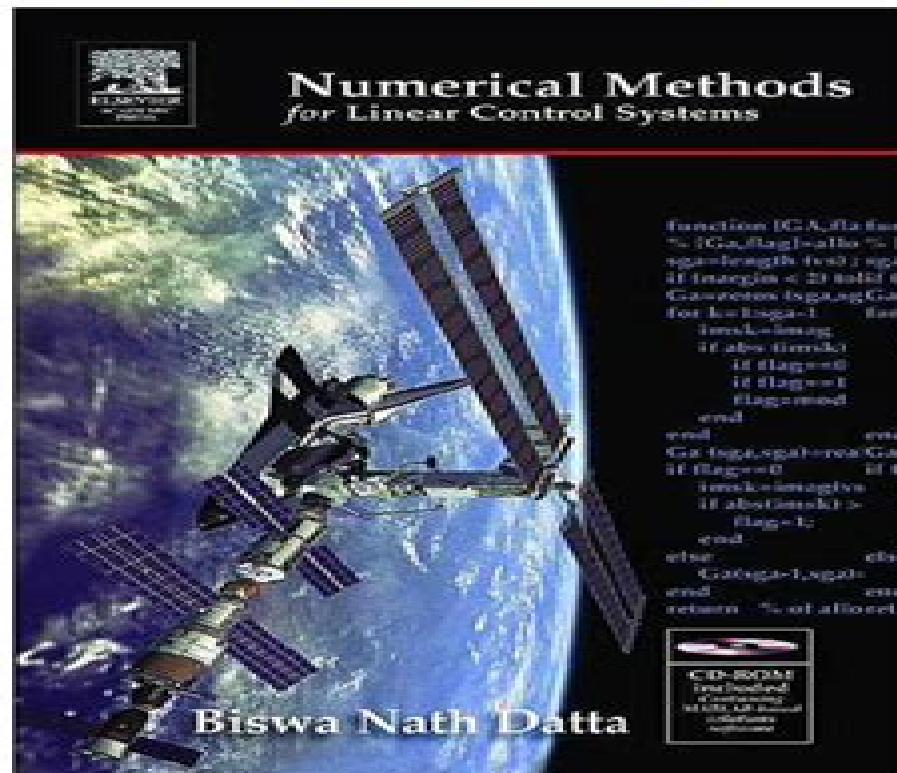


Numerical Methods for Linear Control Systems

by Biswa N. Datta

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Ivan V. Sergienko



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Numerical Linear Algebra Techniques for Systems and Control IEEE Control Systems Society, 1994 A reprint collection of practical papers covering the broad scope of numerical linear algebra in computer aided control system design software Between the 35 page introduction and extensive 21 page bibliography are seven sections general numerical issues in control controllability observability and realizations closeness problems frequency response transfer functions poles and zeros pole assignment and observer design Riccati Lyapunov and Sylvester equations and some relevant results from numerical linear algebra Annotation copyright by Book News Inc Portland OR

Computational Methods for Linear Control Systems Petko Hr. Petkov, Nikolai D. Christov, Mihail M. Konstantinov, 1991-01-01 *Linear Control System Analysis and Design with MATLAB* Constantine H. Houppis, Stuart N. Sheldon, 2013-10-30 This book uses numerous in depth explanations diagrams calculations and tables to provide an intensive overview of modern control theory and control system design Mathematics is kept to a minimum and engineering applications are stressed throughout Completely updated and packed with student friendly features the sixth edition presents a range of updated examples using MATLAB as well as an appendix listing MATLAB functions for optimizing control system analysis and design Over 75 percent of the problems presented in the previous edition have been revised or replaced

Computational Aspects of Linear Control Claude Brezinski, 2013-12-01 Many devices we say dynamical systems or simply systems behave like black boxes they receive an input this input is transformed following some laws usually a differential equation and an output is observed The problem is to regulate the input in order to control the output that is for obtaining a desired output Such a mechanism where the input is modified according to the output measured is called feedback The study

and design of such automatic processes is called control theory. As we will see, the term system embraces any device and control theory has a wide variety of applications in the real world. Control theory is an interdisciplinary domain at the junction of differential and difference equations, system theory, and statistics. Moreover, the solution of a control problem involves many topics of numerical analysis and leads to many interesting computational problems: linear algebra, QR, SVD, projections, Schur complement, structured matrices, localization of eigenvalues, computation of the rank, Jordan normal form, Sylvester and other equations, systems of linear equations, regularization, etc. root localization for polynomials, inversion of the Laplace transform, computation of the matrix exponential, approximation theory, orthogonal polynomials, Padé approximation, continued fractions, and linear fractional transformations, optimization, least squares, dynamic programming, etc. So control theory is also a good excuse for presenting various, sometimes unrelated, issues of numerical analysis and the procedures for their solution. This book is not a book on control.

Computational Methods for Approximation of Large-Scale Dynamical Systems Mohammad Monir Uddin, 2019-04-30

These days, computer-based simulation is considered the quintessential approach to exploring new ideas in the different disciplines of science, engineering, and technology. SET. To perform simulations, a physical system needs to be modeled using mathematics; these models are often represented by linear time-invariant (LTI) continuous-time (CT) systems. Oftentimes, these systems are subject to additional algebraic constraints, leading to first- or second-order differential-algebraic equations (DAEs), otherwise known as descriptor systems. Such large-scale systems generally lead to massive memory requirements and enormous computational complexity, thus restricting frequent simulations, which are required by many applications. To resolve these complexities, the higher-dimensional system may be approximated by a substantially lower-dimensional one through model order reduction (MOR) techniques. *Computational Methods for Approximation of Large-Scale Dynamical Systems* discusses computational techniques for the MOR of large-scale sparse LTI CT systems. Although the book puts emphasis on the MOR of descriptor systems, it begins by showing and comparing the various MOR techniques for standard systems. The book also discusses the low-rank alternating direction implicit (LR-ADI) iteration and the issues related to solving the Lyapunov equation of large-scale sparse LTI systems, to compute the low-rank Gramian factors, which are important components for implementing the Gramian-based MOR. Although this book is primarily aimed at postgraduate students and researchers of the various SET disciplines, the basic contents of this book can be supplemental to the advanced bachelor's level students as well. It can also serve as an invaluable reference to researchers working in academics and industries alike.

Features Provides an up-to-date step-by-step guide for its readers. Each chapter develops theories and provides necessary algorithms, worked examples, numerical experiments, and related exercises. With the combination of this book and its supplementary materials, the reader gains a sound understanding of the topic. The MATLAB codes for some selected algorithms are provided in the book. The solutions to the exercise problems, experiment data sets, and a digital copy of the software are provided on the book's website. The numerical experiments use

real world data sets obtained from industries and research institutes

Piecewise Linear Control Systems Mikael K.-J. Johansson, 2003-07-01

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An Introduction to Linear Control Systems Thomas E. Fortmann, Konrad L. Hitz, 1977-10-01

Methods of Optimization and Systems Analysis for Problems of Transcomputational Complexity Ivan V. Sergienko, 2012-07-27

This work presents lines of investigation and scientific achievements of the Ukrainian school of optimization theory and adjacent disciplines These include the development of approaches to mathematical theories methodologies methods and application systems for the solution of applied problems in economy finances energy saving agriculture biology genetics environmental protection hardware and software engineering information protection decision making pattern recognition self adapting control of complicated objects personnel training etc The methods developed include sequential analysis of variants nondifferential optimization stochastic optimization discrete optimization mathematical modeling econometric modeling solution of extremum problems on graphs construction of discrete images and combinatorial recognition etc Some of these methods became well known in the world s mathematical community and are now known as classic methods

Stability and Stabilization William J. Terrell, 2009-01-26

Stability and Stabilization is the first intermediate level textbook that covers stability and stabilization of equilibria for both linear and nonlinear time invariant systems of ordinary differential equations Designed for advanced undergraduates and beginning graduate students in the sciences engineering and mathematics the book takes a unique modern approach that bridges the gap between linear and nonlinear systems Presenting stability and stabilization of equilibria as a core problem of mathematical control theory the book emphasizes the subject s mathematical coherence and unity and it introduces and develops many of the core concepts of systems and control theory There are five chapters on linear systems and nine

chapters on nonlinear systems an introductory chapter a mathematical background chapter a short final chapter on further reading and appendixes on basic analysis ordinary differential equations manifolds and the Frobenius theorem and comparison functions and their use in differential equations The introduction to linear system theory presents the full framework of basic state space theory providing just enough detail to prepare students for the material on nonlinear systems Focuses on stability and feedback stabilization Bridges the gap between linear and nonlinear systems for advanced undergraduates and beginning graduate students Balances coverage of linear and nonlinear systems Covers cascade systems Includes many examples and exercises

Design of Linear Multivariable Feedback Control Systems Joseph J.

Bongiorno Jr., Kiheon Park, 2020-07-09 This book contains a derivation of the subset of stabilizing controllers for analog and digital linear time invariant multivariable feedback control systems that insure stable system errors and stable controller outputs for persistent deterministic reference inputs that are trackable and for persistent deterministic disturbance inputs that are rejectable For this subset of stabilizing controllers the Wiener Hopf methodology is then employed to obtain the optimal controller for which a quadratic performance measure is minimized This is done for the completely general standard configuration and methods that enable the trading off of optimality for an improved stability margin and or reduced sensitivity to plant model uncertainty are described New and novel results on the optimal design of decoupled non interacting systems are also presented The results are applied in two examples the one and three degree of freedom configurations These demonstrate that the standard configuration is one encompassing all possible feedback configurations Each chapter is completed by a group of worked examples which reveal additional insights and extensions of the theory presented in the chapter Three of the examples illustrate the application of the theory to two physical cases the depth and pitch control of a submarine and the control of a Rosenbrock process In the latter case designs with and without decoupling are compared This book provides researchers and graduate students working in feedback control with a valuable reference for Wiener Hopf theory of multivariable design Basic knowledge of linear systems and matrix theory is required **Springer**

Handbook of Automation Shimon Y. Nof, 2023-06-16 This handbook incorporates new developments in automation It also presents a widespread and well structured conglomeration of new emerging application areas such as medical systems and health transportation security and maintenance service construction and retail as well as production or logistics The handbook is not only an ideal resource for automation experts but also for people new to this expanding field

Perturbation Theory for Matrix Equations M. Konstantinov, D. Wei Gu, V. Mehrmann, P. Petkov, 2003-05-20 The book is devoted to the perturbation analysis of matrix equations The importance of perturbation analysis is that it gives a way to estimate the influence of measurement and or parametric errors in mathematical models together with the rounding errors done in the computational process The perturbation bounds may further be incorporated in accuracy estimates for the solution computed in finite arithmetic This is necessary for the development of reliable computational methods algorithms

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Polynomial and Rational Matrices Tadeusz Kaczorek, 2007-01-19 This book reviews new results in the application of polynomial and rational matrices to continuous and discrete time systems It provides the reader with rigorous and in depth mathematical analysis of the uses of polynomial and rational matrices in the study of dynamical systems It also throws new light on the problems of positive realization minimum energy control reachability and asymptotic and robust stability

Scientific and Technical Aerospace Reports ,1995 *Curriculum Handbook with General Information Concerning ... for the United States Air Force Academy* United States Air Force Academy, 1989 Technical Abstract Bulletin ,1964

Large-Scale Scientific Computing Ivan Lirkov, Svetozar D. Margenov, Jerzy Wasniewski, 2009-03-26 Coverage in this proceedings volume includes robust multilevel and hierarchical preconditioning methods applications for large scale computations and optimization of coupled engineering problems and applications of metaheuristics to large scale problems

Stability and Time-optimal Control of Hereditary Systems Ethelbert N. Chukwu, 2001 Stability and Time Optimal Control of Hereditary Systems is the mathematical foundation and theory required for studying in depth the stability and optimal control of systems whose history is taken into account In this edition the economic application is enlarged and explored in some depth The application holds out the hope that full employment and high income growth will be compatible with low prices and low inflation provided that the control matrix has full rank i e the existing controls are fully effectively used The book concludes with a new appendix containing complete programs data graphs and quantitative results for the US economy

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