



Goro Obinata and Brian D.O. Anderson

Model Reduction for Control System Design



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Model Reduction For Control System Design

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der Vorst, Joost Rommes**



Model Reduction For Control System Design:

Model Reduction for Control System Design Goro Obinata, Brian D.O. Anderson, 2012-12-06 Modern methods of filter design and controller design often yield systems of very high order posing a problem for their implementation Over the past two decades or so sophisticated methods have been developed to achieve simplification of filters and controllers Such methods often come with easy to use error bounds and in the case of controller simplification methods such error bounds will usually be related to closed loop properties This book is the first comprehensive treatment of approximation methods for filters and controllers It is fully up to date and it is authored by two leading researchers who have personally contributed to the development of some of the methods Balanced truncation Hankel norm reduction multiplicative reduction weighted methods and coprime factorization methods are all discussed The book is amply illustrated with examples and will equip practising control engineers and graduates for intelligent use of commercial software modules for model and controller reduction Model Reduction for Control System Design ,1985 *Control Systems Design 2003 (CSD '03)* Stefan Kozak, Mikulas Huba, 2004-04 The material presented in this volume represents current ideas knowledge experience and research results in various fields of control system design **Model Reduction for Control System Design** Dale

Enns, 1984 **Efficient Modeling and Control of Large-Scale Systems** Javad Mohammadpour, Karolos M. Grigoriadis, 2010-06-23 Complexity and dynamic order of controlled engineering systems is constantly increasing Complex large scale systems where large reflects the system's order and not necessarily its physical size appear in many engineering fields such as micro electromechanics manufacturing aerospace civil engineering and power engineering Modeling of these systems often result in very high order models imposing great challenges to the analysis design and control problems Efficient Modeling and Control of Large Scale Systems compiles state of the art contributions on recent analytical and computational methods for addressing model reduction performance analysis and feedback control design for such systems Also addressed at length are new theoretical developments novel computational approaches and illustrative applications to various fields along with An interdisciplinary focus emphasizing methods and approaches that can be commonly applied in various engineering fields Examinations of applications in various fields including micro electromechanical systems MEMS manufacturing processes power networks traffic control Efficient Modeling and Control of Large Scale Systems is an ideal volume for engineers and researchers working in the fields of control and dynamic systems **Process Modelling for**

Control Benoît Codrons, 2005-08-30 Many process control books focus on control design techniques taking the construction of a process model for granted Process Modelling for Control concentrates on the modelling steps underlying a successful design answering questions like How should I carry out the identification of my process in order to obtain a good model How can I assess the quality of a model with a view to using it in control design How can I ensure that a controller will stabilise a real process and achieve a pre specified level of performance before implementation What is the most efficient method of

order reduction to facilitate the implementation of high order controllers Different tools namely system identification model controller validation and order reduction are studied in a framework with a common basis closed loop identification with a controller that is close to optimal will deliver models with bias and variance errors ideally tuned for control design As a result rules are derived applying to all the methods that provide the practitioner with a clear way forward despite the apparently unconnected nature of the modelling tools Detailed worked examples representative of various industrial applications are given control of a mechanically flexible structure a chemical process and a nuclear power plant Process Modelling for Control uses mathematics of an intermediate level convenient to researchers with an interest in real applications and to practising control engineers interested in control theory It will enable working control engineers to improve their methods and will provide academics and graduate students with an all round view of recent results in modelling for control Advances in Industrial Control aims to report and encourage the transfer of technology in control engineering The rapid development of control technology has an impact on all areas of the control discipline The series offers an opportunity for researchers to present an extended exposition of new work in all aspects of industrial control

Model Order Reduction: Theory, Research Aspects and Applications Wilhelmus H. Schilders, Henk A. van der Vorst, Joost Rommes, 2008-08-27 The idea for this book originated during the workshop Model order reduction coupled problems and optimization held at the Lorentz Center in Leiden from September 19-23 2005 During one of the discussion sessions it became clear that a book describing the state of the art in model order reduction starting from the very basics and containing an overview of all relevant techniques would be of great use for students young researchers starting in the field and experienced researchers The observation that most of the theory on model order reduction is scattered over many good papers making it difficult to find a good starting point was supported by most of the participants Moreover most of the speakers at the workshop were willing to contribute to the book that is now in front of you The goal of this book as defined during the discussion sessions at the workshop is three fold first it should describe the basics of model order reduction Second both general and more specialized model order reduction techniques for linear and nonlinear systems should be covered including the use of several related numerical techniques Third the use of model order reduction techniques in practical applications and current research aspects should be discussed We have organized the book according to these goals In Part I the rationale behind model order reduction is explained and an overview of the most common methods is described

Dimension Reduction of Large-Scale Systems Peter Benner, Volker Mehrmann, Danny C. Sorensen, 2006-03-30 In the past decades model reduction has become an ubiquitous tool in analysis and simulation of dynamical systems control design circuit simulation structural dynamics CFD and many other disciplines dealing with complex physical models The aim of this book is to survey some of the most successful model reduction methods in tutorial style articles and to present benchmark problems from several application areas for testing and comparing existing and new algorithms As the discussed methods have often been developed in parallel in disconnected

application areas the intention of the mini workshop in Oberwolfach and its proceedings is to make these ideas available to researchers and practitioners from all these different disciplines

The Control Systems Handbook William S. Levine, 2018-10-03 At publication The Control Handbook immediately became the definitive resource that engineers working with modern control systems required Among its many accolades that first edition was cited by the AAP as the Best Engineering Handbook of 1996 Now 15 years later William Levine has once again compiled the most comprehensive and authoritative resource on control engineering He has fully reorganized the text to reflect the technical advances achieved since the last edition and has expanded its contents to include the multidisciplinary perspective that is making control engineering a critical component in so many fields Now expanded from one to three volumes The Control Handbook Second Edition organizes cutting edge contributions from more than 200 leading experts The third volume Control System Advanced Methods includes design and analysis methods for MIMO linear and LTI systems Kalman filters and observers hybrid systems and nonlinear systems It also covers advanced considerations regarding Stability Adaptive controls System identification Stochastic control Control of distributed parameter systems Networks and networked controls As with the first edition the new edition not only stands as a record of accomplishment in control engineering but provides researchers with the means to make further advances Progressively organized the first two volumes in the set include Control System Fundamentals Control System Applications *Technology for Large Space Systems*, 1983 [Robust Control Design with MATLAB®](#)

Da-Wei Gu, Petko H. Petkov, Mihail M Konstantinov, 2014-07-08 Robust Control Design with MATLAB second edition helps the student to learn how to use well developed advanced robust control design methods in practical cases To this end several realistic control design examples from teaching laboratory experiments such as a two wheeled self balancing robot to complex systems like a flexible link manipulator are given detailed presentation All of these exercises are conducted using MATLAB Robust Control Toolbox 3 Control System Toolbox and Simulink By sharing their experiences in industrial cases with minimum recourse to complicated theories and formulae the authors convey essential ideas and useful insights into robust industrial control systems design using major H_∞ optimization and related methods allowing readers quickly to move on with their own challenges The hands on tutorial style of this text rests on an abundance of examples and features for the second edition rewritten and simplified presentation of theoretical and methodological material including original coverage of linear matrix inequalities new Part II forming a tutorial on Robust Control Toolbox 3 fresh design problems including the control of a two rotor dynamic system and end of chapter exercises Electronic supplements to the written text that can be downloaded from extras.springer.com isbn include M files developed with MATLAB help in understanding the essence of robust control system design portrayed in text based examples MDL files for simulation of open and closed loop systems in Simulink and a solutions manual available free of charge to those adopting Robust Control Design with MATLAB as a textbook for courses Robust Control Design with MATLAB is for graduate students and practising engineers who want to

learn how to deal with robust control design problems without spending a lot of time in researching complex theoretical developments

Design Methods of Control Systems D. Franke, F. Kraus, 2014-05-23 These Proceedings contain a selection of papers presented at the first IFAC Symposium on Design Methods of Control Systems The volume contains three plenary papers and 97 technical papers the latter classified under 15 section headings as listed in the contents

Fuzzy Systems and Knowledge Discovery Lipo Wang, Yaochu Jin, 2005-08-17 This book and its sister volume LNAI 3613 and 3614 constitute the proceedings of the Second International Conference on Fuzzy Systems and Knowledge Discovery FSKD 2005 jointly held with the First International Conference on Natural Computation ICNC 2005 LNCS 3610 3611 and 3612 from August 27-29 2005 in Changsha Hunan China FSKD 2005 successfully attracted 1249 submissions from 32 countries regions the joint ICNC FSKD 2005 received 3136 submissions After rigorous reviews 333 high quality papers i.e. 206 long papers and 127 short papers were included in the FSKD 2005 proceedings representing an acceptance rate of 26.7% The ICNC FSKD 2005 conference featured the most up to date research results in computational algorithms inspired from nature including biological, ecological and physical systems It is an exciting and emerging interdisciplinary area in which a wide range of techniques and methods are being studied for dealing with large complex and dynamic problems The joint conferences also promoted cross fertilization over these exciting and yet closely related areas which had a significant impact on the advancement of these important technologies Specific areas included computation with words fuzzy computation granular computation neural computation quantum computation evolutionary computation DNA computation chemical computation information processing in cells and tissues molecular computation artificial life swarm intelligence ants colony artificial immune systems etc with innovative applications to knowledge discovery, nanotechnology operations research and more

Computer Aided Design of Control Systems M. A. Cuenod, 2014-05-19 Computer Aided Design of Control Systems focuses on the use of computers to analyze and design the control of various processes as well as the development of program packages with different algorithms for digital computers The selection first takes a look at the computer aided design of minimal order controllers including design of interacting and noninteracting dynamic controllers of minimal order and basic algorithm The book then discusses an accelerated Newton process to solve Riccati equation through matrix sign function suboptimal direct digital control of a trickle bed absorption column and structural design of large systems employing a geometric approach The text underscores the computer as an aid for the implementation of advanced control algorithms on physical processes and analysis of direct control algorithms and their parallel realization Topics include hardware influences on the control process influence and interactive structure design of direct control systems The book also takes a look at the optimal control of randomly sampled linear stochastic systems computer aided design of suboptimal test signals for system identification and computer aided design of multi level systems with prescribed structure and control constraints The selection is a dependable source of data for readers interested in the uses of computers

Discrete-Time Control System Design with

Applications C.A. Rabbath, N. Léchevin, 2013-12-02 This unique book provides a bridge between digital control theory and vehicle guidance and control practice It presents practical techniques of digital redesign and direct discrete time design suitable for a real time implementation of controllers and guidance laws at multiple rates and with and computational techniques The theory of digital control is given as theorems lemmas and propositions The design of the digital guidance and control systems is illustrated by means of step by step procedures algorithms and case studies The systems proposed are applied to realistic models of unmanned systems and missiles and digital implementation **Computational And**

Information Science Ji-Huan He, 2004-12-03 This book constitutes the refereed proceedings of the First International Symposium on Computational and Information Science CIS 2004 held in Shanghai China in December 2004 The 190 revised papers presented were carefully reviewed and selected from 450 submissions The papers address virtually all computational and algorithmic aspects in various sciences mathematics and engineering as well as data and information engineering The papers are organized in four main parts on high performance computing and algorithms computational modeling and simulation bioinformatics and medical informatics and data engineering and information science **Computational and**

Information Science Jun Zhang, Ji-Huan He, Yuxi Fu, 2005-01-18 The 2004 International Symposium on Computational and Information Sciences CIS 2004 aimed at bringing researchers in the area of computational and formation sciences together to exchange new ideas and to explore new ground The goal of the conference was to push the application of modern computing technologies to science engineering and information technologies to a new level of sophistication and understanding The initial idea to organize such a conference with a focus on computation and applications was originated by Dr Jun Zhang during his visit to China in August 2003 in consultation with a few friends including Dr Jing Liu at the Chinese Academy of Sciences Dr Jun Hai Yong at Tsinghua University Dr Geng Yang at Nanjing University of Posts and Communications and a few others After several discussions with Dr Ji Huan He it was decided that Donghua University would host CIS 2004 CIS 2004 attempted to distinguish itself from other conferences in its phasis on participation rather than publication A submitted paper was only reviewed with the explicit understanding that if accepted at least one of the authors would attend and present the paper at the conference It is our lief that attending conferences is an important part of one s academic career through which academic networks can be built that may bene t one s academic life in the long run We also made every e ort to support graduate students in attending CIS 2004 In addition to set reduced registration fees for full time graduate students we awarded up to three prizes for to the Best Student Papers at CIS 2004 Students whose papers were selected for awards were given cash prizes plus a waiver of registration fees Numerical Methods for Linear Control Systems Biswa Datta, 2004-02-24 Numerical Methods for Linear Control Systems Design and Analysis is an interdisciplinary textbook aimed at systematic descriptions and implementations of numerically viable algorithms based on well established efficient and stable modern numerical linear techniques for mathematical problems arising in the design and analysis of

linear control systems both for the first and second order models Unique coverage of modern mathematical concepts such as parallel computations second order systems and large scale solutions Background material in linear algebra numerical linear algebra and control theory included in text Step by step explanations of the algorithms and examples Control and Dynamic Systems Volume 36 Richard A Leondes,1990-09-28 Control and Dynamic Systems Advances in Theory and Applications Volume 36 reviews advances in theory and applications of large scale control and dynamic systems Contributors focus on production control and the determination of optimal production rates along with active control systems uncertainty in control system design and methods for analyzing multistage commodity markets This volume is organized into eight chapters and begins with an introduction to multiobjective decision tree analysis and its significance in applied situations with two substantive examples It then shifts to important techniques for the determination of robust economic policies methods used in the analysis of multistage commodity markets and a computationally effective algorithm for the determination of the optimal production rate This book also describes many highly effective techniques for near optimal and robust model truncation Robust adaptive identification and control algorithms for disturbances and unmodeled system dynamics are given consideration The final chapter provides examples of the applied significance of the techniques presented in this book including such large scale systems areas as aerospace defense chemical environmental and infrastructural industries This book will be of interest to students and researchers in engineering and computer science Modeling and Precision Control of Systems with Hysteresis Lei Liu,Yi Yang,2015-11-20 Modelling and Precision Control of Systems with Hysteresis covers the piezoelectric and other smart materials that are increasingly employed as actuators in precision engineering from scanning probe microscopes SPMs in life science and nano manufacturing to precision active optics in astronomy including space laser communication space imaging cameras and the micro electro mechanical systems MEMS As smart materials are known for having hysteretic dynamics it is necessary to overcome issues with a broadband range of frequencies This book offers both the mathematical tools for modeling the systems and applications including complete case studies and source code for the experiments to help both academics and researchers in the industry to achieve precision in the control of Smart Actuator systems Provides a comprehensive identification of typical complex hysteresis Presents control algorithm design for systems with hysteresis Contain numerous real life examples and two complete case studies Source code to examples are provided

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