



[eBooks] Stochastic Systems: Estimation, Identification, And Adaptive Control (Prentice-Hall Information And System Sciences Series)

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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.

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Stochastic Systems-P. R. Kumar 1986

Linear Stochastic Systems-Anders Lindquist 2015-04-24 This book presents a treatise on the theory and modeling of second-order stationary processes, including an exposition on selected application areas that are important in the engineering and applied sciences. The foundational issues regarding stationary processes dealt with in the beginning of the book have a long history, starting in the 1940s with the work of Kolmogorov, Wiener, Cramér and his students, in particular Wold, and have since been refined and complemented by many others. Problems concerning the filtering and

modeling of stationary random signals and systems have also been addressed and studied, fostered by the advent of modern digital computers, since the fundamental work of R.E. Kalman in the early 1960s. The book offers a unified and logically consistent view of the subject based on simple ideas from Hilbert space geometry and coordinate-free thinking. In this framework, the concepts of stochastic state space and state space modeling, based on the notion of the conditional independence of past and future flows of the relevant signals, are revealed to be fundamentally unifying ideas. The book, based on over 30 years of original research, represents a valuable contribution that will inform the fields of stochastic modeling, estimation, system identification, and time series analysis for decades to come. It also provides the mathematical tools needed to grasp and analyze the structures of algorithms in stochastic systems theory.

Linear Stochastic Systems-Peter E. Caines 2018-06-12 Linear Stochastic Systems, originally published in 1988, is today as comprehensive a reference to the theory of linear discrete-time-parameter systems as ever. Its most outstanding feature is the unified presentation, including both input-output and state space representations of stochastic linear systems, together with their interrelationships. The author first covers the foundations of linear stochastic systems and then continues through to more sophisticated topics including the fundamentals of stochastic processes and the construction of stochastic systems; an integrated exposition of the theories of prediction, realization (modeling), parameter estimation, and control; and a presentation of stochastic adaptive control theory. Written in a clear, concise manner and accessible to graduate students, researchers, and teachers, this classic volume also includes background material to make it self-contained and has complete proofs for all the principal results of the book. Furthermore, this edition includes many corrections of errata collected over the years.

Identification and Stochastic Adaptive Control-Han-fu Chen 1991-11 Identifying the input-output relationship of a system or discovering the evolutionary law of a signal on the basis of observation data, and applying the constructed mathematical model to predicting, controlling or extracting other useful information constitute a problem that has been drawing a lot of

attention from engineering and gaining more and more importance in economics, biology, environmental science and other related areas. Over the last 30-odd years, research on this problem has rapidly developed in various areas under different terms, such as time series analysis, signal processing and system identification. Since the randomness almost always exists in real systems and in observation data, and since the random process is sometimes used to model the uncertainty in systems, it is reasonable to consider the object as a stochastic system. In some applications identification can be carried out off line, but in other cases this is impossible, for example, when the structure or the parameter of the system depends on the sample, or when the system is time-varying. In these cases we have to identify the system on line and to adjust the control in accordance with the model which is supposed to be approaching the true system during the process of identification. This is why there has been an increasing interest in identification and adaptive control for stochastic systems from both theorists and practitioners.

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.

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 systems. 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 stochastic 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.

Stochastic Processes with Applications-Antonio Di Crescenzo

2019-11-28 Stochastic processes have wide relevance in mathematics both for theoretical aspects and for their numerous real-world applications in various domains. They represent a very active research field which is attracting the growing interest of scientists from a range of disciplines. This Special Issue aims to present a collection of current contributions concerning various topics related to stochastic processes and their applications. In particular, the focus here is on applications of stochastic processes as models of dynamic phenomena in research areas certain to be of interest, such as economics, statistical physics, queuing theory, biology, theoretical neurobiology, and reliability theory. Various contributions dealing with theoretical issues on stochastic processes are also included.

Principles of System Identification-Arun K. Tangirala 2018-10-08 Master Techniques and Successfully Build Models Using a Single Resource Vital to all data-driven or measurement-based process operations, system identification is an interface that is based on observational science, and centers on developing mathematical models from observed data. Principles of System Identification: Theory and Practice is an introductory-level book that presents the basic foundations and underlying methods relevant to system identification. The overall scope of the book focuses on system identification with an emphasis on practice, and concentrates most specifically on discrete-time linear system identification. Useful for Both Theory and Practice The book presents the foundational pillars of identification, namely, the theory of discrete-time LTI systems, the basics of signal processing, the theory of random processes, and estimation theory. It explains the core theoretical concepts of building (linear) dynamic models from experimental data, as well as the experimental and practical aspects of identification. The author offers glimpses of modern developments in this area, and provides numerical and simulation-based examples, case studies, end-of-chapter problems, and other ample references to code for illustration and training. Comprising 26 chapters, and ideal for coursework and self-

study, this extensive text: Provides the essential concepts of identification Lays down the foundations of mathematical descriptions of systems, random processes, and estimation in the context of identification Discusses the theory pertaining to non-parametric and parametric models for deterministic-plus-stochastic LTI systems in detail Demonstrates the concepts and methods of identification on different case-studies Presents a gradual development of state-space identification and grey-box modeling Offers an overview of advanced topics of identification namely the linear time-varying (LTV), non-linear, and closed-loop identification Discusses a multivariable approach to identification using the iterative principal component analysis Embeds MATLAB® codes for illustrated examples in the text at the respective points Principles of System Identification: Theory and Practice presents a formal base in LTI deterministic and stochastic systems modeling and estimation theory; it is a one-stop reference for introductory to moderately advanced courses on system identification, as well as introductory courses on stochastic signal processing or time-series analysis. The MATLAB scripts and SIMULINK models used as examples and case studies in the book are also available on the author's website: <http://arunkt.wix.com/homepage#!textbook/c397>

Introduction to Mathematical Systems Theory-Christiaan Heij

2006-12-18 This book provides an introduction to the theory of linear systems and control for students in business mathematics, econometrics, computer science, and engineering; the focus is on discrete time systems. The subjects treated are among the central topics of deterministic linear system theory: controllability, observability, realization theory, stability and stabilization by feedback, LQ-optimal control theory. Kalman filtering and LQC-control of stochastic systems are also discussed, as are modeling, time series analysis and model specification, along with model validation.

Nonlinear Dynamics and Statistics-Alistair I. Mees 2012-12-06 This book describes the state of the art in nonlinear dynamical reconstruction theory. The chapters are based upon a workshop held at the Isaac Newton Institute, Cambridge University, UK, in late 1998. The book's chapters present theory and methods topics by leading researchers in applied and theoretical nonlinear dynamics, statistics, probability, and systems theory. Features

and topics: * disentangling uncertainty and error: the predictability of nonlinear systems * achieving good nonlinear models * delay reconstructions: dynamics vs. statistics * introduction to Monte Carlo Methods for Bayesian Data Analysis * latest results in extracting dynamical behavior via Markov Models * data compression, dynamics and stationarity Professionals, researchers, and advanced graduates in nonlinear dynamics, probability, optimization, and systems theory will find the book a useful resource and guide to current developments in the subject.

Recursive Identification and Parameter Estimation-Han-Fu Chen
2014-06-23 Recursive Identification and Parameter Estimation describes a recursive approach to solving system identification and parameter estimation problems arising from diverse areas. Supplying rigorous theoretical analysis, it presents the material and proposed algorithms in a manner that makes it easy to understand—providing readers with the modeling and identification skills required for successful theoretical research and effective application. The book begins by introducing the basic concepts of probability theory, including martingales, martingale difference sequences, Markov chains, mixing processes, and stationary processes. Next, it discusses the root-seeking problem for functions, starting with the classic RM algorithm, but with attention mainly paid to the stochastic approximation algorithms with expanding truncations (SAAWET) which serves as the basic tool for recursively solving the problems addressed in the book. The book not only identifies the results of system identification and parameter estimation, but also demonstrates how to apply the proposed approaches for addressing problems in a range of areas, including:
Identification of ARMAX systems without imposing restrictive conditions
Identification of typical nonlinear systems
Optimal adaptive tracking
Consensus of multi-agents systems
Principal component analysis
Distributed randomized PageRank computation
This book recursively identifies autoregressive and moving average with exogenous input (ARMAX) and discusses the identification of non-linear systems. It concludes by addressing the problems arising from different areas that are solved by SAAWET. Demonstrating how to apply the proposed approaches to solve problems across a range of areas, the book is suitable for students, researchers, and engineers working in systems and control, signal processing, communication, and mathematical statistics.

Adaptive Control, Filtering, and Signal Processing-K.J. Aström
2012-12-06 The area of adaptive systems, which encompasses recursive identification, adaptive control, filtering, and signal processing, has been one of the most active areas of the past decade. Since adaptive controllers are fundamentally nonlinear controllers which are applied to nominally linear, possibly stochastic and time-varying systems, their theoretical analysis is usually very difficult. Nevertheless, over the past decade much fundamental progress has been made on some key questions concerning their stability, convergence, performance, and robustness. Moreover, adaptive controllers have been successfully employed in numerous practical applications, and have even entered the marketplace.

Estimation and Control of Large-Scale Networked Systems-Tong Zhou
2018-06-13 Estimation and Control of Large Scale Networked Systems is the first book that systematically summarizes results on large-scale networked systems. In addition, the book also summarizes the most recent results on structure identification of a networked system, attack identification and prevention. Readers will find the necessary mathematical knowledge for studying large-scale networked systems, as well as a systematic description of the current status of this field, the features of these systems, difficulties in dealing with state estimation and controller design, and major achievements. Numerical examples in chapters provide strong application backgrounds and/or are abstracted from actual engineering problems, such as gene regulation networks and electricity power systems. This book is an ideal resource for researchers in the field of systems and control engineering. Provides necessary mathematical knowledge for studying large scale networked systems
Introduces new features for filter and control design of networked control systems
Summarizes the most recent results on structural identification of a networked system, attack identification and prevention

Simulation and Inference for Stochastic Differential Equations-Stefano M. Iacus
2009-04-27 This book covers a highly relevant and timely

topic that is of wide interest, especially in finance, engineering and computational biology. The introductory material on simulation and stochastic differential equation is very accessible and will prove popular with many readers. While there are several recent texts available that cover stochastic differential equations, the concentration here on inference makes this book stand out. No other direct competitors are known to date. With an emphasis on the practical implementation of the simulation and estimation methods presented, the text will be useful to practitioners and students with minimal mathematical background. What's more, because of the many R programs, the information here is appropriate for many mathematically well educated practitioners, too.

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.

Stochastic Hybrid Systems-Christos G. Cassandras 2018-10-03 Because they incorporate both time- and event-driven dynamics, stochastic hybrid systems (SHS) have become ubiquitous in a variety of fields, from mathematical finance to biological processes to communication networks to engineering. Comprehensively integrating numerous cutting-edge studies, Stochastic Hybrid Systems presents a captivating treatment of some of the most ambitious types of dynamic systems. Cohesively edited by leading experts in the field, the book introduces the theoretical basics, computational methods, and applications of SHS. It first discusses the underlying principles behind SHS and the main design limitations of SHS. Building on these fundamentals, the authoritative contributors present methods for computer calculations that apply SHS analysis and synthesis techniques in practice. The book concludes with examples of systems encountered in a wide range of application areas, including molecular biology, communication networks, and air traffic management. It also explains how to resolve practical problems associated with these systems. Stochastic Hybrid Systems achieves an ideal balance between a theoretical treatment of SHS and practical considerations. The book skillfully explores

the interaction of physical processes with computerized equipment in an uncertain environment, enabling a better understanding of sophisticated as well as everyday devices and processes.

Partially Observed Markov Decision Processes-Vikram Krishnamurthy
2016-03-21 Covering formulation, algorithms, and structural results, and linking theory to real-world applications in controlled sensing (including social learning, adaptive radars and sequential detection), this book focuses on the conceptual foundations of partially observed Markov decision processes (POMDPs). It emphasizes structural results in stochastic dynamic programming, enabling graduate students and researchers in engineering, operations research, and economics to understand the underlying unifying themes without getting weighed down by mathematical technicalities. Bringing together research from across the literature, the book provides an introduction to nonlinear filtering followed by a systematic development of stochastic dynamic programming, lattice programming and reinforcement learning for POMDPs. Questions addressed in the book include: when does a POMDP have a threshold optimal policy? When are myopic policies optimal? How do local and global decision makers interact in adaptive decision making in multi-agent social learning where there is herding and data incest? And how can sophisticated radars and sensors adapt their sensing in real time?

System Identification-Rik Pintelon 2004-04-05 Electrical Engineering
System Identification A Frequency Domain Approach How does one model a linear dynamic system from noisy data? This book presents a general approach to this problem, with both practical examples and theoretical discussions that give the reader a sound understanding of the subject and of the pitfalls that might occur on the road from raw data to validated model. The emphasis is on robust methods that can be used with a minimum of user interaction. Readers in many fields of engineering will gain knowledge about: * Choice of experimental setup and experiment design * Automatic characterization of disturbing noise * Generation of a good plant model * Detection, qualification, and quantification of nonlinear distortions * Identification of continuous- and discrete-time models * Improved model validation tools and from the theoretical side about: * System identification

* Interrelations between time- and frequency-domain approaches *
Stochastic properties of the estimators * Stochastic analysis System Identification: A Frequency Domain Approach is written for practicing engineers and scientists who do not want to delve into mathematical details of proofs. Also, it is written for researchers who wish to learn more about the theoretical aspects of the proofs. Several of the introductory chapters are suitable for undergraduates. Each chapter begins with an abstract and ends with exercises, and examples are given throughout.

Subspace Identification for Linear Systems-Peter van Overschee 2012-12-06 Subspace Identification for Linear Systems focuses on the theory, implementation and applications of subspace identification algorithms for linear time-invariant finite-dimensional dynamical systems. These algorithms allow for a fast, straightforward and accurate determination of linear multivariable models from measured input-output data. The theory of subspace identification algorithms is presented in detail. Several chapters are devoted to deterministic, stochastic and combined deterministic-stochastic subspace identification algorithms. For each case, the geometric properties are stated in a main 'subspace' Theorem. Relations to existing algorithms and literature are explored, as are the interconnections between different subspace algorithms. The subspace identification theory is linked to the theory of frequency weighted model reduction, which leads to new interpretations and insights. The implementation of subspace identification algorithms is discussed in terms of the robust and computationally efficient RQ and singular value decompositions, which are well-established algorithms from numerical linear algebra. The algorithms are implemented in combination with a whole set of classical identification algorithms, processing and validation tools in Xmath's ISID, a commercially available graphical user interface toolbox. The basic subspace algorithms in the book are also implemented in a set of Matlab files accompanying the book. An application of ISID to an industrial glass tube manufacturing process is presented in detail, illustrating the power and user-friendliness of the subspace identification algorithms and of their implementation in ISID. The identified model allows for an optimal control of the process, leading to a significant enhancement of the production quality. The applicability of subspace identification algorithms in industry is further illustrated with the application of the

Matlab files to ten practical problems. Since all necessary data and Matlab files are included, the reader can easily step through these applications, and thus get more insight in the algorithms. Subspace Identification for Linear Systems is an important reference for all researchers in system theory, control theory, signal processing, automation, mechatronics, chemical, electrical, mechanical and aeronautical engineering.

Stochastic Modelling of Social Processes-Andreas Diekmann 2014-05-10 Stochastic Modelling of Social Processes provides information pertinent to the development in the field of stochastic modeling and its applications in the social sciences. This book demonstrates that stochastic models can fulfill the goals of explanation and prediction. Organized into nine chapters, this book begins with an overview of stochastic models that fulfill normative, predictive, and structural-analytic roles with the aid of the theory of probability. This text then examines the study of labor market structures using analysis of job and career mobility, which is one of the approaches taken by sociologists in research on the labor market. Other chapters consider the characteristic trends and patterns from data on divorces. This book discusses as well the two approaches of stochastic modeling of social processes, namely competing risk models and semi-Markov processes. The final chapter deals with the practical application of regression models of survival data. This book is a valuable resource for social scientists and statisticians.

Time Series Analysis-Henrik Madsen 2007-11-28 With a focus on analyzing and modeling linear dynamic systems using statistical methods, Time Series Analysis formulates various linear models, discusses their theoretical characteristics, and explores the connections among stochastic dynamic models. Emphasizing the time domain description, the author presents theorems to highlight the most important results, proofs to clarify some results, and problems to illustrate the use of the results for modeling real-life phenomena. The book first provides the formulas and methods needed to adapt a second-order approach for characterizing random variables as well as introduces regression methods and models, including the general linear model. It subsequently covers linear dynamic deterministic systems, stochastic processes, time domain methods where

the autocorrelation function is key to identification, spectral analysis, transfer-function models, and the multivariate linear process. The text also describes state space models and recursive and adaptive methods. The final chapter examines a host of practical problems, including the predictions of wind power production and the consumption of medicine, a scheduling system for oil delivery, and the adaptive modeling of interest rates. Concentrating on the linear aspect of this subject, Time Series Analysis provides an accessible yet thorough introduction to the methods for modeling linear stochastic systems. It will help you understand the relationship between linear dynamic systems and linear stochastic processes.

Filtering and System Identification-Michel Verhaegen 2007-04-26

Filtering and system identification are powerful techniques for building models of complex systems. This 2007 book discusses the design of reliable numerical methods to retrieve missing information in models derived using these techniques. Emphasis is on the least squares approach as applied to the linear state-space model, and problems of increasing complexity are analyzed and solved within this framework, starting with the Kalman filter and concluding with the estimation of a full model, noise statistics and state estimator directly from the data. Key background topics, including linear matrix algebra and linear system theory, are covered, followed by different estimation and identification methods in the state-space model. With end-of-chapter exercises, MATLAB simulations and numerous illustrations, this book will appeal to graduate students and researchers in electrical, mechanical and aerospace engineering. It is also useful for practitioners. Additional resources for this title, including solutions for instructors, are available online at www.cambridge.org/9780521875127.

Applied Stochastic Differential Equations-Simo Särkkä 2019-04-30

Stochastic differential equations are differential equations whose solutions are stochastic processes. They exhibit appealing mathematical properties that are useful in modeling uncertainties and noisy phenomena in many disciplines. This book is motivated by applications of stochastic differential equations in target tracking and medical technology and, in particular, their use in methodologies such as filtering, smoothing, parameter estimation,

and machine learning. It builds an intuitive hands-on understanding of what stochastic differential equations are all about, but also covers the essentials of It calculus, the central theorems in the field, and such approximation schemes as stochastic Runge-Kutta. Greater emphasis is given to solution methods than to analysis of theoretical properties of the equations. The book's practical approach assumes only prior understanding of ordinary differential equations. The numerous worked examples and end-of-chapter exercises include application-driven derivations and computational assignments. MATLAB/Octave source code is available for download, promoting hands-on work with the methods.

System Identification 2003-Paul Van Den Hof 2004-06-29 The scope of the symposium covers all major aspects of system identification, experimental modelling, signal processing and adaptive control, ranging from theoretical, methodological and scientific developments to a large variety of (engineering) application areas. It is the intention of the organizers to promote SYSID 2003 as a meeting place where scientists and engineers from several research communities can meet to discuss issues related to these areas. Relevant topics for the symposium program include: Identification of linear and multivariable systems, identification of nonlinear systems, including neural networks, identification of hybrid and distributed systems, Identification for control, experimental modelling in process control, vibration and modal analysis, model validation, monitoring and fault detection, signal processing and communication, parameter estimation and inverse modelling, statistical analysis and uncertainty bounding, adaptive control and data-based controller tuning, learning, data mining and Bayesian approaches, sequential Monte Carlo methods, including particle filtering, applications in process control systems, motion control systems, robotics, aerospace systems, bioengineering and medical systems, physical measurement systems, automotive systems, econometrics, transportation and communication systems *Provides the latest research on System Identification *Contains contributions written by experts in the field *Part of the IFAC Proceedings Series which provides a comprehensive overview of the major topics in control engineering.

Stochastic Processes, Estimation, and Control-Jason L. Speyer

2008-11-06 The authors provide a comprehensive treatment of stochastic systems from the foundations of probability to stochastic optimal control. The book covers discrete- and continuous-time stochastic dynamic systems leading to the derivation of the Kalman filter, its properties, and its relation to the frequency domain Wiener filter as well as the dynamic programming derivation of the linear quadratic Gaussian (LQG) and the linear exponential Gaussian (LEG) controllers and their relation to H_2 and H_∞ controllers and system robustness. This book is suitable for first-year graduate students in electrical, mechanical, chemical, and aerospace engineering specializing in systems and control. Students in computer science, economics, and possibly business will also find it useful.

Statistical Methods in Control & Signal Processing-Tohru Katayama 1997-08-08 Presenting statistical and stochastic methods for the analysis and design of technological systems in engineering and applied areas, this work documents developments in statistical modelling, identification, estimation and signal processing. The book covers such topics as subspace methods, stochastic realization, state space modelling, and identification and parameter estimation.

Mathematical System Theory-Athanasios C. Antoulas 2013-04-17 Over the past three decades R.E. Kalman has been one of the most influential personalities in system and control theory. His ideas have been instrumental in a variety of areas. This is a Festschrift honoring his 60th birthday. It contains contributions from leading researchers in the field giving an account of the profound influence of his ideas in a number of areas of active research in system and control theory. For example, since their introduction by Kalman in the early 60's, the concepts of controllability and observability of dynamical systems with inputs, have been the corner stone of the great majority of investigations in the field.

Identification of Dynamic Systems-Rolf Isermann 2010-11-22 Precise dynamic models of processes are required for many applications, ranging from control engineering to the natural sciences and economics. Frequently,

such precise models cannot be derived using theoretical considerations alone. Therefore, they must be determined experimentally. This book treats the determination of dynamic models based on measurements taken at the process, which is known as system identification or process identification. Both offline and online methods are presented, i.e. methods that post-process the measured data as well as methods that provide models during the measurement. The book is theory-oriented and application-oriented and most methods covered have been used successfully in practical applications for many different processes. Illustrative examples in this book with real measured data range from hydraulic and electric actuators up to combustion engines. Real experimental data is also provided on the Springer webpage, allowing readers to gather their first experience with the methods presented in this book. Among others, the book covers the following subjects: determination of the non-parametric frequency response, (fast) Fourier transform, correlation analysis, parameter estimation with a focus on the method of Least Squares and modifications, identification of time-variant processes, identification in closed-loop, identification of continuous time processes, and subspace methods. Some methods for nonlinear system identification are also considered, such as the Extended Kalman filter and neural networks. The different methods are compared by using a real three-mass oscillator process, a model of a drive train. For many identification methods, hints for the practical implementation and application are provided. The book is intended to meet the needs of students and practicing engineers working in research and development, design and manufacturing.

Packets with Deadlines-I-Hong Hou 2013-05-30 With the explosive increase in the number of mobile devices and applications, it is anticipated that wireless traffic will increase exponentially in the coming years. Moreover, future wireless networks all carry a wide variety of flows, such as video streaming, online gaming, and VoIP, which have various quality of service (QoS) requirements. Therefore, a new mechanism that can provide satisfactory performance to the complete variety of all kinds of flows, in a coherent and unified framework, is needed. In this book, we introduce a framework for real-time wireless networks. This consists of a model that jointly addresses several practical concerns for real-time wireless networks, including per-packet delay bounds, throughput requirements, and

heterogeneity of wireless channels. We detail how this framework can be employed to address a wide range of problems, including admission control, packet scheduling, and utility maximization. Table of Contents: Preface / Introduction / A Study of the Base Case / Admission Control / Scheduling Policies / Utility Maximization without Rate Adaptation / Utility Maximization with Rate Adaptation / Systems with Both Real-Time Flows and Non-Real-Time Flows / Broadcasting and Network Coding / Bibliography / Authors' Biographies

Stochastic Modelling and Control-Mark Davis 2013-03-08 This book aims to provide a unified treatment of input/output modelling and of control for discrete-time dynamical systems subject to random disturbances. The results presented are of wide applicability in control engineering, operations research, econometric modelling and many other areas. There are two distinct approaches to mathematical modelling of physical systems: a direct analysis of the physical mechanisms that comprise the process, or a 'black box' approach based on analysis of input/output data. The second approach is adopted here, although of course the properties of the models we study, which within the limits of linearity are very general, are also relevant to the behaviour of systems represented by such models, however they are arrived at. The type of system we are interested in is a discrete-time or sampled-data system where the relation between input and output is (at least approximately) linear and where additive random disturbances are also present, so that the behaviour of the system must be investigated by statistical methods. After a preliminary chapter summarizing elements of probability and linear system theory, we introduce in Chapter 2 some general linear stochastic models, both in input/output and state-space form. Chapter 3 concerns filtering theory: estimation of the state of a dynamical system from noisy observations. As well as being an important topic in its own right, filtering theory provides the link, via the so-called innovations representation, between input/output models (as identified by data analysis) and state-space models, as required for much contemporary control theory.

Block-oriented Nonlinear System Identification-Fouad Giri 2010-08-18 Block-oriented Nonlinear System Identification deals with an area of research that has been very active since the turn of the millennium. The

book makes a pedagogical and cohesive presentation of the methods developed in that time. These include: iterative and over-parameterization techniques; stochastic and frequency approaches; support-vector-machine, subspace, and separable-least-squares methods; blind identification method; bounded-error method; and decoupling inputs approach. The identification methods are presented by authors who have either invented them or contributed significantly to their development. All the important issues e.g., input design, persistent excitation, and consistency analysis, are discussed. The practical relevance of block-oriented models is illustrated through biomedical/physiological system modelling. The book will be of major interest to all those who are concerned with nonlinear system identification whatever their activity areas. This is particularly the case for educators in electrical, mechanical, chemical and biomedical engineering and for practising engineers in process, aeronautic, aerospace, robotics and vehicles control. Block-oriented Nonlinear System Identification serves as a reference for active researchers, newcomers, industrial and education practitioners and graduate students alike.

Random Signals Estimation and Identification-Nirode Mohanty 2012-12-06 The techniques used for the extraction of information from received or observed signals are applicable in many diverse areas such as radar, sonar, communications, geophysics, remote sensing, acoustics, meteorology, medical imaging systems, and electronics warfare. The received signal is usually disturbed by thermal, electrical, atmospheric, channel, or intentional interferences. The received signal cannot be predicted deterministically, so that statistical methods are needed to describe the signal. In general, therefore, any received signal is analyzed as a random signal or process. The purpose of this book is to provide an elementary introduction to random signal analysis, estimation, filtering, and identification. The emphasis of the book is on the computational aspects as well as presentation of common analytical tools for systems involving random signals. The book covers random processes, stationary signals, spectral analysis, estimation, optimization, detection, spectrum estimation, prediction, filtering, and identification. The book is addressed to practicing engineers and scientists. It can be used as a text for courses in the areas of random processes, estimation theory, and system identification by undergraduates and graduate students in engineering and science with

some background in probability and linear algebra. Part of the book has been used by the author while teaching at State University of New York at Buffalo and California State University at Long Beach. Some of the algorithms presented in this book have been successfully applied to industrial projects.

Statistical Signal Processing in Engineering-Umberto Spagnolini

2018-02-05 A problem-solving approach to statistical signal processing for practicing engineers, technicians, and graduate students This book takes a pragmatic approach in solving a set of common problems engineers and technicians encounter when processing signals. In writing it, the author drew on his vast theoretical and practical experience in the field to provide a quick-solution manual for technicians and engineers, offering field-tested solutions to most problems engineers can encounter. At the same time, the book delineates the basic concepts and applied mathematics underlying each solution so that readers can go deeper into the theory to gain a better idea of the solution's limitations and potential pitfalls, and thus tailor the best solution for the specific engineering application. Uniquely, Statistical Signal Processing in Engineering can also function as a textbook for engineering graduates and post-graduates. Dr. Spagnolini, who has had a quarter of a century of experience teaching graduate-level courses in digital and statistical signal processing methods, provides a detailed axiomatic presentation of the conceptual and mathematical foundations of statistical signal processing that will challenge students' analytical skills and motivate them to develop new applications on their own, or better understand the motivation underlining the existing solutions. Throughout the book, some real-world examples demonstrate how powerful a tool statistical signal processing is in practice across a wide range of applications. Takes an interdisciplinary approach, integrating basic concepts and tools for statistical signal processing Informed by its author's vast experience as both a practitioner and teacher Offers a hands-on approach to solving problems in statistical signal processing Covers a broad range of applications, including communication systems, machine learning, wavefield and array processing, remote sensing, image filtering and distributed computations Features numerous real-world examples from a wide range of applications showing the mathematical concepts involved in practice Includes MATLAB code of many of the experiments in the book Statistical Signal Processing in

Engineering is an indispensable working resource for electrical engineers, especially those working in the information and communication technology (ICT) industry. It is also an ideal text for engineering students at large, applied mathematics post-graduates and advanced undergraduates in electrical engineering, applied statistics, and pure mathematics, studying statistical signal processing.

Probability, Statistics, and Stochastic Processes-Peter Olofsson

2012-05-22 Praise for the First Edition ". . . an excellent textbook . . . well organized and neatly written." —Mathematical Reviews ". . . amazingly interesting . . ." —Technometrics Thoroughly updated to showcase the interrelationships between probability, statistics, and stochastic processes, Probability, Statistics, and Stochastic Processes, Second Edition prepares readers to collect, analyze, and characterize data in their chosen fields. Beginning with three chapters that develop probability theory and introduce the axioms of probability, random variables, and joint distributions, the book goes on to present limit theorems and simulation. The authors combine a rigorous, calculus-based development of theory with an intuitive approach that appeals to readers' sense of reason and logic. Including more than 400 examples that help illustrate concepts and theory, the Second Edition features new material on statistical inference and a wealth of newly added topics, including: Consistency of point estimators Large sample theory Bootstrap simulation Multiple hypothesis testing Fisher's exact test and Kolmogorov-Smirnov test Martingales, renewal processes, and Brownian motion One-way analysis of variance and the general linear model Extensively class-tested to ensure an accessible presentation, Probability, Statistics, and Stochastic Processes, Second Edition is an excellent book for courses on probability and statistics at the upper-undergraduate level. The book is also an ideal resource for scientists and engineers in the fields of statistics, mathematics, industrial management, and engineering.

Computational Methods in Stochastic Dynamics-Manolis Papadrakakis

2012-10-03 The considerable influence of inherent uncertainties on structural behavior has led the engineering community to recognize the importance of a stochastic approach to structural problems. Issues related to uncertainty quantification and its influence on the reliability of the

computational models are continuously gaining in significance. In particular, the problems of dynamic response analysis and reliability assessment of structures with uncertain system and excitation parameters have been the subject of continuous research over the last two decades as a result of the increasing availability of powerful computing resources and technology. This book is a follow up of a previous book with the same subject (ISBN 978-90-481-9986-0) and focuses on advanced computational methods and software tools which can highly assist in tackling complex problems in stochastic dynamic/seismic analysis and design of structures. The selected chapters are authored by some of the most active scholars in their respective areas and represent some of the most recent developments in this field. The book consists of 21 chapters which can be grouped into several thematic topics including dynamic analysis of stochastic systems, reliability-based design, structural control and health monitoring, model updating, system identification, wave propagation in random media, seismic fragility analysis and damage assessment. This edited book is primarily intended for researchers and post-graduate students who are familiar with the fundamentals and wish to study or to advance the state of the art on a particular topic in the field of computational stochastic structural dynamics. Nevertheless, practicing engineers could benefit as well from it as most code provisions tend to incorporate probabilistic concepts in the analysis and design of structures.

An Introduction to Statistical Signal Processing-Robert M. Gray
2004-12-02 This book describes the essential tools and techniques of statistical signal processing. At every stage theoretical ideas are linked to specific applications in communications and signal processing using a range of carefully chosen examples. The book begins with a development of basic probability, random objects, expectation, and second order moment theory followed by a wide variety of examples of the most popular random process models and their basic uses and properties. Specific applications to the analysis of random signals and systems for communicating, estimating, detecting, modulating, and other processing of signals are interspersed throughout the book. Hundreds of homework problems are included and the book is ideal for graduate students of electrical engineering and applied mathematics. It is also a useful reference for researchers in signal processing and communications.

Applied Optimal Estimation-Analytic Sciences Corporation. Technical Staff 1974 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 self-contained 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 then 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.

Complex Variables and Analytic Functions: An Illustrated

Introduction-Bengt Fornberg 2019-12-23 At almost all academic institutions worldwide, complex variables and analytic functions are utilized in courses on applied mathematics, physics, engineering, and other related subjects. For most students, formulas alone do not provide a sufficient introduction to this widely taught material, yet illustrations of functions are sparse in current books on the topic. This is the first primary introductory textbook on complex variables and analytic functions to make extensive use of functional illustrations. Aiming to reach undergraduate students entering the world of complex variables and analytic functions, this book utilizes graphics to visually build on familiar cases and illustrate how these same functions extend beyond the real axis. It covers several important topics that are omitted in nearly all recent texts, including techniques for analytic

continuation and discussions of elliptic functions and of Wiener-Hopf methods. It also presents current advances in research, highlighting the subject's active and fascinating frontier. The primary audience for this textbook is undergraduate students taking an introductory course on complex variables and analytic functions. It is also geared toward graduate students taking a second semester course on these topics, engineers and physicists who use complex variables in their work, and students and researchers at any level who want a reference book on the subject.