Discrete Inverse And State Estimation Problems With Geophysical Fluid Applications

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Optimal Estimation of Dynamic Systems BoD – Books on Demand The essential introduction to modern physical oceanography With the advent of computers, novel instruments, satellite technology, and increasingly powerful modeling tools, we know more about the ocean than ever before. Yet we also have a new generation of oceanographers who have become increasingly distanced from the object of their study. Ever fewer scientists collect the observational data on which they base their research. Instead, many download information without always fully understanding how far removed it is from the original data, with opportunity for great misinterpretation. This textbook introduces modern physical oceanography to beginning graduate students in marine sciences and experienced practitioners in allied fields. Real observations are strongly emphasized, as are their implications for understanding the behavior of the global ocean. Written by a leading physical oceanographer, Modern Observational Physical Oceanography explains what the observational revolution of the past twenty-five years has taught us about the real, changing fluid ocean. Unlike any other book, it provides a broad and accessible treatment of the subject, covering everything from modern methods of observation and data analysis to the fluid dynamics and modeling of ocean processes and variability. Fully illustrated in color throughout, the book describes the fundamental concepts that are needed before delving into more advanced topics, including internal-inertial waves, tides, balanced motions, and large-scale circulation physics. Provides an accessible introduction to modern physical oceanography Written by a leading physical oceanographer Emphasizes real observations of the fluid ocean Features hundreds of color illustrations An online illustration package is available to professors

Discrete Inverse and State Estimation Problems Cambridge

University Press

The World Ocean Circulation Experiment drove the development of estimates of the decadal scale time evolving general circulation that are dynamically and kinematically consistent. A long timescale, and a goal of estimation rather than prediction, preclude the use of meteorological methods called “ data assimilation (DA). ” Instead, “ state estimation ” methods are reviewed here and distinguished from DA. Results from the dynamically consistent family of solutions from the project Estimating the Circulation and Climate of the Ocean based upon least-squares Lagrange multipliers (adjoints) are used to discuss the determination of the dominant elements of the circulation in the period since 1992—which marked the beginning of the satellite altimetric record. Significant changes documented in the Arctic in recent decades now mandate consideration of the coupled ocean-cryospheric state.

Cyber-Physical Power Systems State Estimation

Springer Science & Business Media

Stringent demands on modern guided weapon systems require new approaches to guidance, control, and estimation. There are requirements for pinpoint accuracy, low cost per round, easy upgrade paths, enhanced performance in counter-measure environments, and the ability to track low-observable targets. Advances in Missile Guidance, Control, and Estimation brings together in one volume the latest developments in the three major missile-control components—guidance, control, and estimation—as well as advice on implementation. It also shows how these elements contribute to the overall missile design process. Shares Insights from Well-Known Researchers and Engineers from Israel, Korea, France, Canada, the UK, and the US The book features contributions by renowned experts from government, the defense industry, and academia from the United States, Israel, Korea, Canada, France, and the United Kingdom. It starts from the ground up, developing equations of missile motion. It reviews the kinematics of the engagement and the dynamics of the target and missile before delving into autopilot design, guidance, estimation, and practical implementation issues. Covers Nonlinear Control Techniques as Well as Implementation Issues The book discusses the design of autopilots using new nonlinear theories and analyzes the performance over a flight envelope of Mach number and altitude. It also contains a chapter on the recent integrated-guidance-and-control approach, which exploits the synergy between the autopilot and guidance system design. The book then outlines techniques applied to the missile guidance problem, including classical guidance, sliding mode-based, and differential game-based techniques. A chapter on the use of differential games integrates the guidance law with the estimation of the target maneuver. A chapter on particle filter describes the latest development in filtering algorithms. The final chapters—written by engineers working in the defense

industry in the US, Israel, and Canada—consider the design and implementation issues of a command-to-line-of-sight guidance system and autopilots. An Invaluable Resource on the State of the Art of Missile Guidance A guide to advanced topics in missile guidance, control, and estimation, this invaluable book combines state-of-the-art theoretical developments presented in a tutorial form and unique practical insights. It looks at how tracking, guidance, and autopilot algorithms integrate into a missile system and guides control system designers through the challenges of the design process.

Optimal and Robust State Estimation Woodhead Publishing
A rigorous introduction to the theory and applications of state estimation and association, an important area in aerospace, electronics, and defense industries. Applied state estimation and association is an important area for practicing engineers in aerospace, electronics, and defense industries, used in such tasks as signal processing, tracking, and navigation. This book offers a rigorous introduction to both theory and application of state estimation and association. It takes a unified approach to problem formulation and solution development that helps students and junior engineers build a sound theoretical foundation for their work and develop skills and tools for practical applications. Chapters 1 through 6 focus on solving the problem of estimation with a single sensor observing a single object, and cover such topics as parameter estimation, state estimation for linear and nonlinear systems, and multiple model estimation algorithms. Chapters 7 through 10 expand the discussion to consider multiple sensors and multiple objects. The book can be used in a first-year graduate course in control or system engineering or as a reference for professionals. Each chapter ends with problems that will help readers to develop derivation skills that can be applied to new problems and to build computer models that offer a useful set of tools for problem solving. Readers must be familiar with state-variable representation of systems and basic probability theory including random and stochastic processes.

Inverse Engineering Handbook CRC Press
Inverse problems have been the focus of a growing number of research efforts over the last 40 years-and rightly so. The ability to determine a "cause" from an observed "effect" is a powerful one. Researchers now have at their disposal a variety of techniques for solving inverse problems, techniques that go well beyond those useful for relatively simple parameter estimation problems. The question is, where can one find a single, comprehensive resource that details these methods? The answer is the Inverse Engineering Handbook. Leading experts in inverse problems have joined forces to produce the definitive reference that allows readers to understand, implement, and benefit from a variety of problem-solving techniques. Each chapter

details a method developed or refined by its contributor, who provides clear explanations, examples, and in many cases, software algorithms. The presentation begins with methods for parameter estimation, which build a bridge to boundary function estimation problems. The techniques addressed include sequential function estimation, mollification, space marching techniques, and adjoint, Monte Carlo, and gradient-based methods. Discussions also cover important experimental aspects, including experiment design and the effects of uncertain parameters. While many of the examples presented focus on heat transfer, the techniques discussed are applicable to a wide range of inverse problems. Anyone interested in inverse problems, regardless of their specialty, will find the Inverse Engineering Handbook to be a unique and invaluable compendium of up-to-date techniques.

Advances in Missile Guidance, Control, and Estimation SIAM

This eBook is a collection of articles from a Frontiers Research Topic. Frontiers Research Topics are very popular trademarks of the Frontiers Journals Series: they are collections of at least ten articles, all centered on a particular subject. With their unique mix of varied contributions from Original Research to Review Articles, Frontiers Research Topics unify the most influential researchers, the latest key findings and historical advances in a hot research area! Find out more on how to host your own Frontiers Research Topic or contribute to one as an author by contacting the Frontiers Editorial Office: frontiersin.org/about/contact.

Quantum State Estimation Frontiers Media SA

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.

Industrial Tomography Princeton University Press

A practical introduction to intelligent computer vision theory, design, implementation, and technology The past decade has witnessed epic growth in image processing and intelligent computer vision technology. Advancements in machine learning methods—especially among adaboost varieties and particle filtering methods—have made machine learning in intelligent computer vision more accurate and reliable than ever before. The need for expert coverage of the state of the art in this burgeoning field has never been greater, and this book satisfies that need. Fully updated and extensively revised, this 2nd Edition of the popular guide provides designers, data analysts, researchers and advanced post-graduates with a fundamental yet wholly practical introduction to intelligent computer vision. The authors walk you through the basics of computer vision, past and present, and they explore the more subtle intricacies of intelligent computer vision, with an emphasis on intelligent measurement systems. Using many timely, real-world examples, they explain and vividly demonstrate the latest developments in image and video processing techniques and technologies for machine learning in computer vision systems, including: PRTools5 software for MATLAB—especially the latest representation and generalization software toolbox for PRTools5 Machine learning applications for computer vision, with detailed discussions of contemporary state estimation techniques vs older content of particle filter methods The latest techniques for classification and supervised learning, with an emphasis on Neural Network, Genetic State Estimation and other particle filter and AI state estimation methods All new coverage of the Adaboost and its implementation in PRTools5. A valuable working resource for professionals and an excellent introduction for advanced-level students, this 2nd Edition features a wealth of illustrative examples, ranging from basic techniques to advanced intelligent computer vision system implementations. Additional examples and tutorials, as well as a

question and solution forum, can be found on a companion website.

Direct Tomographic Reconstruction and Applications to Mining MIT Press

An innovative survey of large-scale ocean circulation that links observations, conceptual models, numerical models, and theories.

Data Assimilation: Methods, Algorithms, and Applications Cambridge University Press

This volume presents a well balanced combination of state-of-the-art theoretical results in the field of nonlinear controller and observer design, combined with industrial applications stemming from mechatronics, electrical, (bio–) chemical engineering, and fluid dynamics. The unique combination of results of finite as well as infinite–dimensional systems makes this book a remarkable contribution addressing postgraduates, researchers, and engineers both at universities and in industry. The contributions to this book were presented at the Symposium on Nonlinear Control and Observer Design: From Theory to Applications (SYNCOD), held September 15–16, 2005, at the University of Stuttgart, Germany. The conference and this book are dedicated to the 65th birthday of Prof. Dr.–Ing. Dr.h.c. Michael Zeitz to honor his life – long research and contributions on the fields of nonlinear control and observer design.

Perturbation Compensator based Robust Tracking Control and State Estimation of Mechanical Systems Elsevier

The stratified ocean mixes episodically in small patches where energy is dissipated and density smoothed over scales of centimeters. The net effect of these countless events effects the shape of the ocean's thermocline, how heat is transported from the sea surface to the interior, and how dense bottom water is lifted into the global overturning circulation. This book explores the primary factors affecting mixing, beginning with the thermodynamics of seawater, how they vary in the ocean and how they depend on the physical properties of seawater. Turbulence and double diffusion are then discussed, which determines how mixing evolves and the different impacts it has on velocity, temperature, and salinity. It reviews insights from both laboratory studies and numerical modelling, emphasising the assumptions and limitations of these methods. This is an excellent reference for researchers and graduate students working to advance our understanding of mixing, including oceanographers, atmospheric scientists and limnologists.

Discrete Time Systems Cambridge University Press

Data assimilation is an approach that combines observations and model output, with the objective of improving the latter. This book

places data assimilation into the broader context of inverse problems and the theory, methods, and algorithms that are used for their solution. It provides a framework for, and insight into, the inverse problem nature of data assimilation, emphasizing ?why? and not just ?how.? Methods and diagnostics are emphasized, enabling readers to readily apply them to their own field of study. Readers will find a comprehensive guide that is accessible to nonexperts; numerous examples and diverse applications from a broad range of domains, including geophysics and geophysical flows, environmental acoustics, medical imaging, mechanical and biomedical engineering, economics and finance, and traffic control and urban planning; and the latest methods for advanced data assimilation, combining variational and statistical approaches.

Computer Aided State Estimation of Electric Power Network Cambridge University Press

A 2006 introduction to inverse and state estimation problems for graduate students and researchers in oceanography, climate science, and geophysical fluid dynamics.

Introduction to Quantum-State Estimation Springer Science & Business Media

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.

Bulletin Elsevier

This monograph investigates a practical way to achieve robust motion control and state estimation (Kalman filtering) of mechanical

systems, which is a promising approach in terms of the perturbation compensator. The book presents novel approaches for design and analysis of perturbation observers as well as an extension to robust motion control and robust state estimation. The book is written in a self-contained manner including experimental results in each chapter clearly validating the developed theories.

Ocean Mixing Cambridge University Press While the prediction of observations is a forward problem, the use of actual observations to infer the properties of a model is an inverse problem. Inverse problems are difficult because they may not have a unique solution. The description of uncertainties plays a central role in the theory, which is based on probability theory. This book proposes a general approach that is valid for linear as well as for nonlinear problems. The philosophy is essentially probabilistic and allows the reader to understand the basic difficulties appearing in the resolution of inverse problems. The book attempts to explain how a method of acquisition of information can be applied to actual real-world problems, and many of the arguments are heuristic.

Climate Time Series Analysis CRC Press Control and Dynamic Systems: Advances in Theory and Applications, Volume 56: Digital and Numeric Techniques and their Applications in Control Systems, Part 2 of 2 covers the significant developments in digital and numerical techniques for the analysis and design of modern complex control systems. This volume is composed of 12 chapters and starts with a description of the design techniques of linear constrained discrete-time control systems. The subsequent chapters describe the techniques dealing with robust real-time system identification, the adaptive control algorithms, and the utilization of methods from generalized interpolation and operator theory to deal with a wide range of problems in robust control. These topics are followed by reviews f the decentralized control design for interconnected uncertain systems; the computation of frequency response of descriptor systems by rational interpolation; the techniques for the synthesis of multivariable feedback control laws; and the effect of the initial condition in state estimation for discrete-time linear systems. Other chapters illustrate practical, efficient, and reliable numerical algorithms for robust multivariable control design of linear time-invariant systems, as well as a complete analysis of closed-loop transfer recovery in discrete-time systems using observer-based controllers. The last chapters provide the techniques in robust policy-making in the global economic environment and the implications of robust control techniques for continuous-time systems. This book will prove useful to process, control, systems, and design engineers.

Oceanobs'19: An Ocean of Opportunity. Volume I Lecture Notes of the Les Houch

Climate is a paradigm of a complex system. Analysing climate data is an exciting challenge, which is increased by non-normal distributional shape, serial dependence, uneven spacing and timescale uncertainties. This book presents bootstrap resampling as a computing-intensive method able to meet the challenge. It shows the bootstrap to perform reliably in the most important statistical estimation techniques: regression, spectral analysis, extreme values and correlation. This book is written for climatologists and applied statisticians. It explains step by step the bootstrap algorithms (including novel adaptions) and methods for confidence interval construction. It tests the accuracy of the algorithms by means of Monte Carlo experiments. It analyses a large array of climate time series, giving a detailed account on the data and the associated climatological questions. This makes the book self-contained for graduate students and researchers.

Applied State Estimation and Association John Wiley & Sons

A modern look at state estimation, targeted at students and practitioners of robotics, with emphasis on three-dimensional applications.

Assessment and Future Directions of Nonlinear Model Predictive Control John Wiley & Sons

Cyber-Physical Power System State Estimation updates classic state estimation tools to enable real-time operations and optimize reliability in modern electric power systems. The work introduces and contextualizes the core concepts and classic approaches to state estimation modeling. It builds on these classic approaches with a suite of data-driven models and non-synchronized measurement tools to reflect current measurement trends required by increasingly more sophisticated grids. Chapters outline core definitions, concepts and the network analysis procedures involved in the real-time operation of EPS. Specific sections introduce power flow problem in EPS, highlighting network component modeling and power flow equations for state estimation before addressing quasi static state estimation in electrical power systems using Weighted Least Squares (WLS) classical and alternatives formulations. Particularities of the state estimation process in distribution systems are also considered. Finally, the work goes on to address observability analysis, measurement redundancy and the processing of gross errors through the analysis of WLS static state estimator residuals. Develops advanced approaches to smart grid real-time monitoring

through quasi-static model state estimation and non-synchronized measurements system models Presents a novel, extended optimization, physics-based model which identifies and corrects for measurement error presently egregiously discounted in classic models Demonstrates how to embed cyber-physical security into smart grids for real-time monitoring Introduces new approaches to calculate power flow in distribution systems and for estimating distribution system states Incorporates machine-learning based approaches to complement the state estimation process, including pattern recognition-based solutions, principal component analysis and support vector machines