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System Identification - Tien C. Hsia - 1977

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.

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The method of least squares was discovered by Gauss in 1795. It has since become the principal tool to reduce the influence of errors when fitting models to given observations. Today, applications of least squares arise in a great number of scientific areas, such as statistics, geodesics, signal processing, and control. In the last 20 years there has been a great increase in the capacity for automatic data capturing and computing. Least squares problems of large size are now routinely solved. Tremendous progress has been made in numerical methods for least squares problems, in particular for generalized and modified least squares problems and direct and iterative methods for sparse problems. Until now there has not been a monograph that covers the full spectrum of relevant problems and methods in least squares. This volume gives an in-depth treatment of topics such as methods for sparse least squares problems, iterative methods, modified least squares, weighted problems, and constrained and regularized problems. The more than 800 references provide a comprehensive survey of the available literature on the subject.

Orthogonal Least Squares Methods and Their Application to Nonlinear System Identification - S. Chen - 1988

Orthogonal Least Squares Methods and Their Application to Nonlinear System Identification - S. Chen - 1968

Statistical Techniques for Transportation Engineering - Kumar Molugaram - 2017-03-03
Statistical Techniques for Transportation Engineering is written with a systematic approach in mind and covers a full range of data analysis topics, from the introductory level (basic probability, measures of dispersion, random variable, discrete and continuous distributions) through more generally used techniques (common statistical distributions, hypothesis testing), to advanced analysis and statistical modeling techniques (regression, Anova, and time series). The book also provides worked out examples and solved problems for a wide variety of transportation engineering challenges. Demonstrates how to effectively interpret, summarize, and report transportation data using appropriate statistical descriptors. Teaches how to identify and apply appropriate analysis methods for transportation data. Explains how to evaluate transportation proposals and schemes with statistical rigor.

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Least squares methods based on first-order systems have been recently proposed and analyzed for second-order
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Domain Decomposition Algorithms for First-order System Least Squares Methods - Luca F. Pavarino -
1996

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This book presents an overview of the different errors-in-variables (EIV) methods that can be used for system
identification. Readers will explore the properties of an EIV problem. Such problems play an important role when
the purpose is the determination of the physical laws that describe the process, rather than the prediction or
control of its future behaviour. EIV problems typically occur when the purpose of the modelling is to get physical
insight into a process. Identifiability of the model parameters for EIV problems is a non-trivial issue, and sufficient
conditions for identifiability are given. The author covers various modelling aspects which, taken together, can
find a solution, including the characterization of noise properties, extension to multivariable systems, and
continuous-time models. The book finds solutions that are constituted of methods that are compatible with a set of
noisy data, which traditional approaches to solutions, such as (total) least squares, do not find. A number of
identification methods for the EIV problem are presented. Each method is accompanied with a detailed analysis
based on statistical theory, and the relationship between the different methods is explained. A multitude of
methods are covered, including: instrumental variables methods; methods based on bias-compensation;
covariance matching methods; and prediction error and maximum-likelihood methods. The book shows how many of
the methods can be applied in either the time or the frequency domain and provides special methods adapted to
the case of periodic excitation. It concludes with a chapter specifically devoted to practical aspects and user

Errors-in-Variables Methods in System Identification gives readers the possibility of recovering true system dynamics from
noisy measurements, while solving over-determined systems of equations, making it suitable for statisticians and
mathematicians alike. The book also acts as a reference for researchers and computer engineers because of its
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Least-Squares Finite Element Methods - Pavel B. Bochev - 2009-04-28

Since their emergence, finite element methods have taken a place as one of the most versatile and powerful
methodologies for the approximate numerical solution of Partial Differential Equations. These methods are used in
incompressible fluid flow, heat transfer, and other problems. This book provides researchers and practitioners
with a concise guide to the theory and practice of least-square finite element methods, their strengths and
weaknesses, established successes, and open problems.


Regulation of Economic Systems by Linear Least-squares Methods - Alastair MacCormick - 1969

The Least-Squares Finite Element Method - Bo-nan Jiang - 2013-03-14

The Least-Squares Finite Element Method - Bo-nan Jiang - 2013-03-14

Recent Advances in Total Least Squares Techniques and Errors-in-variables Modeling - Sabine van Huffel - 1997-01-01

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Advanced Kalman Filtering, Least-squares and Modeling - Bruce P. Gibbs - 2011-03-29

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Methods for deciding on the “best” model are also presented. A second goal is to present little known extensions of least squares estimation or Kalman filtering that provide guidance on model structure and parameters, or make the estimator more robust to changes in real-world behavior. A third goal is discussion of implementation issues that make the estimator more accurate or efficient, or that make it flexible so that model alternatives can be easily compared. The fourth goal is to provide the designer/analist with guidance in evaluating estimator performance and in determining/correcting problems. The final goal is to provide a subroutine library that simplifies implementation, and flexible general purpose high-level drivers that allow both easy analysis of alternative models and access to extensions of the basic filtering. Supplemental materials and up-to-date errata are downloadable at http://booksupport.wiley.com.


Teaches students about classical and nonclassical adaptive systems within one pair of covers Helps tutors with time-saving course plans, ready-made practical assignments and examination guidance The recently developed "practical sub-space adaptive filter" allows the reader to combine any set of classical and/or non-classical adaptive systems to form a powerful technology for solving complex nonlinear problems


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New Perspectives in Partial Least Squares and Related Methods - Herve Abdi - 2013-10-17

New Perspectives in Partial Least Squares and Related Methods shares original, peer-reviewed research from presentations during the 2012 partial least squares methods meeting (PLS 2012). This was the 7th meeting in the series of PLS conferences and the first to take place in the USA. PLS is an abbreviation for Partial Least Squares and is latent structure analysis as an approach for modeling relations between data matrices of different types of variables measured on the same set of objects. The twenty-two papers in this volume, which include three invited contributions from our keynote speakers, provide a comprehensive overview of the current state of the most advanced research related to PLS and related methods. Prominent scientists from around the world took part in PLS 2012 and their contributions covered the multiple dimensions of the partial least squares-based methods. These exciting theoretical developments ranged from partial least squares regression and correlation, component based path modeling to regularized regression and subspace visualization. In following the tradition of the six previous PLS meetings, these contributions also included a large variety of PLS approaches such as PLS metamodels, variable selection, sparse PLS regression, distance based PLS, significance vs. reliability, and non-linear PLS. Finally, these contributions applied PLS methods to data originating from the traditional econometric/economic data to genomics data, brain images, information systems, epidemiology, and chemical spectroscopy. Such a broad and comprehensive volume will also encourage new uses of PLS models in work by researchers and students in many fields.

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A Least Squares Method for Improving the Source Location of Rock Noise - Fred Leighton - 1972

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Least Squares Data Fitting with Applications - Per Christian Hansen - 2013-01-15

As one of the classical statistical regression techniques, and often the first to be taught to new students, least squares fitting can be a very effective tool in data analysis. Given measured data, we establish a relationship between independent and dependent variables so that we can use the data predictively. The main concern of Least Squares Data Fitting with Applications is how to do this on a computer with efficient and robust computational methods for linear and nonlinear relationships. The presentation also establishes a link between the statistical setting and the computational issues. In a number of applications, the accuracy and efficiency of the least squares fit is central, and Per Christian Hansen, Victor Pereyra, and Godela Scherer survey modern computational methods and illustrate them in fields ranging from engineering and environmental sciences to geophysics. Anyone working with problems of linear and nonlinear least squares fitting will find this book invaluable as a hands-on guide, with accessible text and carefully explained problems. Included are • an overview of computational methods together with their properties and advantages • topics from statistical regression analysis that help readers to understand and evaluate the computational aspects • many examples that illustrate the techniques and algorithms Least Squares Data Fitting with Applications can be used as a textbook for advanced undergraduate or graduate courses and professionals in the sciences and in engineering.

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Numerical Methods for Least Squares Problems - Ake Björck - 1996-12-01

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Nonlinear Systems - - 2020-05-13

The editors of this book have incorporated contributions from a diverse group of leading researchers in the field of nonlinear systems and some aspects of fractional calculus. The main subject areas are divided into two theoretical and applied sections. Nonlinear systems are useful for researchers in mathematics, applied mathematics, and physics, as well as graduate students who are studying these systems with reference to their theory and application. This book is also an ideal complement to the specific literature on engineering, biology, health science, and other applied science areas. The opportunity given by IntechOpen to offer this book under the open access system contributes to disseminating the field of nonlinear systems to a wide range of researchers.

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Parameter Estimation and Inverse Problems - Richard C. Aster - 2013

Parameter Estimation and Inverse Problems, Second Edition provides geoscience students and professionals with answers to common questions like how one can derive a physical model from a finite set of observations containing errors, and how one may determine the quality of such a model. This book takes on these fundamental and challenging problems, introducing students and professionals to the broad range of approaches that lie in the realm of inverse theory. The authors present both the underlying theory and practical algorithms for solving inverse problems. The authors’ treatment is appropriate for geoscience graduate students and advanced undergraduates with a basic working knowledge of calculus, linear algebra, and statistics. Parameter Estimation and Inverse Problems, Second Edition introduces readers to both linear and nonlinear problems with particular attention paid to computational, mathematical, and statistical issues related to their application to geophysical problems. The textbook includes Appendices covering essential linear algebra, statistics, and notation in the context of the subject. Includes appendices for review of needed concepts in linear, statistics, and vector calculus. Accessible to students and professionals without a highly specialized mathematical background.

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Domain Decomposition Algorithms for First-Order System Least Squares Methods - National Aeronautics and Space Administration (NASA) - 2018-07-02

Least squares methods based on first-order systems have been recently proposed and analyzed for second-order elliptic equations and systems. They produce symmetric and positive definite discrete systems by using standard finite element spaces, which are not required to satisfy the inf-sup condition. In this paper, several domain...
least-squares-methods-for-system-identification

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Electrical Load Forecasting - S.A. Soliman - 2010-05-26
Succinct and understandable, this book is a step-by-step guide to the mathematics and construction of electrical load forecasting models. Written by one of the world's foremost experts on the subject, Electrical Load Forecasting provides a brief discussion of algorithms, their advantages and disadvantages and when they are best utilized. The book begins with a good description of the basic theory and models needed to truly understand how the models are prepared so that they are not just blindly plugging and chugging numbers. This is followed by a clear and rigorous exposition of the statistical techniques and algorithms such as regression, neural networks, fuzzy logic, and expert systems. The book is also supported by an online computer program that allows readers to construct, validate, and run short and long term models. Step-by-step guide to model construction Construct, verify, and run short and long term models Accurately evaluate load shape and pricing Create regional specific electrical load models

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Scattered Data Approximation - Holger Wendland - 2004-12-13
Many practical applications require the reconstruction of a multivariate function from discrete, unstructured data. This book gives a self-contained, complete introduction into this subject. It concentrates on truly meshless methods such as radial basis functions, moving least squares, and partitions of unity. The book starts with an overview on typical applications of scattered data approximation, coming from surface reconstruction, fluid-structure interaction, and the numerical solution of partial differential equations. It then leads the reader from basic properties to the current state of research, addressing all important issues, such as existence, uniqueness, approximation properties, numerical stability, and efficient implementation. Each chapter ends with a section giving information on the historical background and hints for further reading. Complete proofs are included, making this perfectly suited for graduate courses on multivariate approximation and it can be used to support courses in computer-aided geometric design, and meshless methods for partial differential equations.

Solving Least Squares Problems - Charles L. Lawson - 1995-12-01
This Classic edition includes a new appendix which summarizes the major developments since the book was originally published in 1974. The additions are organized in short sections associated with each chapter. An additional 230 references have been added, bringing the bibliography to over 400 entries. Appendix C has been edited to reflect changes in the associated software package and software distribution method.

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Methods in Systems Biology - - 2011-09-19
Systems biology is a term used to describe a number of trends in bioscience research and a movement that draws on those trends. This volume in the Methods in Enzymology series comprehensively covers the methods in systems biology. With an international board of authors, this volume is split into sections that cover subjects such as machines for systems biology, protein production and quantification for systems biology, and enzymatic assays in systems biology research. This volume in the Methods in Enzymology series comprehensively covers the methods in systems biology. With an international board of authors, this volume is split into sections that cover subjects such as machines for systems biology, protein production and quantification for systems biology, and enzymatic assays in systems biology research.

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A Numerical Least-square Method for Resolving Complex Pulse Height Spectra - Jacob I. Trombka - 1968
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Introduction to Modeling in Physiology and Medicine - Claudio Cobelli - 2008-02-06
This unified modeling textbook for students of biomedical engineering provides a complete course text on the foundations, theory and practice of modeling and simulation in physiology and medicine. It is dedicated to the needs of biomedical engineering and clinical students, supported by applied BME applications and examples. Developed for biomedical engineering and related courses: speaks to BME students at a level and in a language appropriate to their needs, with an interdisciplinary clinical/engineering approach, quantitative basis, and many applications to enhance learning Delivers a quantitative approach to modeling and also covers simulation: the perfect foundation text for studies across BME and medicine Extensive case studies and engineering applications from BME, plus end-of-chapter exercises
of related interest. Nonlinear Regression Analysis and its Applications Douglas M. Bates and Donald G. Watts. "an extraordinary presentation of concepts and methods concerning the use and analysis of nonlinear regression models. highly recommend[ed], for anyone needing to use and/or understand issues concerning the analysis of nonlinear regression models. " --Technometrics This book provides a balance between theory and practice supported by extensive displays of instructive geometrical constructs. Numerous in-depth case studies illustrate the use of nonlinear regression analysis--with all data sets real. Topics include: multi-response parameter estimation; models defined by systems of differential equations; and improved methods for presenting inferential results of nonlinear analysis. 1988 (0-471-81643-4) 365 pp. Nonlinear Regression G. A. F. Seber and C. J. Wild. "[a] comprehensive and scholarly work.impressively thorough with attention given to every aspect of the modeling process." --Short Book Reviews of the International Statistical Institute In this introduction to nonlinear modeling, the authors examine a wide range of estimation techniques including least squares, quasi-likelihood, and Bayesian methods, and discuss some of the problems associated with estimation. The book presents new and important material relating to the concept of curvature and its growing role in statistical inference. It also covers three useful classes of models --growth, compartmental, and multiphase --and emphasizes the limitations involved in fitting these models. Packed with examples and graphs, it offers statisticians, statistical consultants, and statistically oriented research scientists up-to-date access to their fields. 1989 (0-471-61760-1) 768 pp.

Recession Basics - Leo H. Kahane - 2007-11-28

Using a friendly, nontechnical approach, the Second Edition of Recession Basics introduces readers to the fundamentals of recession. Accessible to anyone with an introductory statistics background, this book builds from a simple two-variable model to a model of greater complexity. Author Leo H. Kahane weaves four engaging examples throughout the text to illustrate not only the techniques of regression but also how this empirical tool can be applied in creative ways to consider a broad array of topics. New to the Second Edition • Offers greater coverage of the availability of panel data--Because the data is not time-series, there are end-of-chapter problems. This new edition includes coverage of estimation with multiple cross-sections of data across time. • Provides an introductory discussion of omitted variables bias: As a problem that frequently arises, this issue is important for those new to regression analysis to understand. • Includes up-to-date advances: Chapter 7 is expanded to include recent developments in regression. • Uses a diverse selection of examples: Engaging examples illustrate the wide application of regression analysis from baseball salaries to presidential voting to British crime rates to U.S. abortion rates and more. • Includes end-of-chapter problems. This edition offers new questions at the end of chapters that are based on the new examples woven through the book. • Illustrates examples using software programs: Appendix B now includes screenshots to further aid readers working with Microsoft Excel® and SPSS. Intended Audience This is an ideal core or supplemental text for advanced undergraduate and graduate courses such as Regression and Correlation, Sociological Research Methods, Quantitative Research Methods, and Statistical Methods in the fields of economics, public policy, political science, sociology, public affairs, urban planning, education, and geography.

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important for those new to regression analysis to understand. • Includes up-to-date advances: Chapter 7 is expanded to include recent developments in regression. • Uses a diverse selection of examples: Engaging examples illustrate the wide application of regression analysis from baseball salaries to presidential voting to British crime rates to U.S. abortion rates and more. • Includes more end-of-chapter problems: This edition offers new questions at the end of chapters that are based on the new examples woven through the book. • Illustrates examples using software programs: Appendix B now includes screenshots to further aid readers working with Microsoft Excel® and SPSS. Intended Audience This is an ideal core or supplemental text for advanced undergraduate and graduate courses such as Regression and Correlation, Sociological Research Methods, Quantitative Research Methods, and Statistical Methods in the fields of economics, public policy, political science, sociology, public affairs, urban planning, education, and geography.

Estimation of Simultaneous Systems of Linear Equations with Nonlinear Constraints Among the Coefficients - Peter Ole Anderson - 1969

The basic problem considered here is the estimation of the coefficients in a simultaneous system of linear equations. Maximum likelihood, linearized maximum likelihood, two-stage least-squares and three-stage least-squares methods have primarily been studied for the case of linear constraints among the coefficients. In this paper the case of nonlinear constraints is considered. It is shown that by linearizing the nonlinear constraints and using a three-stage least-squares procedure one can obtain similar large sample, and also small sigma, results. (Author).

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Understanding Least Squares Estimation and Geomatics Data Analysis - John Olusegun Ogundare - 2018-10-05

Provides a modern approach to least squares estimation and data analysis for undergraduate land surveying and geomatics programs Rich in theory and concepts, this comprehensive book on least square estimation and data analysis provides examples that are designed to help students extend their knowledge to solving more practical problems. The sample problems are accompanied by suggested solutions, and are challenging, yet easy enough to manually work through using simple computing devices, and chapter objectives provide an overview of the material contained in each section. Understanding Least Squares Estimation and Geomatics Data Analysis begins with an explanation of survey observables, observations, and their stochastic properties. It reviews matrix structure and construction and explains the needs for adjustment. Next, it discusses analysis and error propagation of survey observations, including the application of heuristic rule for covariance propagation. Then, the important elements of statistical distributions commonly used in geomatics are discussed. Main topics of the book include: concepts of datum definitions; the formulation and linearization of parametric, conditional and general model equations involving typical geomatics observables; geomatics problems; least squares adjustments of parametric, conditional and general models; confidence region estimation; problems of network design and pre-analysis; three-dimensional geodetic network adjustment; nuisance parameter elimination and the sequential least squares adjustment; post-adjustment data analysis and reliability; the problems of datum; mathematical filtering and prediction; an introduction to least squares collocation and the kriging methods; and more. Contains ample concepts/theory and content, as well as practical and workable examples Based on the author's manual, which he developed as a complete and comprehensive book for his Adjustment of Surveying Measurements and Special Topics in Adjustments courses Provides geomatics undergraduates and geomatics professionals with required foundational knowledge An excellent companion to Precision Surveying: The Principles and Geomatics Practice Understanding Least Squares Estimation and Geomatics Data Analysis is recommended for undergraduates studying geomatics, and will benefit many readers from a variety of geomatics backgrounds, including practicing surveyors/engineers who are interested in least squares estimation and data analysis, geomatics researchers, and software developers for geomatics.


A Selected Annotated Bibliography on the Analysis of Water Resource Systems - - 1974

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