

Communications and Control Engineering



Roberto Tempo
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Randomized Algorithms for Analysis and Control of Uncertain Systems

With Applications

Second Edition

 Springer

Randomized Algorithms For Analysis And Control Of Uncertain Systems

Sergio Bittanti, Patrizio Colaneri



Randomized Algorithms For Analysis And Control Of Uncertain Systems:

Randomized Algorithms for Analysis and Control of Uncertain Systems Roberto Tempo, Giuseppe Calafiore, Fabrizio Dabbene, 2012-10-21 The presence of uncertainty in a system description has always been a critical issue in control The main objective of Randomized Algorithms for Analysis and Control of Uncertain Systems with Applications Second Edition is to introduce the reader to the fundamentals of probabilistic methods in the analysis and design of systems subject to deterministic and stochastic uncertainty The approach propounded by this text guarantees a reduction in the computational complexity of classical control algorithms and in the conservativeness of standard robust control techniques The second edition has been thoroughly updated to reflect recent research and new applications with chapters on statistical learning theory sequential methods for control and the scenario approach being completely rewritten Features self contained treatment explaining Monte Carlo and Las Vegas randomized algorithms from their genesis in the principles of probability theory to their use for system analysis development of a novel paradigm for convex and nonconvex controller synthesis in the presence of uncertainty and in the context of randomized algorithms comprehensive treatment of multivariate sample generation techniques including consideration of the difficulties involved in obtaining identically and independently distributed samples applications of randomized algorithms in various endeavours such as PageRank computation for the Google Web search engine unmanned aerial vehicle design both new in the second edition congestion control of high speed communications networks and stability of quantized sampled data systems Randomized Algorithms for Analysis and Control of Uncertain Systems second edition is certain to interest academic researchers and graduate control students working in probabilistic robust or optimal control methods and control engineers dealing with system uncertainties The present book is a very timely contribution to the literature I have no hesitation in asserting that it will remain a widely cited reference work for many years M Vidyasagar *Randomized Algorithms for Analysis and Control of Uncertain Systems* Roberto Tempo, Giuseppe Calafiore, Fabrizio Dabbene, 2005-09-05 Moving on from earlier stochastic and robust control paradigms this book introduces the fundamentals of probabilistic methods in the analysis and design of uncertain systems The use of randomized algorithms guarantees a reduction in the computational complexity of classical robust control algorithms and in the conservativeness of methods like H infinity control Features self contained treatment explaining randomized algorithms from their genesis in the principles of probability theory to their use for robust analysis and controller synthesis comprehensive treatment of sample generation including consideration of the difficulties involved in obtaining independent and identically distributed samples applications in congestion control of high speed communications networks and the stability of quantized sampled data systems This monograph will be of interest to theorists concerned with robust and optimal control techniques and to all control engineers dealing with system uncertainties **Randomized Algorithms for Analysis and Control of Uncertain Systems** Roberto Tempo, Giuseppe Calafiore, Fabrizio Dabbene, 2004-09-28 Moving on

from earlier stochastic and robust control paradigms this book introduces the fundamentals of probabilistic methods in the analysis and design of uncertain systems The use of randomized algorithms guarantees a reduction in the computational complexity of classical robust control algorithms and in the conservativeness of methods like H infinity control Features self contained treatment explaining randomized algorithms from their genesis in the principles of probability theory to their use for robust analysis and controller synthesis comprehensive treatment of sample generation including consideration of the difficulties involved in obtaining independent and identically distributed samples applications in congestion control of high speed communications networks and the stability of quantized sampled data systems This monograph will be of interest to theorists concerned with robust and optimal control techniques and to all control engineers dealing with system uncertainties

An Overview on Randomized Algorithms for Analysis and Control of Uncertain Systems, 2003 Control of Uncertain Systems: Modelling, Approximation, and Design Bruce A. Francis, 2006-03-07 This Festschrift contains a collection of articles by friends co authors colleagues and former Ph D students of Keith Glover Professor of Engineering at the University of Cambridge on the occasion of his sixtieth birthday Professor Glover s scientific work spans a wide variety of topics the main themes being system identification model reduction and approximation robust controller synthesis and control of aircraft and engines The articles in this volume are a tribute to Professor Glover s seminal work in these areas

Dynamic Surface Control of Uncertain Nonlinear Systems Bongsob Song, J. Karl Hedrick, 2011-05-16 Although the problem of nonlinear controller design is as old as that of linear controller design the systematic design methods framed in response are more sparse Given the range and complexity of nonlinear systems effective new methods of control design are therefore of significant importance Dynamic Surface Control of Uncertain Nonlinear Systems provides a theoretically rigorous and practical introduction to nonlinear control design The convex optimization approach applied to good effect in linear systems is extended to the nonlinear case using the new dynamic surface control DSC algorithm developed by the authors A variety of problems DSC design output feedback input saturation and fault tolerant control among them are considered The inclusion of applications material demonstrates the real significance of the DSC algorithm which is robust and easy to use for nonlinear systems with uncertainty in automotive and robotics Written for the researcher and graduate student of nonlinear control theory this book will provide the applied mathematician and engineer alike with a set of powerful tools for nonlinear control design It will also be of interest to practitioners working with a mechatronic systems in aerospace manufacturing and automotive and robotics milieux

Periodic Systems Sergio Bittanti, Patrizio Colaneri, 2009 This book offers a comprehensive treatment of the theory of periodic systems including the problems of filtering and control It covers an array of topics presenting an overview of the field and focusing on discrete time signals and systems

Stability Theory of Switched Dynamical Systems Zhendong Sun, Shuzhi Sam Ge, 2011-01-06 There are plenty of challenging and interesting problems open for investigation in the field of switched systems Stability issues help to generate many complex nonlinear

dynamic behaviors within switched systems The authors present a thorough investigation of stability effects on three broad classes of switching mechanism arbitrary switching where stability represents robustness to unpredictable and undesirable perturbation constrained switching including random within a known stochastic distribution dwell time with a known minimum duration for each subsystem and autonomously generated with a pre assigned mechanism switching and designed switching in which a measurable and freely assigned switching mechanism contributes to stability by acting as a control input For each of these classes this book propounds detailed stability analysis and or design related robustness and performance issues connections to other control problems and many motivating and illustrative examples

Nonlinear and Adaptive Control with Applications Alessandro Astolfi, Dimitrios Karagiannis, Romeo Ortega, 2007-12-06 The authors here

provide a detailed treatment of the design of robust adaptive controllers for nonlinear systems with uncertainties They employ a new tool based on the ideas of system immersion and manifold invariance New algorithms are delivered for the construction of robust asymptotically stabilizing and adaptive control laws for nonlinear systems The methods proposed lead to modular schemes that are easier to tune than their counterparts obtained from Lyapunov redesign

Iterative Learning Control Hyo-Sung Ahn, Kevin L. Moore, YangQuan Chen, 2007-06-28 This monograph studies the design of robust

monotonically convergent iterative learning controllers for discrete time systems Iterative learning control ILC is well recognized as an efficient method that offers significant performance improvement for systems that operate in an iterative or repetitive fashion e.g robot arms in manufacturing or batch processes in an industrial setting Though the fundamentals of ILC design have been well addressed in the literature two key problems have been the subject of continuing search activity First many ILC design strategies assume nominal knowledge of the system to be controlled Only recently has a comprehensive approach to robust ILC analysis and design been established to handle the situation where the plant model is uncertain Second it is well known that many ILC algorithms do not produce monotonic convergence though in applications monotonic convergence can be essential This monograph addresses these two key problems by providing a unified analysis and design framework for robust monotonically convergent ILC The particular approach used throughout is to consider ILC design in the iteration domain rather than in the time domain Using a lifting technique the two dimensional ILC system which has dynamics in both the time and iteration domains is transformed into a one dimensional system with dynamics only in the iteration domain The so called super vector framework resulting from this transformation is used to analyze both robustness and monotonic convergence for typical uncertainty models including parametric interval uncertainties frequency like uncertainty in the iteration domain and iterative domain stochastic uncertainty

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thunderstorm has a particular combination of winds