Essential Of Robust Control Solution Manual

The book blends readability and accessibility common to undergraduate control systems texts with the mathematical rigor necessary to form a solid theoretical foundation. Appendices cover linear algebra and provide a Matlab overivew and files. The reviewers pointed out that this is an ambitious project but one that will pay off because of the lack of good up-to-date textbooks in the area.

Shows readers how to exploit the capabilities of the MATLAB® Robust Control and Control Systems Toolboxes to the fullest using practical robust control examples.

This volume is the second of the three volume publication containing the proceedings of the 1989 International Symposium on the Mathemat ical Theory of Networks and Systems (MTNS-89), which was held in Amsterdam, The Netherlands, June 19-23, 1989 The International Symposia MTNS focus attention on problems from system and control theory, circuit theory and signal processing, which, in general, require application of sophisticated mathematical tools, such as from function and operator theory, linear algebra and matrix theory, differential and algebraic geometry. The interaction between advanced mathematical methods and practical engineering problems of circuits, systems and control, which is typical for MTNS, turns out to be most effective and is, as these proceedings show, a continuing source of exciting advances. The second volume contains invited papers and a large selection of other symposium presentations in the vast area of robust and nonlinear control. Modern developments in robust control and H-infinity theory, for finite as well as for infinite dimensional systems, are presented. A large part of the volume is devoted to nonlinear control. Special atten tion is paid to problems in robotics. Also the general theory of nonlinear and infinite dimensional systems is discussed. A couple of papers deal with problems of stochastic control and filterina. vi Preface The titles of the two other volumes are: Realization and Modelling in System Theory (volume 1) and Signal Processing, Scattering and Operator Theory, and Numerical Methods (volume 3).

Robust Industrial Control Systems: Optimal Design Approach for Polynomial Systems presents a comprehensive introduction to the use of frequency domain and polynomial system design techniques for a range of industrial control and signal processing applications. The solution of stochastic and robust optimal control problems is considered, building up from single-input problems and gradually developing the results for multivariable design of the later chapters. In addition to cataloguing many of the results in polynomial systems needed to calculate industrial controllers and filters, basic design procedures are also introduced which enable cost functions and system descriptions to be specified in order to satisfy industrial requirements. Providing a range of solutions to control and signal processing problems, this book: *

Presents a comprehensive introduction to the polynomial systems approach for the solution of H_2 and H_infinity optimal control problems. * Develops robust control design procedures using frequency domain methods. * Demonstrates design examples for gas turbines, marine systems, metal processing, flight control, wind turbines, process control and manufacturing systems. * Includes the analysis of multi-degrees of freedom controllers and the computation of restricted structure controllers that are simple to implement. * Considers time-varying control and signal processing problems. * Addresses the control of non-linear processes using both multiple model concepts and new optimal control solutions. Robust Industrial Control Systems: Optimal Design Approach for Polynomial Systems is essential reading for professional engineers requiring an introduction to optimal control theory and insights into its use in the design of real industrial processes. Students and researchers in the field will also find it an excellent reference tool.

"Stability Analysis and Robust Control of Time-Delay Systems" focuses on essential aspects of this field, including the stability analysis, stabilization, control design, and filtering of various time-delay systems. Primarily based on the most recent research, this monograph presents all the above areas using a free-weighting matrix approach first developed by the authors. The effectiveness of this method and its advantages over other existing ones are proven theoretically and illustrated by means of various examples. The book will give readers an overview of the latest advances in this active research area and equip them with a pioneering method for studying time-delay systems. It will be of significant interest to researchers and practitioners engaged in automatic control engineering. Prof. Min Wu, senior member of the IEEE, works at the Central South University, China.

The main objective of this monograph is to present a broad range of well worked out, recent theoretical and application studies in the field of robust control system analysis and design. The contributions presented here include but are not limited to robust PID, H-infinity, sliding mode, fault tolerant, fuzzy and QFT based control systems. They advance the current progress in the field, and motivate and encourage new ideas and solutions in the robust control area.

Control and Dynamic Systems: Advances in Theory and Applications, Volume 50: Robust Control System Techniques and Applications, Part 1 of 2 is a two-volume sequence devoted to the issues and application of robust control systems techniques. This volume is composed of 10 chapters and begins with a presentation of the important techniques for dealing with conflicting design objectives in control systems. The subsequent chapters describe the robustness techniques of systems using differential-difference equations; the design of a wide class of robust nonlinear systems, the techniques for dealing with the problems resulting from the use of observers in robust systems design, and the effective techniques for the robust control on non-linear time varying of tracking control systems with uncertainties. These topics are followed by discussions of the effective techniques for the robust control on non-linear time varying of tracking control systems with uncertainties and for incorporating adaptive control techniques into a (non-adaptive) robust control design. Other chapters present techniques for achieving exponential and robust stability for a rather general class of nonlinear systems, techniques in modeling uncertain dynamics for robust control systems design, and techniques for the optimal synthesis of these systems. The last chapters provide a generalized eigenproblem solution for both singular and nonsingular system cases. These chapters also look into the stability robustness design for discrete-time systems. This book will be of value to process and systems engineers, designers, and researchers.

Robust Control System Design: Advanced State Space Techniques, Second Edition expands upon a groundbreaking and combinatorial approach to state space control system design that fully realizes the critical loop transfer function and robustness properties of state/generalized state feedback control. This edition offers many new examples and exercises to illustrate and clarify new design concepts, approaches, and procedures while highlighting the fact that state/generalized state feedback control can improve system performance and robustness more effectively than other forms of control. Revised and expanded throughout, the second edition presents an improved eigenstructure assignment design method that enhances system performance and robustness more directly and effectively and allows for adjustment of design formulations based on design testing and simulation. The author proposes the systematic controller order adjustment for the tradeoff between performance and robustness based on the complete unification of the state feedback control and static output feedback control. The book also utilizes a more accurate robust stability measure to guide control designs.

This textbook offers a concise yet rigorous introduction to calculus of variations and optimal control theory, and is a self-contained resource for graduate students in engineering, applied mathematics, and related subjects. Designed specifically for a one-semester course, the book begins with calculus of variations, preparing the ground for optimal control. It then gives a complete proof of the maximum principle and covers key topics such as the Hamilton-Jacobi-Bellman theory of dynamic programming and linear-quadratic optimal control. Calculus of Variations and Optimal Control Theory also traces the historical development of the subject and features numerous exercises, notes and references at the end of each chapter, and suggestions for further study. Offers a concise yet rigorous introduction Requires limited background in control theory or advanced mathematics Provides a complete proof of the maximum principle Uses consistent notation in the exposition of classical and modern topics Traces the historical development of the subject Solutions manual (available only to teachers) Leading universities that have adopted this book include: University of Illinois at Urbana-Champaign ECE 553: Optimum Control Systems Georgia Institute of Technology ECE 6553: Optimal Control and Optimization University of Pennsylvania ESE 680: Optimal Control Theory University of Notre Dame EE 60565: Optimal Control

During the 90s robust control theory has seen major advances and achieved a new maturity, centered around the notion of convexity. The goal of this book is to give a graduate-level course on this theory that emphasizes these new developments, but at the same time conveys the main principles and ubiquitous tools at the heart of the subject. Its pedagogical objectives are to introduce a coherent and unified framework for studying the theory, to provide students with the control-theoretic background required to read and contribute to the research literature, and to present the main ideas and demonstrations of the major results. The book will be of value to mathematical researchers and computer scientists, graduate students planning to do research in the area, and engineering practitioners requiring advanced control techniques.

In recent years, new paradigms have emerged to replace-or augment-the traditional, mathematically based approaches to optimization. The most powerful of these are genetic algorithms (GA), inspired by natural selection, and genetic programming, an extension of GAs based on the optimization of symbolic codes. Robust Control Systems with Genetic Algorithms builds a bridge between genetic algorithms and the design of robust control systems. After laying a foundation in the basics of GAs and genetic programming, it demonstrates the power of these new tools for developing optimal robust controllers for linear control systems, optimal disturbance rejection controllers, and predictive and variable structure control. It also explores the application of hybrid approaches: how to enhance genetic algorithms and programming with fuzzy logic to design intelligent control systems. The authors consider a variety of applications, such as the optimal control of robotic manipulators, flexible links and jet engines, and illustrate a multi-objective, genetic algorithm approach to the design of robust controllers with a gasification plant case study. The authors are all masters in the field and clearly show the effectiveness of GA techniques. Their presentation is your first opportunity to fully explore this cutting-edge approach to robust optimal control system design and exploit its methods for your own applications.

The need to be tolerant to changes in the control systems or in the operational environment of systems subject to unknown disturbances has generated new control methods that are able to deal with the non-parametrized disturbances of systems, without adapting itself to the system uncertainty but rather providing stability in the presence of errors bound in a model. With this approach in mind and with the intention to exemplify robust control applications, this book includes selected chapters that describe models of H-infinity loop, robust stability and uncertainty, among others. Each robust control method and model discussed in this book is illustrated by a relevant example that serves as an overview of the theoretical and practical method in robust control.

This is a unified collection of important recent results for the design of robust controllers for uncertain systems, primarily based on H8 control theory or its stochastic counterpart, risk sensitive control theory. Two practical applications are used to illustrate the methods throughout.

For graduate—level courses and for professional reference dealing with robust linear control, multivariable design and H...à Control. Assumes prior knowledge of feedback and control systems and linear systems theory. Also appropriate for practicing engineers familiar with modern control techniques. Class-tested at major institutions around the world and regarded as an “instant classic” by reviewers, this work offers the most complete coverage of robust and H...à control available. The clarity of the overall methodology: how one sets a problem up, introduces uncertainty models, weights, performance norms, etc. set this book apart from others in the field. Offers detailed treatment of topics not found elsewhere including — Riccati equations, ...m theory, H...à loopshaping, controller reduction, how to formulate problems in a LFT form. Key results are given immediately for quick access in the beginning of the book. Overall the book serves as a tremendous self-contained reference by having collected and developed all the important proofs and key results available. Problems sets are available on Internet.

Presented in a tutorial style, this comprehensive treatment unifies, simplifies, and explains most of the techniques for designing and analyzing adaptive control systems. Numerous examples clarify procedures and methods. 1995 edition.

This monograph introduces a newly developed robust-control design technique for a wide class of continuous-time dynamical systems called the “attractive ellipsoid method.” Along with a coherent introduction to the proposed control design and related topics, the monograph studies nonlinear affine control systems in the presence of uncertainty and presents a constructive and easily implementable control strategy that guarantees certain stability properties. The authors discuss linear-style feedback control synthesis in the context of the above-mentioned systems. The development and physical implementation of high-performance robust-feedback controllers that work in the absence of complete information is addressed, with numerous examples to illustrate how to apply the attractive ellipsoid method to mechanical and electromechanical systems. While theorems are proved systematically, the emphasis is on understanding and applying the theory to real-world situations. Attractive Ellipsoids in Robust Control will appeal to undergraduate and graduate students with a background in modern systems theory as well as researchers in the fields of control engineering and applied mathematics.

Many plants have large variations in operating conditions. To ensure smooth running it is essential to find a simple fixed gain controller that guarantees rapidly decaying and well-damped transients for all admissible operating conditions. Robust Control presents design tools, developed by the authors, for the solution of this design problem. Examples of simple and complex cases such as a crane, a flight control problem and the automatic and active four-wheel steering of a car illustrate the use of these tools. This book is intended for anyone who has taken an undergraduate course in feedback control systems and who seeks an advanced treatment of robust control with applications. Drawing on the resources and authoritative research of a leading aerospace institute, it will mainly be of interest to mechanical and electrical engineers in universities, institutes and industrial research centres.

An excellent introduction to feedback control system design, this book offers a theoretical approach that captures the essential issues and can be applied to a wide range of practical problems. Its explorations of recent developments in the field emphasize the relationship of new procedures to classical control theory, with a focus on single input and output systems that keeps concepts accessible to students with limited backgrounds. The text is geared toward a single-semester senior course or a graduate-level class for students of electrical engineering. The opening chapters constitute a basic treatment of feedback design. Topics include a detailed formulation of the control design program, the fundamental issue of performance/stability robustness tradeoff, and the graphical design technique of loopshaping. Subsequent chapters extend the discussion of the loopshaping technique and connect it with notions of optimality. Concluding chapters examine controller design via optimization, offering a mathematical approach that is useful for multivariable systems.

An operator theoretic approach to robust control analysis for linear time-varying systems, with the emphasis on the conceptual similarity with the H control theory for time-invariant systems. It clarifies the major difficulties confronted in the time varying case and all the necessary operator theory is developed from first principles, making the book as self-contained as possible. After presenting the necessary results from the theories of Toeplitz operators and nest algebras, linear systems are defined as input-output operators and the relationship between stabilisation and the existence of co-prime factorisations is described. Uniform optimal control problems are formulated as model-matching problems and are reduced to four block problems, while robustness is considered both from the point of view of fractional representations and the "time varying gap" metric, as is the relationship between these types of uncertainties. The book closes with the solution of the orthogonal embedding problem for time-varying contractive systems. As such, this book is useful to both mathematicians and to control engineers.

The essential introduction to the principles and applications of feedback systems—now fully revised and expanded This textbook covers the mathematics needed to model, analyze, and design feedback systems. Now more user-friendly than ever, this revised and expanded edition of Feedback Systems is a one-volume resource for students and researchers in mathematics and engineering. It has applications across a range of disciplines that utilize feedback in physical, biological, information, and economic systems. Karl Åström and Richard Murray use techniques from physics, computer science, and operations research to introduce control-oriented modeling. They begin with state space tools for analysis and design, including stability of solutions, Lyapunov functions, reachability, state feedback observability, and estimators. The matrix exponential plays a central role in the analysis of linear control systems, allowing a concise development of many of the key concepts for this class of models. Åström and Murray then develop and explain tools in the frequency domain, including transfer functions, Nyquist analysis, PID control, frequency domain design, and robustness. Features a new chapter on design principles and tools, illustrating the types of problems that can be solved using feedback Includes a new chapter on fundamental limits and new material on the Routh-Hurwitz criterion and root locus plots Provides exercises at the end of every chapter Comes with an electronic solutions manual An ideal textbook for undergraduate and graduate students Indispensable for researchers seeking a self-contained resource on control theory

Control of nonlinear systems, one of the most active research areas in control theory, has always been a domain of natural convergence of research interests in applied mathematics and control engineering. The theory has developed from the early phase of its history, when the basic tool was essentially only the Lyapunov second method, to the present day, where the mathematics ranges from differential geometry, calculus of variations, ordinary and partial differential equations, functional analysis, abstract algebra and stochastic processes, while the applications to advanced engineering design span a wide variety of topics, which include nonlinear controllability and observability, optimal control, state estimation, stability and stabilization, feedback equivalence, motion planning, noninteracting control, disturbance attenuation, asymptotic tracking. The reader will find in the book methods and results which cover a wide variety of problems: starting from pure mathematics (like recent fundamental results on (non)analycity of small balls and the distance function), through its applications to all just mentioned topics of nonlinear control, up to industrial applications of nonlinear control algorithms.

Over the past few decades there has been a prolific increase in research and development in area of heat transfer, heat exchangers and their associated technologies. This book is a collection of current research in the above mentioned areas and describes modelling, numerical methods, simulation and information technology with modern ideas and methods to analyse and enhance heat transfer for single and multiphase systems. The topics considered include various basic concepts of heat transfer, the fundamental modes of heat transfer (namely conduction, convection and radiation), thermophysical properties, computational methodologies, control, stabilization and optimization problems, condensation, boiling and freezing, with many real-world problems and important modern applications. The book is divided in four sections : "Inverse, Stabilization and Optimization Problems", "Numerical Methods and Calculations", "Heat Transfer in Mini/Micro Systems", "Energy Transfer and Solid Materials", and each section discusses various issues, methods and applications in accordance with the subjects. The combination of fundamental approach with many important practical applications of current interest will make this book of interest to researchers, scientists, engineers and graduate students in many disciplines, who make use of mathematical modelling, inverse problems, implementation of recently developed numerical methods in this multidisciplinary field as well as to experimental and theoretical researchers in the field of heat and mass transfer.

Structured Controllers for Uncertain Systems focuses on the development of easy-to-use design strategies for robust low-order or fixed-structure controllers (particularly the industrially ubiquitous PID controller). These strategies are based on a recently-developed stochastic optimization method termed the "Heuristic Kalman Algorithm" (HKA) the use of which results in a simplified methodology that enables the solution of the structured control problem without a profusion of user-defined parameters. An overview of the main stochastic methods employable in the context of continuous non-convex optimization problems is also provided and various optimization criteria for the design of a structured controller are considered; H ?, H2, and mixed H2/H? each merits a chapter to itself. Time-domain-performance specifications can be easily incorporated in the design.

Optimal and Robust ControlAdvanced Topics with MATLAB®CRC Press

Robust control has been a topic of active research in the last three decades culminating in H_2/H_\infty and \mu design methods followed by research on parametric robustness, initially motivated by Kharitonov's theorem, the extension to non-linear time delay systems, and other more recent methods. The two volumes of Recent Advances in Robust Control give a selective overview of recent theoretical developments and present selected application examples. The volumes comprise 39 contributions covering various theoretical aspects as well as different application areas. The first volume covers selected problems in the theory of robust control and its application to robotic and electromechanical systems. The second volume is dedicated to special topics in robust control and problem specific solutions. Recent Advances in Robust Control will be a valuable reference for those interested in the recent theoretical advances and for researchers working in the broad field of robotics and mechatronics.

Although parallel robots are known to offer many advantages with respect to accuracy, dynamics, and stiffness, major breakthroughs in industrial applications have not yet taken place. This is due to a knowledge gap preventing fast and precise execution of industrial handling and assembly tasks. This book focuses on the design, modeling, and control of innovative parallel structures as well as the integration of novel machine elements. Special attention is paid to the integration of active components into lightweight links and passive joints. In addition, new control concepts are introduced to minimize structural vibrations. Although the optimization of robot systems itself allows a reduction of cycle times, these can be further decreased by improved path planning, robot programming, and automated assembly planning concepts described by 25 contributions within this book. The content of this volume is subdivided into four main parts dealing with Modeling and Design, System Implementation, Control and Programming as well as Adaptronics and Components. This book is aimed at researchers and postgraduates working in the field of parallel robots as well as practicing engineers dealing with industrial robot development and robotic applications.

Robot Motion Control 2009 presents very recent results in robot motion and control. Forty short papers have been chosen from those presented at the sixth International Workshop on Robot Motion and Control held in Poland in June 2009. The authors of these papers have been carefully selected and represent leading institutions in this field. The following recent developments are discussed: design of trajectory planning schemes for holonomic and nonholonomic systems with optimization of energy, torque limitations and other factors, new control algorithms for industrial robots, nonholonomic systems and legged robots, different applications of robotic systems in industry and everyday life, like medicine, education, entertainment and others, multiagent systems consisting of mobile and flying robots with their applications. The book is suitable for graduate students of automation and robotics, informatics and management, mechatronics, electronics and production engineering systems as well as scientists and researchers working in these fields.

Comprehensive and up to date coverage of robust control theory and its application • Presented in a well-planned and logical way • Written by a respected leading author, with extensive experience in robust control • Accompanying website provides solutions manual and other supplementary material

Self-contained introduction to control theory that emphasizes on the most modern designs for high performance and robustness. It assumes no previous coursework and offers three chapters of key topics summarizing classical control. To provide readers with a deeper understanding of robust control theory than would be otherwise possible, the text incorporates mathematical derivations and proofs. Includes many elementary examples and advanced case studies using MATLAB Toolboxes.

Essential Computational Modeling in Chemistry presents key contributions selected from the volume in the Handbook of Numerical Analysis: Computational Modeling in Chemistry Vol. 10(2005). Computational Modeling is an active field of scientific computing at the crossroads between Physics, Chemistry, Applied Mathematics and Computer Science. Sophisticated mathematical models are increasingly complex and extensive computer simulations are on the rise. Numerical Analysis and scientific software have emerged as essential steps for validating mathematical models and simulations based on these models. This guide provides a quick reference of computational methods for use in understanding chemical reactions and how to control them. By demonstrating various computational methods in research, scientists can predict such things as molecular properties. The reference offers a number of techniques and the numerical analysis needed to perform rigorously founded computations. Various viewpoints of methods and applications are available for researchers to chose and experiment with; Numerical analysis and open problems is useful for experimentation; Most commonly used models and techniques for the molecular case is quickly accessible

Based upon the popular "Robust and Optimal Control" by Zhou, et al. (PH, 1996), this book offers a streamlined approach to robust control that reflects the most recent topics and developments in the field. FEATURES: Features coverage of state-of-the-art topics, including... Gap metric. V-gap metric. Model validation. Real mu. Offers the essentials of both robust and "Ha control" and is suitable for "self-study." Adopts a self-contained approach, including detailed proof and development of each topic. Incorporates MATLAB tools--accompanied by step-by-step illustrations--throughout the book to execute computations. Supports discussions with numerous diagrams and figures. Guides readers through a wealth of worked examples depicting step-by-step development. Provides highlights of key results at the beginning of the book. Constructs a strong pedagogical framework in each chapter, including... Guidelines for selecting topics. Chapter highlights. Lists of key terms and symbols. End-of-chapter notes. Exercises. Features more than 50 illustrative examples, 95 figures, and 150 exercises and problems.

This book covers the most attractive problem in robot control, dealing with the direct interaction between a robot and a dynamic environment, including the human-robot physical interaction. It provides comprehensive theoretical and experimental coverage of interaction control problems, starting from the mathematical modeling of robots interacting with complex dynamic environments, and proceeding to various concepts for interaction control design and implementation algorithms at different control layers. Focusing on the learning principle, it also shows the application of new and advanced learning algorithms for robotic contact tasks.The ultimate aim is to strike a good balance between the necessary theoretical framework and theoretical aspects of interactive robots.

The seven volumes LNCS 12249-12255 constitute the refereed proceedings of the 20th International Conference on Computational Science and Its Applications, ICCSA 2020, held in Cagliari, Italy, in July 2020. Due to COVID-19 pandemic the conference was organized in an online event. Computational Science is the main pillar of most of the present research, industrial and commercial applications, and plays a unique role in exploiting ICT innovative technologies. The 466 full papers and 32 short papers presented were carefully reviewed and selected from 1450 submissions. Apart from the general track, ICCSA 2020 also include 52 workshops, in various areas of computational sciences, ranging from computational science technologies, to specific areas of computational sciences, such as software engineering, security, machine learning and artificial intelligence, blockchain technologies, and of applications in many fields.

Game theory involves multi-person decision making and differential dynamic game theory has been widely applied to n-person decision making problems, which are stimulated by a vast number of applications. This book addresses the gap to discuss general stochastic n-person noncooperative and cooperative game theory with wide applications to control systems, signal processing systems, communication systems, managements, financial systems, and biological systems. H? game strategy, n-person cooperative and noncooperative game strategy are discussed for linear and nonlinear stochastic systems along with some computational algorithms developed to efficiently solve these game strategies.

Optimal and Robust Scheduling for Networked Control Systems tackles the problem of integrating system components—controllers, sensors, and actuators—in a networked control system. It is common practice in industry to solve such problems heuristically, because the few theoretical results available are not comprehensive and cannot be readily applied by practitioners. This book offers a solution to the deterministic scheduling problem that is based on rigorous control theoretical tools but also addresses practical implementation issues. Helping to bridge the gap between control theory and computer science, it suggests that the consideration of communication constraints at the design stage will significantly improve the performance of the control system. Technical Results, Design Techniques, and Practical Applications The book brings together well-known measures for robust performance as well as fast stochastic algorithms to assist designers in selecting the best network configuration and guaranteeing the speed of offline optimization. The authors propose a unifying framework for modelling NCSs with time-triggered communication and present technical results. They also introduce design techniques, including for the codesign of a controller and communication sequence and for the robust design of a communication sequence for a given controller. Case studies explore the use of the FlexRay TDMA and time-triggered control area network (CAN) protocols in an automotive control system. Practical Solutions to Your Time-Triggered Communication Problems This unique book develops ready-to-use engineering tools for large-scale control system integration with a focus on robustness and performance. It emphasizes techniques that are directly applicable to time-triggered communication problems in the automotive industry and in avionics, robotics, and automated manufacturing.

There are many books on advanced control for specialists, but not many present these topics for non-specialists. Assuming only a basic knowledge of automatic control and signals and systems, this second edition of Optimal and Robust Control offers a straightforward, self-contained handbook of advanced topics and tools in automatic control. The book deals with advanced automatic control techniques, paying particular attention to robustness-the ability to guarantee stability in the presence of uncertainty. It explains advanced techniques for handling uncertainty and optimizing the control loop. It also details analytical strategies for obtaining reduced order models. The authors then propose using the Linear Matrix Inequality (LMI) technique as a unifying tool to solve many types of advanced control problems. Topics covered in the book include, LQR and H? approaches Kalman and singular value decomposition Open-loop balancing and reduced order models Closed-loop balancing Positive-real systems, bounded-real systems, and imaginary-negative systems Criteria for stability control Time-delay systems This easy-to-read text presents the essential theoretical background and provides numerous examples and MATLAB® exercises to help the reader efficiently acquire new skills. Written for electrical, electronic, computer science, space, and automation engineers interested in automatic control, this book can also be used for self-study of for a one-semester course in robust control. This fully renewed second edition of the book also includes new fundamental topics such as Lyapunov functions for stability, variational calculus, formulation in terms of optimization problems of matrix algebraic equations, negative-imaginary systems, and time-delay systems.

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-infinity 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.

Stabilization, Optimal and Robust Control develops robust control of infinite-dimensional dynamical systems derived from time-dependent coupled PDEs associated with boundary-value problems. Rigorous analysis takes into account nonlinear system dynamics, evolutionary and coupled PDE behaviour and the selection of function spaces in terms of solvability and model quality. Mathematical foundations are provided so that the book remains accessible to the non-control-specialist. Following chapters giving a general view of convex analysis and optimization and robust and optimal control, problems arising in fluid mechanical, biological and materials scientific systems are laid out in detail. The combination of mathematical fundamentals with application of current interest will make this book of much interest to researchers and graduate students looking at complex problems in mathematics, physics and biology as well as to control theorists.

While there are many books on advanced control for specialists, there are few that present these topics for nonspecialists. Assuming only a basic knowledge of automatic control and signals and systems, Optimal and Robust Control: Advanced Topics with MATLAB® offers a straightforward, self-contained handbook of advanced topics and tools in automatic control. Techniques for Controlling System Performance in the Presence of Uncertainty The book deals with advanced automatic control techniques, paying particular attention to robustness—the ability to guarantee stability in the presence of uncertainty. It explains advanced techniques for handling uncertainty and optimizing the control loop. It also details analytical strategies for obtaining reduced order models. The authors then propose using the Linear Matrix Inequalities (LMI) technique as a unifying tool to solve many types of advanced control problems. Topics covered include: LQR and H-infinity approaches Kalman and singular value decomposition Open-loop balancing and reduced order models Closed-loop balancing Passive systems and bounded-real systems Criteria for stability control This easy-to-read text presents the essential theoretical background and provides numerous examples and MATLAB exercises to help the reader efficiently acquire new skills. Written for electrical, electronic, computer science, space, and automation engineers interested in automatic control, this book can also be used for self-study or for a one-semester course in robust control.