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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

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.

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.

Errors-in-Variables Methods in System Identification - Torsten Söderström 2018-04-07

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 perspectives that will facilitate the transfer of the theoretical material to application in real systems. 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 detailed exploration of EIV problems.

Recursive System Identification Using Least Squares Method - Gholamreza Ghorbani Moghadam 1989

Identification of Continuous Systems - Heinz Unbehauen 1987

Bringing together important advances in the field of continuous system identification, this book deals with both parametric and nonparametric methods. It pays special attention to the problem of retaining continuous model parameters in the estimation equations, to which all the existing techniques used in estimating discrete models may be applied. It is aimed at both the academic researcher and the control engineer in industry. The techniques covered range from certain simple numerical or graphical methods applicable to some of the frequently encountered model forms, to attractive recursive algorithms for continuous model identification suitable for real time implementation. These include the recent methods based on orthogonal functions such as those of Walsh and Poisson moment functionals. Some techniques based on stable model adaptation principles are also presented and illustrated.

Total Least Squares and Errors-in-Variables Modeling - S. van Huffel 2013-03-14

In response to a growing interest in Total Least Squares (TLS) and Errors-In-Variables (EIV) modeling by researchers and practitioners, well-known experts from several disciplines were invited to prepare an overview paper and present it at the third international workshop on TLS and EIV modeling held in Leuven, Belgium, August 27-29, 2001. These invited papers, representing two-thirds of the book, together with a selection of other presented contributions yield a complete overview of the main scientific achievements since 1996 in TLS and Errors-In-Variables modeling. In this way, the book nicely completes two earlier books on TLS (SIAM 1991 and 1997). Not only computational issues, but also statistical, numerical, algebraic properties are described, as well as many new generalizations and applications. Being aware of the growing interest in these techniques, it is a strong belief that this book will aid and stimulate users to apply the new techniques and models correctly to their own practical problems.

Subspace Methods for System Identification - Tohru Katayama 2005-06-15

An in-depth introduction to subspace methods for system identification in discrete-time linear systems thoroughly augmented with advanced and novel results, this text is structured into three parts. Part I deals with the mathematical preliminaries: numerical linear algebra; system theory; stochastic processes; and Kalman filtering. Part II explains realization theory as applied to subspace identification. Stochastic realization results based on spectral factorization and Riccati equations, and on canonical correlation analysis for stationary processes are included. Part III demonstrates the closed-loop application of subspace identification methods. Subspace Methods for System Identification is an excellent reference for researchers and a useful text for tutors and graduate students involved in control and signal processing courses. It can be used for self-study and will be of interest to applied scientists or engineers wishing to use advanced methods in modeling and identification of complex systems.

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, new comers, industrial and education practitioners and graduate students alike.

Instrumental Variable Methods for System Identification - T. Söderström 1983-09

System Identification - Lennart Ljung 1998-12-29 The field's leading text, now completely updated. Modeling dynamical systems — theory, methodology, and applications. Lennart Ljung's System Identification: Theory for the User is a complete, coherent description of the theory, methodology, and practice of System Identification. This completely revised Second Edition introduces subspace methods, methods that utilize frequency domain data, and general non-linear black box methods, including neural networks and neuro-fuzzy modeling. The book contains many new computer-based examples designed for Ljung's market-leading software, System Identification Toolbox for MATLAB. Ljung combines careful mathematics, a practical understanding of real-world applications, and extensive exercises. He introduces both black-box and tailor-made models of linear as well as non-linear systems, and he describes principles, properties, and algorithms for a variety of identification techniques: Nonparametric time-domain and frequency-domain methods. Parameter estimation methods in a general prediction error setting. Frequency domain data and frequency domain interpretations.

Asymptotic analysis of parameter estimates. Linear regressions, iterative search methods, and other ways to compute estimates. Recursive (adaptive) estimation techniques. Ljung also presents detailed coverage of the key issues that can make or break system identification projects, such as defining objectives, designing experiments, controlling the bias distribution of transfer-function estimates, and carefully validating the resulting models. The first edition of System Identification has been the field's most widely cited reference for over a decade. This new edition will be the new text of choice for anyone concerned with system identification theory and practice.

Nonlinear System Identification - Stephen A. Billings 2013-09-23 Nonlinear System Identification: NARMAX Methods in the Time, Frequency, and Spatio-Temporal Domains describes a comprehensive framework for the identification and analysis of nonlinear dynamic systems in the time, frequency, and spatio-temporal domains. This book is written with an emphasis on making the algorithms accessible so that they can be applied and used in practice. Includes coverage of: The NARMAX (nonlinear autoregressive moving average with exogenous inputs) model The orthogonal least squares algorithm that allows models to be built term by term where the error reduction ratio reveals the percentage contribution of each model term Statistical and qualitative model validation methods that can be applied to any model class Generalised frequency response functions which provide significant insight into nonlinear behaviours A completely new class of filters that can move, split, spread, and focus energy The response spectrum map and the study of sub harmonic and severely nonlinear systems Algorithms that can track rapid time variation in both linear and nonlinear systems The important class of spatio-temporal systems that evolve over both space and time Many case study examples from modelling space weather, through identification of a model of the visual processing system of fruit flies, to tracking causality in EEG data are all included to demonstrate how easily the methods can be applied in practice and to show the insight that the algorithms reveal even for complex systems NARMAX algorithms provide a fundamentally different approach to nonlinear system identification and signal processing for nonlinear systems. NARMAX methods provide models that are transparent, which can easily be analysed, and which can be used to solve real problems. This book is intended for graduates, postgraduates and researchers in the sciences and engineering, and also for users from other fields who have collected data and who wish to identify models to help to understand the dynamics of their systems.

System Identification - Torsten Söderström 1989
A textbook designed for senior undergraduate and graduate level classroom courses on system identification. Examples and problems. Annotation copyrighted by Book News, Inc., Portland, OR

System Identification - R. Isermann 2014-05-23
System Identification is a special section of the International Federation of Automatic Control (IFAC)-Journal Automatica that contains tutorial papers regarding the basic methods and procedures utilized for system identification. Topics include modeling and identification; step response and frequency response methods; correlation methods; least squares parameter estimation; and maximum likelihood and prediction error

methods. After analyzing the basic ideas concerning the parameter estimation methods, the book elaborates on the asymptotic properties of these methods, and then investigates the application of the methods to particular model structures. The text then discusses the practical aspects of process identification, which includes the usual, general procedures for process identification; selection of input signals and sampling time; offline and on-line identification; comparison of parameter estimation methods; data filtering; model order testing; and model verification. Computer program packages are also discussed. This compilation of tutorial papers aims to introduce the newcomers and non-specialists in this field to some of the basic methods and procedures used for system identification.

System Identification - Tien C. Hsia 1977

Identification of Continuous-Time Systems - N.K. Sinha 2012-12-06

In view of the importance of system identification, the International Federation of Automatic Control (IFAC) and the International Federation of Operational Research Societies (IFORS) hold symposia on this topic every three years. Interest in continuous time approaches to system identification has been growing in recent years. This is evident from the fact that the of invited sessions on continuous time systems has increased from one in the 8th number Symposium that was held in Beijing in 1988 to three in the 9th Symposium in Budapest in 1991. It was during the 8th Symposium in August 1988 that the idea of bringing together important results on the topic of Identification of continuous time systems was conceived. Several distinguished colleagues, who were with us in Beijing at that time, encouraged us by promising on the spot to contribute to a comprehensive volume of collective work. Subsequently, we contacted colleagues all over the world, known for their work in this area, with a formal request to contribute to the proposed volume. The response was prompt and overwhelmingly encouraging. We sincerely thank all the authors for their valuable contributions covering various aspects of identification of continuous time systems.

Applied System Identification - Jer-Nan Juang 1994

System identification is the process of developing or improving a mathematical representation of a physical system using experimental data. Over the past decade, several system identification techniques have been developed within different disciplines. This text/reference brings together the significant advances over the past decade into a single unified source -- with common mathematical notation that will enable readers from a variety of engineering areas -- e.g., aerospace, electrical, civil, and mechanical engineering --to apply system identification to engineering systems. Focuses on the three types of identification in engineering structures -- modal parameter identification; structural-model parameter identification; and control-model identification. For researchers and engineers, students, and teachers in vibrations, controls and system identification.

System Identification - Rik Pintelon 2012-04-04

System identification is a general term used to describe mathematical tools and algorithms that build dynamical models from measured data. Used for prediction, control, physical interpretation, and the designing of any electrical systems, they are vital in the fields of electrical, mechanical, civil, and chemical engineering. Focusing mainly on frequency domain techniques, System Identification: A Frequency Domain Approach, Second Edition also studies in detail the similarities and differences with the classical time domain approach. It high??lights many of the important steps in the identification process, points out the possible pitfalls to the reader, and illustrates the powerful tools that are available. Readers of this Second Editon will benefit from: MATLAB software support for identifying multivariable systems that is freely available at the website http://booksupport.wiley.com State-of-the-art system identification methods for both time and frequency domain data New chapters on non-parametric and parametric transfer function modeling using (non-)period excitations Numerous examples and figures that facilitate the learning process A simple writing style that allows the reader to learn more about the theo??retical aspects of the proofs and algorithms Unlike other books in this field, System Identification, Second Edition is ideal for practicing engineers, scientists, researchers, and both master's and PhD students in electrical, mechanical, civil, and chemical engineering.

Applied Control Systems Design - Magdi S. Mahmoud 2012-04-13

Applied Control System Design examines several methods for building up systems models based on real experimental data from typical industrial processes and incorporating system identification techniques. The text takes a comparative approach to the models derived in this way judging their suitability for use in different systems and under different operational circumstances. A broad spectrum of control methods including various forms of filtering, feedback and feedforward control is applied to the models and the guidelines derived from the closed-loop responses are then composed into a concrete self-tested recipe to serve as a check-list for industrial engineers or control designers. System identification and control design are given equal weight in model derivation and testing to reflect their equality of importance in the proper design and optimization of high-performance control systems. Readers' assimilation of the material discussed is assisted by the provision of problems and examples. Most of these exercises use MATLAB® to make computation and visualization more straightforward. Applied Control System Design will be of interest to academic researchers for its comparison of different systems models and their response to different control methods and will assist graduate students in learning the practical necessities of advanced control system design. The consistent reference to real systems coupled with self-learning tools will assist control practitioners who wish to keep up to date with the latest control design ideas.

Identification of Continuous-Time Systems

- Allamaraju Subrahmanyam 2019-12-06

Models of dynamical systems are required for various purposes in the field of systems and control. The models are handled either in discrete time (DT) or in continuous time (CT). Physical systems give rise to models only in CT because they are based on physical laws which are invariably in CT. In system identification, indirect methods provide DT models which are then converted into CT. Methods of directly identifying CT models are preferred to the indirect methods for various reasons. The direct methods involve a primary stage of signal processing, followed by a secondary stage of parameter estimation. In the primary stage, the measured signals are processed by a general linear dynamic operation—computational or realized through prefilters, to preserve the system parameters in their native CT form—and the literature is rich on this aspect. In this book: Identification of Continuous-Time Systems-Linear and Robust Parameter Estimation, Allamaraju Subrahmanyam and Ganti Prasada Rao consider CT system models that are linear in their unknown parameters and propose robust methods of estimation. This book complements the existing literature on the identification of CT systems by enhancing the secondary stage through linear and robust estimation. In this book, the authors provide an overview of CT system identification, consider Markov-parameter models and time-moment models as simple linear-in-parameters models for CT system identification, bring them into mainstream model parameterization via basis functions, present a methodology to robustify the recursive least squares algorithm for parameter estimation of linear regression models, suggest a simple off-line error quantification scheme to show that it is possible to quantify error even in the absence of informative priors, and indicate some directions for further research. This modest volume is intended to be a useful addition to the literature on identifying CT systems.

Exact and Approximate Modeling of Linear Systems - Ivan Markovsky 2006-01-01

This title elegantly introduces the behavioral approach to mathematical modeling, an approach that requires models to be viewed as sets of possible outcomes rather than to be a priori bound to particular representations. The authors discuss exact and approximate fitting of data by linear, bilinear, and quadratic static models and linear dynamic models, a formulation that enables readers to select the most suitable representation for a particular purpose. This book presents exact subspace-type and approximate optimization-based identification methods, as well as representation-free problem formulations, an overview of solution approaches, and software implementation. Readers will find an exposition of a wide variety of modeling problems starting from observed data. The presented theory leads to algorithms that are implemented in C language and in MATLAB.

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

System Identification - Karel J. Keesman 2011-05-16

System Identification shows the student reader how to approach the system identification problem in a systematic fashion. The process is divided into three basic steps: experimental design and data collection; model structure selection and parameter estimation; and model validation, each of which is the subject of one or more parts of the text. Following an introduction on system theory, particularly in relation to model representation and model properties, the book contains four parts covering: • data-based identification – non-parametric methods for use when prior system knowledge is very limited; • time-invariant identification for systems with constant parameters; • time-varying systems identification, primarily with recursive

estimation techniques; and • model validation methods. A fifth part, composed of appendices, covers the various aspects of the underlying mathematics needed to begin using the text. The book uses essentially semi-physical or gray-box modeling methods although data-based, transfer-function system descriptions are also introduced. The approach is problem-based rather than rigorously mathematical. The use of finite input-output data is demonstrated for frequency- and time-domain identification in static, dynamic, linear, nonlinear, time-invariant and time-varying systems. Simple examples are used to show readers how to perform and emulate the identification steps involved in various control design methods with more complex illustrations derived from real physical, chemical and biological applications being used to demonstrate the practical applicability of the methods described. End-of-chapter exercises (for which a downloadable instructors' Solutions Manual is available from fill in URL here) will both help students to assimilate what they have learned and make the book suitable for self-tuition by practitioners looking to brush up on modern techniques. Graduate and final-year undergraduate students will find this text to be a practical and realistic course in system identification that can be used for assessing the processes of a variety of engineering disciplines. System Identification will help academic instructors teaching control-related to give their students a good understanding of identification methods that can be used in the real world without the encumbrance of undue mathematical detail.
Cluster Analysis for Data Mining and System Identification - János Abonyi 2007-08-10
The aim of this book is

to illustrate that advanced fuzzy clustering algorithms can be used not only for partitioning of the data. It can also be used for visualization, regression, classification and time-series analysis, hence fuzzy cluster analysis is a good approach to solve complex data mining and system identification problems. This book is oriented to undergraduate and postgraduate and is well suited for teaching purposes.

Optimized System Identification - Jer-Nan Juang 1999

In system identification, one usually cares most about finding a model whose outputs are as close as possible to the true system outputs when the same input is applied to both. However, most system identification algorithms do not minimize this output error. Often they minimize model equation error instead, as in typical least-squares fits using a finite-difference model, and it is seen here that this distinction is significant. Here, we develop a set of system identification algorithms that minimize output error for multi-input/multi-output and multi-input/single-output systems. This is done with sequential quadratic programming iterations on the nonlinear least-squares problems, with an eigendecomposition to handle indefinite second partials. This optimization minimizes a nonlinear function of many variables, and hence can converge to local minima. To handle this problem, we start the iterations from the OKID (Observer/Kalman Identification) algorithm result. Not only has OKID proved very effective in practice, it minimizes an output error of an observer which has the property that as the data set gets large, it converges to minimizing the criterion of interest here. Hence, it is a particularly good starting point for the nonlinear iterations here. Examples show that the methods developed here eliminate the bias that is often observed using any system identification methods of either over-estimating or under-estimating the damping of vibration modes in lightly damped structures.

Linear Parameter-varying System Identification - Paulo Lopes dos Santos 2012

This review volume reports the state-of-the-art in Linear Parameter Varying (LPV) system identification. It focuses on the most recent LPV identification methods for both discrete-time and continuous-time models--

Mastering System Identification in 100 Exercises - Johan Schoukens 2012-04-02

This book enables readers to understand system identification and linear system modeling through 100 practical exercises without requiring complex theoretical knowledge. The contents encompass state-of-the-art system identification methods, with both time and frequency domain system identification methods covered, including the pros and cons of each. Each chapter features MATLAB exercises, discussions of the exercises, accompanying MATLAB downloads, and larger projects that serve as potential assignments in this learn-by-doing resource.

Control, Identification, and Input Optimization - Robert Kalaba 2012-12-06

This book is a self-contained text devoted to the numerical determination of optimal inputs for system identification. It presents the current state of optimal inputs with extensive background material on optimization and system identification. The field of optimal inputs has been an area of considerable research recently with important advances by R. Mehra, G. c. Goodwin, M. Aoki, and

N. E. Nahi, to name just a few eminent in vestigators. The authors' interest in optimal inputs first developed when F. E. Yates, an eminent physiologist, expressed the need for optimal or preferred inputs to estimate physiological parameters. The text assumes no previous knowledge of optimal control theory, numerical methods for solving two-point boundary-value problems, or system identification. As such it should be of interest to students as well as researchers in control engineering, computer science, biomedical en gineering, operations research, and economics. In addition the sections on beam theory should be of special interest to mechanical and civil en gineers and the sections on eigenvalues should be of interest to numerical analysts. The authors have tried to present a balanced viewpoint; however, primary emphasis is on those methods in which they have had first-hand experience. Their work has been influenced by many authors. Special acknowledgment should go to those listed above as well as R. Bellman, A. Miele, G. A. Bekey, and A. P. Sage. The book can be used for a two-semester course in control theory, system identification, and optimal inputs.

Nonlinear system identification. 1. Nonlinear system parameter identification - Robert Haber 1999

On Line Modified Least Squares System Identification in the Presence of Correlated Noise - Anthony Hoo Che Leung 1974

Quadratically Constrained Least Squares Identification and Nonlinear System Identification Using Hammerstein/nonlinear Feedback Models - Tobin H. Van Pelt 2000

Nonlinear System Identification - Oliver Nelles 2013-03-09 Written from an engineering point of view, this book covers the most common and important approaches for the identification of nonlinear static and dynamic systems. The book also provides the reader with the necessary background on optimization techniques, making it fully self-contained. The new edition includes exercises.

Regularized System Identification - Gianluigi Pillonetto 2022-05-13

This open access book provides a comprehensive treatment of recent developments in kernel-based identification that are of interest to anyone engaged in learning dynamic systems from data. The reader is led step by step into understanding of a novel paradigm that leverages the power of machine learning without losing sight of the system-theoretical principles of black-box identification. The authors' reformulation of the identification problem in the light of regularization theory not only offers new insight on classical questions, but paves the way to new and powerful algorithms for a variety of linear and nonlinear problems. Regression methods such as regularization networks and support vector machines are the basis of techniques that extend the function-estimation problem to the estimation of dynamic models. Many examples, also from real-world applications, illustrate the comparative advantages of the new nonparametric approach with respect to classic parametric prediction error methods. The challenges it addresses lie at the intersection of several disciplines so Regularized System Identification will be of interest to a variety of researchers and practitioners in the areas of control systems, machine learning, statistics, and data science. This is an open access book.

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.

Trends and Progress in System Identification - Pieter Eykhoff

2014-05-20
Trends and Progress in System Identification is a three-part book that focuses on model considerations, identification methods, and experimental conditions involved in system identification. Organized into 10 chapters, this book begins with a discussion of model method in system identification, citing four examples differing on the nature of the models involved, the nature of the fields, and their goals. Subsequent chapters describe the most important aspects of model theory; the ""classical"" methods and time series estimation; application of least squares and related techniques for the estimation of dynamic system parameters; the maximum likelihood and error prediction methods; and the modern development of statistical methods. Non-parametric approaches, identification of nonlinear systems by piecewise approximation, and the minimax identification are then explained. Other chapters explore the Bayesian approach to system identification; choice of input signals; and choice and effect of different feedback configurations in system identification. This book will be useful for control engineers, system scientists, biologists, and members of other disciplines dealing withdynamical relations.

Frequency Domain State-space System Identification - Chung-Wen Chen 1992

Least Squares Method of System Identification for Multivariable Linear Systems - Keith Randall Holstine 1987

System Identification Parameter and State Estimation - P. Eykhoff 1974-05-23

Identification of Linear Systems - J. Schoukens 2014-06-28
This book concentrates on the problem of

accurate modeling of linear systems. It presents a thorough description of a method of modeling a linear dynamic invariant system by its transfer function. The first two chapters provide a general introduction and review for those readers who are unfamiliar with identification theory so that they have a sufficient background knowledge for understanding the methods described later. The main body of the book looks at the basic method used by the authors to estimate the parameter of the transfer function, how it is possible to optimize the excitation signals. Further chapters extend the estimation method proposed. Applications are then discussed and the book concludes with practical guidelines which illustrate the method and offer some rules-of-thumb.

Multivariable System Identification For Process Control - Y. Zhu 2001-10-08

Systems and control theory has experienced significant development in the past few decades. New techniques have emerged which hold enormous potential for industrial applications, and which have therefore also attracted much interest from academic researchers. However, the impact of these developments on the process industries has been limited. The purpose of Multivariable System Identification for Process Control is to bridge the gap between theory and application, and to provide industrial solutions, based on sound scientific theory, to process identification problems. The book is organized in a reader-friendly way, starting with the simplest methods, and then gradually introducing more complex techniques. Thus, the reader is offered clear physical insight without recourse to large amounts of mathematics. Each method is covered in a single chapter or section, and experimental design is explained before any identification algorithms are discussed. The many simulation examples and industrial case studies demonstrate the power and efficiency of process identification, helping to make the theory more applicable. MatlabTM M-files, designed to help the reader to learn identification in a computing environment, are included.