

MATHEMATICAL MODELLING: THEORY AND APPLICATIONS

# NONLINEAR SYSTEM IDENTIFICATION – INPUT-OUTPUT MODELING APPROACH

Volume 1: Nonlinear System Parameter  
Identification

Robert Haber and László Keviczky

Kluwer Academic Publishers

# Nonlinear System Identification Input Output Modeling Approach

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Gakujutsu Kōenkai**



## **Nonlinear System Identification Input Output Modeling Approach:**

Nonlinear system identification : input-output modeling approach. 1. Nonlinear system parameter identification Robert Haber, László Keviczky, 1999      Nonlinear System Identification — Input-Output Modeling Approach Robert Haber, L. Keviczky, 2012-12-22 The subject of the book is to present the modeling parameter estimation and other aspects of the identification of nonlinear dynamic systems The treatment is restricted to the input output modeling approach Because of the widespread usage of digital computers discrete time methods are preferred Time domain parameter estimation methods are dealt with in detail frequency domain and power spectrum procedures are described shortly The theory is presented from the engineering point of view and a large number of examples of case studies on the modeling and identifications of real processes illustrate the methods Almost all processes are nonlinear if they are considered not merely in a small vicinity of the working point To exploit industrial equipment as much as possible mathematical models are needed which describe the global nonlinear behavior of the process If the process is unknown or if the describing equations are too complex the structure and the parameters can be determined experimentally which is the task of identification The book is divided into seven chapters dealing with the following topics 1 Nonlinear dynamic process models 2 Test signals for identification 3 Parameter estimation methods 4 Nonlinearity test methods 5 Structure identification 6 Model validity tests 7 Case studies on identification of real processes Chapter I summarizes the different model descriptions of nonlinear dynamical systems

Nonlinear system identification. 1. Nonlinear system parameter identification Robert Haber, László Keviczky, 1999 The first of two volumes this handbook presents a comprehensive overview of nonlinear dynamic system parameter identification The volumes cover many aspects of nonlinear processes including modelling parameter estimation structure search nonlinearity and model validity tests      **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

**Nonlinear system identification. 2. Nonlinear system structure identification** Robert Haber, László Keviczky, 1999 This is the second part of a two volume handbook presenting a comprehensive overview of nonlinear dynamic system identification The books include many aspects of nonlinear processes such as modelling parameter estimation structure search nonlinearity and model validity tests

*Nonlinear System Identification* Stephen A. Billings, 2013-07-29 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

**Block-oriented Nonlinear System Identification** Fouad Giri,Er-Wei Bai,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

*Soft Computing Methods for Practical Environment Solutions: Techniques and Studies* Gestal Pose, Marcos,Rivero Cebrián, Daniel,2010-05-31 This publication presents a series of practical applications of different Soft Computing techniques to real world problems showing the enormous potential of these techniques in solving problems Provided by publisher

**Nonlinear System Identification with Applications to Space Weather Prediction** Harish J.

Palanhandalam-Madapusi,2007 *Nonlinear System Identification Via Stochastic Projection Methods* Ho-En Liao,1993

**Adaptive Nonlinear System Identification** Tokunbo Ogunfunmi,2007-09-12 Adaptive Nonlinear System Identification

The Volterra and Wiener Model Approaches introduces engineers and researchers to the field of nonlinear adaptive system identification. The book includes recent research results in the area of adaptive nonlinear system identification and presents simple concise easy to understand methods for identifying nonlinear systems. These methods use adaptive filter algorithms that are well known for linear systems identification. They are applicable for nonlinear systems that can be efficiently modeled by polynomials. After a brief introduction to nonlinear systems and to adaptive system identification the author presents the discrete Volterra model approach. This is followed by an explanation of the Wiener model approach. Adaptive algorithms using both models are developed. The performance of the two methods are then compared to determine which model performs better for system identification applications. Adaptive Nonlinear System Identification: The Volterra and Wiener Model Approaches is useful to graduates students engineers and researchers in the areas of nonlinear systems control biomedical systems and in adaptive signal processing.

**System Identification** Seth LaRoe Lacy, 2002. Then we return to the Wiener identification problem and develop a two stage direct computation approach for the identification of Wiener systems with finite impulse response and polynomial nonlinearities. My approach is based on multi index notation.

*Nonlinear System Identification with an Application to Hydraulic Actuator Friction Dynamics* Byung-Jae Kwak, 2000. A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy Electrical Engineering Systems in The University of Michigan 2000.

*Identification and System Parameter Estimation*, 1979. *Control Theory and Advanced Technology*, 1994.

**Midwest Symposium on Circuits and Systems**, 1982. *System Identification Methods for a Class of Structured Nonlinear Systems* Gregory Jon Wolodkin, 1996.

**Biomedical Technologies Conference**, 1987. **SICE 2002** Keisoku Jidō Seigyo Gakkai (Japan). Gakujutsu Kōenkai, 2002. Proceedings of the ... SICE Annual Conference Keisoku Jidō Seigyo Gakkai (Japan). Gakujutsu Kōenkai, 2002.

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