamentals of optimal estimation. Optimal Estimation of Dynamic Systems explores topics that are important in the field of control where the signals received are used to determine highly sensitive processes such as the flight path of a plane, the orbit of a space vehicle, or the control of a machine. The authors use dynamic models from mechanical and aerospace engineering to provide immediate results of estimation concepts with a minimal reliance on mathematical skills. The book documents the development of the central concepts and methods of optimal estimation theory in a manner accessible to engineering students, applied mathematicians, and practicing engineers. It includes rigorous theoretial derivations and a significant amount of qualitiative discussion and judgements. It also presents prototype algorithms, giving detail and discussion to stimulate development of efficient computer programs and intelligent use of them. This book illustrates the application of optimal estimation methods to problems with varying degrees of analytical and numercial difficulty. It compares various approaches to help develop a feel for the absolute and relative utility of different methods, and provides many applications in the fields of aerospace, mechanical, and electrical engineering.

Smoothing, Filtering and Prediction Garry Einicke 2012-02-24 This book describes the classical smoothing, filtering and prediction techniques together with some more recently developed embellishments for improving performance within applications. It aims to present the subject in an accessible way, so that it can serve as a practical guide for undergraduates and newcomers to the field. The material is organised as a ten-lecture course. The foundations are laid in Chapters 1 and 2, which explain minimum-mean-square-error solution construction and asymptotic behaviour. Chapters 3 and 4 introduce continuous-time and discrete-time minimum-variance filtering. Generalisations for missing data, deterministic inputs, correlated noises, direct feedthrough terms, output estimation and equalisation are described. Chapter 5 simplifies the minimum-variance filtering results for steady-state problems. Observability, Riccati equation solution convergence, asymptotic stability and Wiener filter equivalence are discussed. Chapters 6 and 7 cover the subject of continuous-time and discrete-time smoothing. The main fixed-lag, fixed-point and fixed-interval smoother results are derived. It is shown that the minimum-variance fixed-interval smoother attains the best performance. Chapter 8 attends to parameter estimation. As the above-mentioned approaches all rely on knowledge of the underlying model parameters, maximum-likelihood techniques within expectation-maximisation algorithms for joint state and parameter estimation are described. Chapter 9 is concerned with robust techniques that accommodate uncertainties within problem specifications. An extra term within Riccati equations enables designers to trade-off average error and peak error performance. Chapter 10 rounds off the course by applying the afore-mentioned linear techniques to nonlinear estimation problems. It is demonstrated that step-wise linearisations can be used within predictors, filters and smoothers, albeit by forsaking optimal performance guarantees.

Estimation and Control of Dynamical Systems Alain Bensoussan 2018-05-23 This book provides a comprehensive presentation of classical and advanced topics in estimation and control of dynamical systems with an emphasis on stochastic control. Many aspects which are not easily found in a single text are provided, such as connections between control theory and mathematical finance, as well as differential games. The book is self-contained and prioritizes concepts rather than full rigor, targeting scientists who want to use control theory in their research in applied mathematics, engineering, economics, and management science. Examples and exercises are included throughout, which will be useful for PhD courses and graduate courses in general. Dr. Alain Bensoussan is Lars Magnus Ericsson Chair at UT Dallas and Director of the International Center for Decision and Risk Analysis which focuses on risk management research as it pertains to large-investment industrial projects that involve new technologies, applications and markets. He is also Chair Professor at City University Hong Kong.

Fundamentals of High Accuracy Inertial Navigation Averil Burton Chatfield 1997

Optimal Estimation Frank L. Lewis 1986 Describes the use of optimal control and estimation in the design of robots, controlled mechanisms, and navigation and guidance systems. Covers control theory specifically for students with minimal background in probability theory. Presents optimal estimation theory as a tutorial with a direct, well-organized approach and a parallel treatment of discrete and continuous time systems. Gives practical examples and computer simulations. Provides enough mathematical rigor to put results on a firm foundation without an overwhelming amount of proofs and theorems.

Computer Aided Methods in Optimal Design and Operations Ian David Lockhart Bogle 2006 This book covers different topics on optimal design and operations with particular emphasis on chemical engineering applications. A wide range of optimization methods OCo deterministic, stochastic, global and hybrid OCo are considered. Containing papers presented at the bilateral workshop by British and Lithuanian scientists, the book brings together researchers'' contributions from different fields OCo chemical engineering including reaction and separation processes, food and biological production, as well as business cycle optimization, bankruptcy, protein analysis and bioinformatics. Sample Chapter(s). Chapter 1: Hybrid Methods for Optimisation (520 KB). Contents: Hybrid Methods for Optimisation (E S Fraga); An MILP Model for Multi-Class Data Classification (G Xu & L G Papageorgiou); Studying the Rate of Convergence of the Steepest Descent Optimisation Algorithm with Relaxation (R J Haycroft); Optimal Estimation of Parameters in Market Research Models (V Savani); A Redundancy Detection Approach to Mining Bioinformatics Data (H Camacho & A Salhi); Optimal Open-Loop Recipe Generation for Particle Size Distribution Control in Semi-Batch Emulsion Polymerisation (N Bianco & C D Immanuel); Multidimensional Scaling Using Parallel Genetic Algorithm (A Varoneckas et al.); Evaluating the Applicability of Time Temperature Integrators as Process Exploration and Validation Tools (S Bakalis et al.); Optimal Deflection Yoke Tuning (V Vaitkus et al.); and other papers. Readership: Academics, researchers, practitioners and postgraduates students in operations research and engineering."

Discrete Time Systems Mario Alberto Jordán 2011-04-26 Discrete-Time Systems comprehend an important and broad research field. The consolidation of digital-based computational means in the present, pushes a technological tool into the field with a tremendous impact in areas like Control, Signal Processing, Communications, System Modelling and related Applications. This book attempts to give a scope in the wide area of Discrete-Time Systems. Their contents are grouped conveniently in sections according to significant areas, namely Filtering, Fixed and Adaptive Control Systems, Stability Problems and Miscellaneous Applications. We think that the contribution of the book enlarges the field of the Discrete-Time Systems with signification in the present state-of-the-art. Despite the vertiginous advance in the field, we also believe that the topics described here allow us also to look through some main tendencies in the next years in the research area.

Optimal Filtering Brian D. O. Anderson 2012-05-23 Graduate-level text extends studies of signal processing, particularly regarding communication systems and digital filtering theory. Topics include filtering, linear systems, and estimation; discrete-time Kalman filter; time-invariant filters; more. 1979 edition.

Statistical Estimation I.A. Ibragimov 2013-11-11 when certain parameters in the problem tend to limiting values (for example, when the sample size increases indefinitely, the intensity of the noise ap proaches zero, etc.) To address the problem of asymptotically optimal estimators consider the following important case. Let X 1, X 2, ... , X n be independent observations with the joint probability density !(x,O) (with respect to the Lebesgue measure on the real line) which depends on the unknown patameter o e 9 c R1. It is required to derive the best (asymptotically) estimator 0:(X b ... , X n) of the parameter O. The first question which arises in connection with this problem is how to compare different estimators or, equivalently, how to assess their quality, in terms of the mean square deviation from the parameter or perhaps in some other way. The presently accepted approach to this problem, resulting from A. Wald's contributions, is as follows: introduce a nonnegative function w(0|> ( ), Ob Oe 9 (the loss function) and given two estimators Of and O! n 2 2 the estimator for which the expected loss (risk) Eown(Oj, 0), j = 1 or 2, is smallest is called the better with respect to Wn at point 0 (here EoO is the expectation evaluated under the assumption that the true value of the parameter is 0). Obviously, such a method of comparison is not without its defects.

Stochastic Filtering with Applications in Finance Ramaprasad Bhar 2010 This book provides a comprehensive account of stochastic filtering as a modeling tool in finance and economics. It aims to present this very important tool with a view to making it more popular among researchers in the disciplines of finance and economics. It is not intended to give a complete mathematical treatment of different stochastic filtering approaches, but rather to describe them in simple terms and illustrate their application with real historical data for problems normally encountered in these disciplines. Beyond laying out the steps to be implemented, the steps are demonstrated in the context of different market segments. Although no prior knowledge in this area is required, the reader is expected to have knowledge of probability theory as well as a general mathematical aptitude. Its simple presentation of complex algorithms required to solve modeling problems in increasingly sophisticated financial markets makes this book particularly valuable as a reference for graduate students and researchers interested in the field. Furthermore, it analyses the model estimation results in the context of the market and contrasts these with contemporary research publications. It is also suitable for use as a text for graduate level courses on stochastic modeling.

Bayesian Inference for Stochastic Processes Lyle D. Broemeling 2017-12-12 This is the first book designed to introduce Bayesian inference procedures for stochastic processes. There are clear advantages to the Bayesian approach (including the optimal use of prior information). Initially, the book begins with a brief review of Bayesian inference and uses many examples relevant to the analysis of stochastic processes, including the four major types, namely those with discrete time and discrete state space and continuous time and continuous state space. The elements necessary to understanding stochastic processes are then introduced, followed by chapters devoted to the Bayesian analysis of such processes. It is important that a chapter devoted to the fundamental concepts in stochastic processes is included. Bayesian inference (estimation, testing hypotheses, and prediction) for discrete time Markov chains, for Markov jump processes, for normal processes (e.g. Brownian motion and the Ornstein–Uhlenbeck process), for traditional time series, and, lastly, for point and spatial processes are described in detail. Heavy emphasis is placed on many examples taken from biology and other scientific disciplines. In order analyses of stochastic processes, it will use R and WinBUGS. Features: Uses the Bayesian approach to make statistical Inferences about stochastic processes The R package is used to simulate realizations from different types of processes Based on realizations from stochastic processes, the WinBUGS package will provide the Bayesian analysis (estimation, testing hypotheses, and prediction) for the unknown parameters of stochastic processes To illustrate the Bayesian inference, many examples taken from biology, economics, and astronomy will reinforce the basic concepts of the subject A practical approach is implemented by considering realistic examples of interest to the scientific community WinBUGS and R code are provided in the text, allowing the reader to easily verify the results of the inferential procedures found in the many examples of the book Readers with a good background in two areas, probability theory and statistical inference, should be able to master the essential ideas of this book.

Fundamentals of Spacecraft Attitude Determination and Control F. Landis Markley 2014-05-31 This book explores topics that are central to the field of spacecraft attitude determination and control. The authors provide rigorous theoretical derivations of significant algorithms accompanied by a generous amount of qualitative discussions of the subject matter. The book documents the development of the important concepts and methods in a manner accessible to practicing engineers, graduate-level engineering students and applied mathematicians. It includes detailed examples from actual mission designs to help ease the transition from theory to practice and also provides prototype algorithms that are readily available on the author's website. Subject matter includes both theoretical derivations and practical implementation of spacecraft attitude determination and control systems. It provides detailed derivations for attitude kinematics and dynamics and provides detailed description of the most widely used attitude parameterization, the quaternion. This title also provides a thorough treatise of attitude dynamics including Jacobian elliptical functions. It is the first known book to provide detailed derivations and explanations of state attitude determination and gives readers real-world examples from actual working spacecraft missions. The subject matter is chosen to fill the void of existing textbooks and treatises, especially in state and dynamics attitude determination. MATLAB code of all examples will be provided through an external website.