S. Unnikrishna Pillai
Theodore I. Shim

Spectrum Estimation and System Identification

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Spectrum Estimation and System Identification S.Unnikrishna Pillai,Theodore I. Shim,2012-12-06 Spectrum estimation refers to analyzing the distribution of power or en ergy with frequency of the given signal and system identification refers to ways of characterizing the mechanism or system behind the observed sig nal data Such an identification allows one to predict the system outputs and as a result this has considerable impact in several areas such as speech processing pattern recognition target identification seismology and signal processing A new outlook to spectrum estimation and system identification is pre sented here by making use of the powerful concepts of positive functions and bounded functions An indispensable tool in classical network analysis and synthesis problems positive functions and bounded functions are well and their intimate one to one connection with power spectra understood makes it possible to study many of the signal processing problems from a new viewpoint Positive functions have been used to study interpolation problems in the past and although the spectrum extension problem falls within this scope surprisingly the system identification problem can also be analyzed in this context in an interesting manner One useful result in this connection is regarding rational and stable approximation of nonrational transfer functions both in the single channel case and the multichannel case Such an approximation has important applications in distributed system theory simulation of systems governed by partial differential equations and analysis of differential equations with delays This book is intended as an introductory graduate level textbook and as a reference book for engineers and researchers   Identification and System Parameter Estimation 1982 G. A. Bekey,G. N. Saridis,2016-06-06 Identification and System Parameter Estimation 1982 covers the proceedings of the Sixth International Federation of Automatic Control IFAC Symposium The book also serves as a tribute to Dr Naum S Rajbman The text covers issues concerning identification and estimation such as increasing interrelationships between identification estimation and other aspects of system theory including control theory signal processing experimental design numerical mathematics pattern recognition and information theory The book also provides coverage regarding the application and problems faced by several engineering and scientific fields that use identification and estimation such as biological systems traffic control geophysics aeronautics robotics economics and power systems Researchers from all scientific fields will find this book a great reference material since it presents topics that concern various disciplines   **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 2003* Paul Van Den Hof,Bo Wahlberg,Siep Weiland,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 *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   *Identification of Physical Systems* Rajamani Doraiswami,Maryhelen Stevenson,Chris Diduch,2014-05-12 Identification of a physical system deals with the problem of identifying its mathematical model using the measured input and output data As the physical system is generally complex nonlinear and its input output data is corrupted noise there are fundamental theoretical and practical issues that need to be considered Identification of Physical Systems addresses this need presenting a systematic unified approach to the problem of physical system identification and its practical applications Starting with a least squares method the authors develop various schemes to address the issues of accuracy variation in the operating regimes closed loop and interconnected subsystems Also presented is a non parametric signal or data based scheme to identify a means to provide a quick macroscopic picture of the system to complement the precise microscopic picture given by the parametric model based scheme Finally a sequential integration of totally different schemes such as non parametric Kalman filter and parametric model is developed to meet the speed and accuracy requirement of mission critical systems Key features Provides a clear understanding of theoretical and practical issues in identification and its applications enabling the reader to grasp a clear understanding of the theory and apply it to practical problems Offers a self contained guide by including the background necessary to understand this interdisciplinary subject Includes case studies for the application of identification on physical laboratory scale systems as

well as number of illustrative examples throughout the book Identification of Physical Systems is a comprehensive reference for researchers and practitioners working in this field and is also a useful source of information for graduate students in electrical computer biomedical chemical and mechanical engineering   **Signals and Systems in Biomedical Engineering: Physiological Systems Modeling and Signal Processing** Suresh R. Devasahayam,2019-03-29 Physiology is a set of processes that maintain homeostasis and physiological measurement is a means of observing these processes Systems theory and signal processing offer formal tools for the study of processes and measured quantities This book shows that systems modeling can be used to develop simulations of physiological systems which use formal relations between the underlying processes and the observed measurements The inverse of such relations suggest signal processing tools that can be applied to interpret experimental data Both signal processing and systems modeling are invaluable in the study of human physiology Discussing signal processing techniques ranging from filtering and spectrum analysis to wavelet analysis the book uses graphs and analogies to supplement the mathematics and make the book more accessible to physiologists and more interesting to engineers Physiological systems modeling helps in both gaining insight and generating methods of analysis This book shows how numerical computation with graphical display haptics and multimedia can be used to simulate physiological systems In this third edition the simulations are more closely related to clinical examination and experimental physiology than in previous editions Detailed models of nerve and muscle at the cellular and systemic levels and simplified models of cardiovascular blood flow provide examples for the mathematical methods and computer simulations Several of the models are sufficiently sophisticated to be of value in understanding real world issues like neuromuscular disease The book features expanded problem sets and a link to extra downloadable material containing simulation programs that are solutions to the theory developed in the text   **Digital Signal Processing with Kernel Methods** Jose Luis Rojo-Alvarez,Manel Martinez-Ramon,Jordi Munoz-Mari,Gustau Camps-Valls,2018-02-05 A realistic and comprehensive review of joint approaches to machine learning and signal processing algorithms with application to communications multimedia and biomedical engineering systems Digital Signal Processing with Kernel Methods reviews the milestones in the mixing of classical digital signal processing models and advanced kernel machines statistical learning tools It explains the fundamental concepts from both fields of machine learning and signal processing so that readers can quickly get up to speed in order to begin developing the concepts and application software in their own research Digital Signal Processing with Kernel Methods provides a comprehensive overview of kernel methods in signal processing without restriction to any application field It also offers example applications and detailed benchmarking experiments with real and synthetic datasets throughout Readers can find further worked examples with Matlab source code on a website developed by the authors http github com DSPKM Presents the necessary basic ideas from both digital signal processing and machine learning concepts Reviews the state of the art in SVM algorithms for classification and detection problems in the context of signal processing Surveys advances in

kernel signal processing beyond SVM algorithms to present other highly relevant kernel methods for digital signal processing An excellent book for signal processing researchers and practitioners Digital Signal Processing with Kernel Methods will also appeal to those involved in machine learning and pattern recognition *Identification and System Parameter Estimation* ,1985 <u>Digital Signal Processing Handbook on CD-ROM</u> VIJAY MADISETTI,Douglas Williams,1999-02-26 A best seller in its print version this comprehensive CD ROM reference contains unique fully searchable coverage of all major topics in digital signal processing DSP establishing an invaluable time saving resource for the engineering community Its unique and broad scope includes contributions from all DSP specialties including telecommunications computer engineering acoustics seismic data analysis DSP software and hardware image and video processing remote sensing multimedia applications medical technology radar and sonar applications **Three Decades of Progress in Control Sciences** Xiaoming Hu,Ulf Jonsson,Bo Wahlberg,Bijoy Ghosh,2010-10-29 In this edited collection we commemorate the 60th birthday of Prof Christopher Byrnes and the retirement of Prof Anders Lindquist from the Chair of Optimization and Systems Theory at KTH These papers were presented in part at a 2009 workshop in KTH Stockholm honoring the lifetime contributions of Professors Byrnes and Lindquist in various fields of applied mathematics *Identification of Continuous-time Models from Sampled Data* Hugues Garnier,Liuping Wang,2008-03-13 This is the first book dedicated to direct continuous time model identification for 15 years It cuts down on time spent hunting through journals by providing an overview of much recent research in an increasingly busy field The CONTSID toolbox discussed in the final chapter gives an overview of developments and practical examples in which MATLAB can be used for direct time domain identification of continuous time systems This is a valuable reference for a broad audience **Inverse system identification with applications in predistortion** Ylva Jung,2018-12-19 Models are commonly used to simulate events and processes and can be constructed from measured data using system identification The common way is to model the system from input to output but in this thesis we want to obtain the inverse of the system Power amplifiers PAs used in communication devices can be nonlinear and this causes interference in adjacent transmitting channels A prefilter called predistorter can be used to invert the effects of the PA such that the combination of predistorter and PA reconstructs an amplified version of the input signal In this thesis the predistortion problem has been investigated for outphasing power amplifiers where the input signal is decomposed into two branches that are amplified separately by highly efficient nonlinear amplifiers and then recombined We have formulated a model structure describing the imperfections in an outphasing abbrPA and the matching ideal predistorter The predistorter can be estimated from measured data in different ways Here the initially nonconvex optimization problem has been developed into a convex problem The predistorters have been evaluated in measurements The goal with the inverse models in this thesis is to use them in cascade with the systems to reconstruct the original input It is shown that the problems of identifying a model of a preinverse and a postinverse are fundamentally different It turns out that the true inverse is not necessarily the best one when noise is present and that other

models and structures can lead to better inversion results To construct a predistorter for a PA for example a model of the inverse is used and different methods can be used for the estimation One common method is to estimate a postinverse and then using it as a preinverse making it straightforward to try out different model structures Another is to construct a model of the system and then use it to estimate a preinverse in a second step This method identifies the inverse in the setup it will be used but leads to a complicated optimization problem A third option is to model the forward system and then invert it This method can be understood using standard identification theory in contrast to the ones above but the model is tuned for the forward system not the inverse Models obtained using the various methods capture different properties of the system and a more detailed analysis of the methods is presented for linear time invariant systems and linear approximations of block oriented systems The theory is also illustrated in examples When a preinverse is used the input to the system will be changed and typically the input data will be different than the original input This is why the estimation of preinverses is more complicated than for postinverses and one set of experimental data is not enough Here we have shown that identifying a preinverse in series with the system in repeated experiments can improve the inversion performance   System Identification Rik Pintelon,Johan Schoukens,2012-03-19 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   *CONTROL SYSTEMS, ROBOTICS AND AUTOMATION – Volume V* Heinz Unbehauen,2009-10-11 This Encyclopedia of Control Systems Robotics and Automation is a component of the global Encyclopedia of Life Support Systems EOLSS which is an integrated compendium of twenty one Encyclopedias This 22 volume set contains 240 chapters each of size 5000 30000 words with perspectives applications and extensive illustrations It is the only publication of its kind carrying state of the art knowledge in the fields of Control Systems Robotics and Automation and is aimed by virtue of the several applications at the following five major target audiences

University and College Students Educators Professional Practitioners Research Personnel and Policy Analysts Managers and Decision Makers and NGOs   Mechatronics Clarence W. de Silva,Farbod Khoshnoud,Maoqing Li,Saman K. Halgamuge,2015-12-01 An Up To Date Reference on the Latest Developments of MechatronicsGeared toward engineers designers researchers educators and students Mechatronics Fundamentals and Applications focuses on integrating practice with theory relevant to electromechanical and multidomain systems A result of the Distinguished Visiting Fellowship of the Royal Acad   *Signals and Systems in Biomedical Engineering* Suresh R. Devasahayam,2012-12-06 In the past few years Biomedical Engineering has received a great deal of attention as one of the emerging technologies in the last decade and for years to come as witnessed by the many books conferences and their proceedings Media attention due to the applications oriented advances in Biomedical Engineering has also increased Much of the excitement comes from the fact that technology is rapidly changing and new technological adventures become available and feasible every day For many years the physical sciences contributed to medicine in the form of expertise in radiology and slow but steady contributions to other more diverse fields such as computers in surgery and diagnosis neurology cardiology vision and visual prosthesis audition and hearing aids artificial limbs biomechanics and biomaterials The list goes on It is therefore hard for a person unfamiliar with a subject to separate the substance from the hype Many of the applications of Biomedical Engineering are rather complex and difficult to understand even by the not so novice in the field Much of the hardware and software tools available are either too simplistic to be useful or too complicated to be understood and applied In addition the lack of a common language between engineers and computer scientists and their counterparts in the medical profession sometimes becomes a barrier to progress

Linear Circuits Nobuo Nagai,2020-08-26 This book documents the significant progress in studies concerning linear circuits and systems including their applications to digital filters in Japan It considers rational approximations in circuit and system theory and deals with the digital lattice filters used in digital signal processing   Random Signals Estimation and Identification Nirode Mohanty,2012-12-06 The techniques used for the extraction of information from received or ob served signals are applicable in many diverse areas such as radar sonar communications geophysics remote sensing acoustics meteorology med ical imaging systems and electronics warfare The received signal is usually disturbed by thermal electrical atmospheric channel or intentional inter ferences The received signal cannot be predicted deterministically so that statistical methods are needed to describe the signal In general therefore any received signal is analyzed as a random signal or process The purpose of this book is to provide an elementary introduction to random signal analysis estimation filtering and identification The emphasis of the book is on the computational aspects as well as presentation of com mon analytical tools for systems involving random signals The book covers random processes stationary signals spectral analysis estimation optimiz ation detection spectrum estimation prediction filtering and identification The book is addressed to practicing engineers and scientists It can be used as a text for courses in the areas of random processes estimation theory and system

identification by undergraduates and graduate students in engineer ing and science with some background in probability and linear algebra Part of the book has been used by the author while teaching at State University of New York at Buffalo and California State University at Long Beach Some of the algorithms presented in this book have been successfully applied to industrial projects **Blind Equalization and System Identification** Chong-Yung Chi,Chih-Chun Feng,Chii-Horng Chen,Ching-Yung Chen,2006-05-20 The absence of training signals from many kinds of transmission necessitates the widespread use of blind equalization and system identification There have been many algorithms developed for these purposes working with one or two dimensional signals and with single input single output or multiple input multiple output real or complex systems It is now time for a unified treatment of this subject pointing out the common characteristics of these algorithms as well as learning from their different perspectives Blind Equalization and System Identification provides such a unified treatment presenting theory performance analysis simulation implementation and applications This is a textbook for graduate courses in discrete time random processes statistical signal processing and blind equalization and system identification It contains material which will also interest researchers and engineers working in digital communications source separation speech processing and other similar applications

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