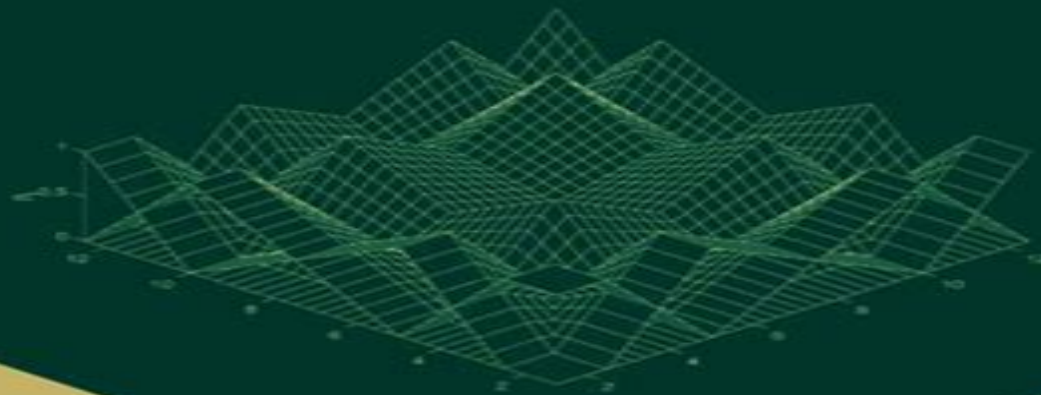


FUZZY MODEL IDENTIFICATION FOR CONTROL

János Abonyi



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Fuzzy Model Identification For Control

Ruiyun Qi, Gang Tao, Bin Jiang



Fuzzy Model Identification For Control:

Fuzzy Model Identification for Control Janos Abonyi, 2003-02-28 This book presents new approaches to constructing fuzzy models for model based control Simulated examples and real world applications from chemical and process engineering illustrate the main methods and techniques Supporting MATLAB and Simulink files create a computational platform for exploration of the concepts and algorithms

Fuzzy Model Identification for Control Janos Abonyi, 2012-12-06 Overview Since the early 1990s fuzzy modeling and identification from process data have been and continue to be an evolving subject of interest Although the application of fuzzy models proved to be effective for the approximation of uncertain nonlinear processes the data driven identification of fuzzy models alone sometimes yields complex and unrealistic models Typically this is due to the over parameterization of the model and insufficient information content of the identification data set These difficulties stem from a lack of initial a priori knowledge or information about the system to be modeled To solve the problem of limited knowledge in the area of modeling and identification there is a tendency to blend information of different natures to employ as much knowledge for model building as possible Hence the incorporation of different types of a priori knowledge into the data driven fuzzy model generation is a challenging and important task Motivated by our research into this topic our book presents new approaches to the construction of fuzzy models for model based control New model structures and identification algorithms are described for the effective use of heterogeneous information in the form of numerical data qualitative knowledge and first principle models By exploiting the mathematical properties of the proposed model structures such as invertibility and local linearity new control algorithms will be presented

Fuzzy Model Identification Hans Hellendoorn, Dimitar Driankov, 2012-12-06 During the past few years two principally different approaches to the design of fuzzy controllers have emerged heuristics based design and model based design The main motivation for the heuristics based design is given by the fact that many industrial processes are still controlled in one of the following two ways The process is controlled manually by an experienced operator The process is controlled by an automatic control system which needs manual on line trimming of its parameters by an experienced operator In both cases it is enough to translate in terms of a set of fuzzy if then rules the operator's manual control algorithm or manual on line trimming strategy in order to obtain an equally good or even better wholly automatic fuzzy control system This implies that the design of a fuzzy controller can only be done after a manual control algorithm or trimming strategy exists It is admitted in the literature on fuzzy control that the heuristics based approach to the design of fuzzy controllers is very difficult to apply to multiple input/multiple output control problems which represent the largest part of challenging industrial process control applications Furthermore the heuristics based design lacks systematic and formally verifiable tuning techniques Also studies of the stability performance and robustness of a closed loop system incorporating a heuristics based fuzzy controller can only be done via extensive simulations

Fuzzy Model Identification & Control of Non-Linear Systems Sunil Gupta, Meena Tushir, 2016-03-10

Fuzzy System Identification and Adaptive Control Ruiyun Qi, Gang Tao, Bin Jiang, 2019-06-11 This book provides readers with a systematic and unified framework for identification and adaptive control of Takagi Sugeno T S fuzzy systems Its design techniques help readers applying these powerful tools to solve challenging nonlinear control problems The book embodies a systematic study of fuzzy system identification and control problems using T S fuzzy system tools for both function approximation and feedback control of nonlinear systems Alongside this framework the book also introduces basic concepts of fuzzy sets logic and inference system discusses important properties of T S fuzzy systems develops offline and online identification algorithms for T S fuzzy systems investigates the various controller structures and corresponding design conditions for adaptive control of continuous time T S fuzzy systems develops adaptive control algorithms for discrete time input output form T S fuzzy systems with much relaxed design conditions and discrete time state space T S fuzzy systems and designs stable parameter adaptation algorithms for both linearly and nonlinearly parameterized T S fuzzy systems The authors address adaptive fault compensation problems for T S fuzzy systems subject to actuator faults They cover a broad spectrum of related technical topics and to develop a substantial set of adaptive nonlinear system control tools Fuzzy System Identification and Adaptive Control helps engineers in the mechanical electrical and aerospace fields to solve complex control design problems The book can be used as a reference for researchers and academics in nonlinear intelligent adaptive and fault tolerant control

Instrument Engineers' Handbook, Volume Two Bela G. Liptak, 2018-10-08 The latest update to Bela Liptak s acclaimed bible of instrument engineering is now available Retaining the format that made the previous editions bestsellers in their own right the fourth edition of Process Control and Optimization continues the tradition of providing quick and easy access to highly practical information The authors are practicing engineers not theoretical people from academia and their from the trenches advice has been repeatedly tested in real life applications Expanded coverage includes descriptions of overseas manufacturer s products and concepts model based optimization in control theory new major inventions and innovations in control valves and a full chapter devoted to safety With more than 2000 graphs figures and tables this all inclusive encyclopedic volume replaces an entire library with one authoritative reference The fourth edition brings the content of the previous editions completely up to date incorporates the developments of the last decade and broadens the horizons of the work from an American to a global perspective B la G Lipt k speaks on Post Oil Energy Technology on the AT T Tech Channel

Intelligent Components and Instruments for Control Applications 2003 (SICICA 2003) L. Almeida, S. Boverie, Luis B. Almeida, 2003 A Proceedings volume from the IFAC Symposium on Intelligent Components and Instruments for Control Applications Portugal 2003 Provides an overview of the theory and applications and presents an exchange of experiences on recent advances in this field

Monitoring and Control of Information-Poor Systems Arthur L. Dexter, 2012-02-16 The monitoring and control of a system whose behaviour is highly uncertain is an important and challenging practical problem Methods of solution based on fuzzy techniques have generated considerable interest but very

little of the existing literature considers explicit ways of taking uncertainties into account This book describes an approach to the monitoring and control of information poor systems that is based on fuzzy relational models which generate fuzzy outputs The first part of Monitoring and Control of Information Poor Systems aims to clarify why design decisions must take account of the uncertainty associated with optimal choices and to explain how a fuzzy relational model can be used to generate a fuzzy output which reflects the uncertainties associated with its predictions Part two gives a brief introduction to fuzzy decision making and shows how it can be used to design a predictive control scheme that is suitable for controlling information poor systems using inaccurate measurements Part three describes different ways in which fuzzy relational models can be generated online and explains the practical issues associated with their identification and application The final part of the book provides examples of the use of the previously described techniques in real applications Key features Describes techniques applicable to a wide range of engineering environmental medical financial and economic applications Uses simple examples to help explain the basic techniques for dealing with uncertainty Describes a novel design approach based on the use of fuzzy relational models Considers practical issues associated with applying the techniques to real systems Monitoring and Control of Information Poor Systems forms an invaluable resource for a wide range of graduate students and is also a comprehensive reference for researchers and practitioners working on problems involving mathematical modelling and control

Interpretability of Computational Intelligence-Based Regression Models Tamás Kenesei,János Abonyi,2015-10-22 The key idea of this book is that hinging hyperplanes neural networks and support vector machines can be transformed into fuzzy models and interpretability of the resulting rule based systems can be ensured by special model reduction and visualization techniques The first part of the book deals with the identification of hinging hyperplane based regression trees The next part deals with the validation visualization and structural reduction of neural networks based on the transformation of the hidden layer of the network into an additive fuzzy rule base system Finally based on the analogy of support vector regression and fuzzy models a three step model reduction algorithm is proposed to get interpretable fuzzy regression models on the basis of support vector regression The authors demonstrate real world use of the algorithms with examples taken from process engineering and they support the text with downloadable Matlab code The book is suitable for researchers graduate students and practitioners in the areas of computational intelligence and machine learning

Handbook of Fuzzy Computation E Ruspini,P Bonissone,W Pedrycz,2020-03-05 Initially conceived as a methodology for the representation and manipulation of imprecise and vague information fuzzy computation has found wide use in problems that fall well beyond its originally intended scope of application Many scientists and engineers now use the paradigms of fuzzy computation to tackle problems that are either intractable

Fault Diagnosis and Sustainable Control of Wind Turbines Silvio Simani,Saverio Farsoni,2018-01-02 Fault Diagnosis and Sustainable Control of Wind Turbines Robust Data Driven and Model Based Strategies discusses the development of reliable and robust fault diagnosis and fault

tolerant sustainable control schemes by means of data driven and model based approaches These strategies are able to cope with unknown nonlinear systems and noisy measurements The book also discusses simpler solutions relying on data driven and model based methodologies which are key when on line implementations are considered for the proposed schemes The book targets both professional engineers working in industry and researchers in academic and scientific institutions In order to improve the safety reliability and efficiency of wind turbine systems thus avoiding expensive unplanned maintenance the accommodation of faults in their early occurrence is fundamental To highlight the potential of the proposed methods in real applications hardware in the loop test facilities representing realistic wind turbine systems are considered to analyze the digital implementation of the designed solutions The achieved results show that the developed schemes are able to maintain the desired performances thus validating their reliability and viability in real time implementations Different groups of readers ranging from industrial engineers wishing to gain insight into the applications potential of new fault diagnosis and sustainable control methods to the academic control community looking for new problems to tackle will find much to learn from this work Provides wind turbine models with varying complexity as well as the solutions proposed and developed by the authors Addresses in detail the design development and realistic implementation of fault diagnosis and fault tolerant control strategies for wind turbine systems Addresses the development of sustainable control solutions that in general do not require the introduction of further or redundant measurements Proposes active fault tolerant sustainable solutions that are able to maintain the wind turbine working conditions with gracefully degraded performance before required maintenance can occur Presents full coverage of the diagnosis and fault tolerant control problem starting from the modeling and identification and finishing with diagnosis and fault tolerant control approaches Provides MATLAB and Simulink codes for the solutions proposed

Multiple Model Approaches To Nonlinear Modelling And Control R Murray-Smith,T. Johansen,2020-11-25 This work presents approaches to modelling and control problems arising from conditions of ever increasing nonlinearity and complexity It prescribes an approach that covers a wide range of methods being combined to provide multiple model solutions Many component methods are described as well as discussion of the strategies available for building a successful multiple model approach

Systems, Automation and Control Nabil Derbel,Faouzi Derbel,Olfa Kanoun,2017-12-04 The fifth volume of the Series Advances in Systems Signals and Devices is dedicated to fields related to Systems Automation and Control The scope of this issue encompasses all aspects of the research development and applications of the science and technology in these fields Topics of this issue concern system design system identification biological and economical models control modern control theory nonlinear observers control and application of chaos adaptive non adaptive backstepping control techniques advances in linear control theory systems optimization multivariable control large scale and infinite dimension systems nonlinear control distributed control predictive control geometric control adaptive control optimal and stochastic control robust control neural control fuzzy control intelligent control systems diagnostics fault tolerant control

robotics and mechatronics navigation robotics and human machine interaction hierarchical and man machine systems etc Authors are encouraged to submit novel contributions which include results of research or experimental work discussing new developments in the field of systems automation and control The series can be also addressed for editing special issues for novel developments in specific fields The aim of this volume is to promote an international scientific progress in the fields of systems automation and control It provides at the same time an opportunity to be informed about interesting results that have been reported during the international SSD conferences

Computational Intelligence and Bioinspired Systems

Joan Cabestany,Alberto Prieto,Francisco Sandoval,2005-06-21 We present in this volume the collection of finally accepted papers of the eighth edition of the IWANN conference International Work Conference on Artificial Neural Networks This biennial meeting focuses on the foundations theory models and applications of systems inspired by nature neural networks fuzzy logic and evolutionary systems Since the first edition of IWANN in Granada LNCS 540 1991 the Artificial Neural Network ANN community and the domain itself have matured and evolved Under the ANN banner we find a very heterogeneous scenario with a main interest and objective to better understand nature and beings for the correct elaboration of theories models and new algorithms For scientists engineers and professionals working in the area this is a very good way to get solid and competitive applications We are facing a real revolution with the emergence of embedded intelligence in many artificial systems systems covering diverse fields industry domotics leisure healthcare So we are convinced that an enormous amount of work must be and should be still done Many pieces of the puzzle must be built and placed into their proper positions offering us new and solid theories and models necessary tools for the application and praxis of these current paradigms The above mentioned concepts were the main reason for the subtitle of the IWANN 2005 edition Computational Intelligence and Bioinspired Systems The call for papers was launched several months ago addressing the following topics 1 Mathematical and theoretical methods in computational intelligence Methods and Applications of Intelligent Control S.G. Tzafestas,2012-12-06 This book is concerned with Intelligent Control methods and applications The field of intelligent control has been expanded very much during the recent years and a solid body of theoretical and practical results are now available These results have been obtained through the synergetic fusion of concepts and techniques from a variety of fields such as automatic control systems science computer science neurophysiology and operational research Intelligent control systems have to perform anthropomorphic tasks fully autonomously or interactively with the human under known or unknown and uncertain environmental conditions Therefore the basic components of any intelligent control system include cognition perception learning sensing planning numeric and symbolic processing fault detection repair reaction and control action These components must be linked in a systematic synergetic and efficient way Predecessors of intelligent control are adaptive control self organizing control and learning control which are well documented in the literature Typical application examples of intelligent controls are intelligent robotic systems intelligent manufacturing systems intelligent medical systems

and intelligent space teleoperators Intelligent controllers must employ both quantitative and qualitative information and must be able to cope with severe temporal and spatial variations in addition to the fundamental task of achieving the desired transient and steady state performance Of course the level of intelligence required in each particular application is a matter of discussion between the designers and users The current literature on intelligent control is increasing but the information is still available in a sparse and disorganized way

Advances in Robust Control and Applications Nabil Derbel,Ahmed Said Nouri,Quanmin Zhu,2023-09-12 The book presents recent applications and developments in the field of control of industrial systems covering a wide range of modeling and feedback control using various robust approaches such as fuzzy systems sliding mode control and H infinity This book provides insights into theory applications and perspectives relevant to the field of robotic systems exoskeletons power systems photovoltaic systems etc as well as general methodologies and paradigms around them Each chapter provides an enriched understanding of a research topic along with a balanced treatment of the relevant theories methods or applications It reports on the latest advances in the field This book is a good reference for graduate students researchers educators engineers and scientists and contains a total of 15 chapters divided into five parts as follows The first part of this book focuses on the application of fuzzy control to robotic systems and consists of three chapters The second part of this book proposes the control of lower and upper limb exoskeletons and includes two chapters The third part is dedicated to the control of power systems and comprises three chapters The fourth part deals with various approaches to the modeling and control of industrial processes and comprises four chapters The fifth and final part describes observers and fault tolerant control systems and comprises five chapters

Evolving Intelligent Systems Plamen Angelov,Dimitar P. Filev,Nik Kasabov,2010-03-25 From theory to techniques the first all in one resource for EIS There is a clear demand in advanced process industries defense and Internet and communication VoIP applications for intelligent yet adaptive evolving systems Evolving Intelligent Systems is the first self contained volume that covers this newly established concept in its entirety from a systematic methodology to case studies to industrial applications Featuring chapters written by leading world experts it addresses the progress trends and major achievements in this emerging research field with a strong emphasis on the balance between novel theoretical results and solutions and practical real life applications Explains the following fundamental approaches for developing evolving intelligent systems EIS the Hierarchical Prioritized Structure the Participatory Learning Paradigm the Evolving Takagi Sugeno fuzzy systems eTS the evolving clustering algorithm that stems from the well known Gustafson Kessel offline clustering algorithm Emphasizes the importance and increased interest in online processing of data streams Outlines the general strategy of using the fuzzy dynamic clustering as a foundation for evolvable information granulation Presents a methodology for developing robust and interpretable evolving fuzzy rule based systems Introduces an integrated approach to incremental real time feature extraction and classification Proposes a study on the stability of evolving neuro fuzzy recurrent networks Details methodologies for evolving clustering and classification

Reveals different applications of EIS to address real problems in areas of evolving inferential sensors in chemical and petrochemical industry learning and recognition in robotics Features downloadable software resources Evolving Intelligent Systems is the one stop reference guide for both theoretical and practical issues for computer scientists engineers researchers applied mathematicians machine learning and data mining experts graduate students and professionals

Artificial Neural Networks and Neural Information Processing — ICANN/ICONIP 2003 Okyay Kaynak, Ethem Alpaydin, Erkki Oja, Lei Xu, 2003-08-03 The refereed proceedings of the Joint International Conference on Artificial Neural Networks and International Conference on Neural Information Processing ICANN/ICONIP 2003 held in Istanbul Turkey in June 2003 The 138 revised full papers were carefully reviewed and selected from 346 submissions The papers are organized in topical sections on learning algorithms support vector machine and kernel methods statistical data analysis pattern recognition vision speech recognition robotics and control signal processing time series prediction intelligent systems neural network hardware cognitive science computational neuroscience context aware systems complex valued neural networks emotion recognition and applications in bioinformatics

Stochastic Control Chris Myers, 2010-08-17 Uncertainty presents significant challenges in the reasoning about and controlling of complex dynamical systems To address this challenge numerous researchers are developing improved methods for stochastic analysis This book presents a diverse collection of some of the latest research in this important area In particular this book gives an overview of some of the theoretical methods and tools for stochastic analysis and it presents the applications of these methods to problems in systems theory science and economics

Advanced Control of Solar Plants Manuel Berenguel, Francisco R. Rubio, 2012-12-06 The series *Advances in Industrial Control* aims to report and encourage technology transfer in control engineering The rapid development of control technology impacts all areas of the control discipline New theory new controllers actuators sensors new industrial processes computer methods new applications new philosophies new challenges Much of this development work resides in industrial reports feasibility study papers and the reports of advanced collaborative projects The series offers an opportunity for researchers to present an extended exposition of such new work in all aspects of industrial control for wider and rapid dissemination This volume by Professor Eduardo F Camacho and his colleagues Manuel Berenguel and Francisco R Rubio is an exemplar of what an *Advances in Industrial Control* monograph should be In it the control of a thermal solar facility is used to study the performance obtainable from an interesting range of control algorithms These methods range from the conventional PID controller through to model based predictive and robust optimal control methods and finishing with two fuzzy logic based control techniques The scientific methodology applied is modelling simulation and plant implementation In the last chapter a rigorous approach for a comparative study is described involving a careful selection of performance metrics The text is rich in relevant up to date source material and contains many thought provoking comments The presentation is well balanced impartial and very readable

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