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Linear systems theory is the cornerstone of control theory and a well-established discipline that focuses on linear differential equations from the perspective of control and estimation. This updated second edition of Linear Systems Theory covers the subject's key topics in a unique lecture-style format, making the book easy to use for instructors and students. João Hespanha looks at system representation, stability, controllability and state feedback, observability and state estimation ...

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the system is called memoryless. Note. The rationale When all the matrices A(t), B(t), C(t), D(t) are constant $t \geq 0$, the system (1.1) behind this terminology is explained in Lecture 3. is called a Linear Time-Invariant (LT) system. In the general case, (1.1) is called a Linear Time-Varying (LTV) system to emphasize that time invariance ...

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Linear Systems Theory Second Edition - TOC

Linear System Theory, Second Edition. Wilson J. Rugh. Linear System Theory, Second Edition, outlines the basic theory of linear systems in a unified, accessible, and careful manner, with parallel, independent treatment of continuous-time and discrete-time linear systems. Categories:

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specialization. Second, much of the research literature in linear systems treats the time-varying case—for generality and because time-varying linear system theory plays an important role in other areas, for example adaptive control and nonlinear systems. Finally, of course, the theory is directly relevant when a physical system is described by a linear state equation with time-varying coefficients. Technical development of the material is careful, even rigorous, but not fancy.

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A fully updated textbook on linear systems theory Linear systems theory is the cornerstone of control theory and a well-established discipline that focuses on linear differential equations from the perspective of control and estimation. This updated second edition of Linear Systems Theory covers the subject's key topics in a unique lecture-style format, making the book easy to use for instructors and students. João Hespanha looks at system representation, stability, controllability and state feedback, observability and state estimation, and realization theory. He provides the background for advanced modern control design techniques and feedback linearization and examines advanced foundational topics, such as multivariable poles and zeros and LQG/LQR. The textbook presents only the most essential mathematical derivations and places comments, discussion, and terminology in sidebars so that readers can follow the core material easily and without distraction. Annotated proofs with sidebars explain the techniques of proof construction, including contradiction, contraposition, cycles of implications to prove equivalence, and the difference between necessity and sufficiency. Annotated theoretical developments also use sidebars to discuss relevant commands available in MATLAB, allowing students to understand these tools. This second edition contains a large number of new practice exercises with solutions. Based on typical problems, these exercises guide students to succinct and precise answers, helping to clarify issues and consolidate knowledge. The book's balanced chapters can each be covered in approximately two hours of lecture time, simplifying course planning and student review. Easy-to-use textbook in unique lecture-style format Sidebars explain topics in further detail Annotated proofs and discussions of MATLAB commands Balanced chapters can each be taught in two hours of course lecture New practice exercises with solutions included

Linear System Theory, Second Edition, outlines the basic theory of linear systems in a unified, accessible, and careful manner, with parallel, independent treatment of continuous-time and discrete-time linear systems.

This second edition comprehensively presents important tools of linear systems theory, including differential and difference equations, Laplace and Z transforms, and more. Linear Systems Theory discusses: Nonlinear and linear systems in the state space form and through the transfer function method Stability, including marginal stability, asymptotical stability, global asymptotical stability, uniform stability, uniform exponential stability, and BIBO stability Controllability Observability Canonical forms System realizations and minimal realizations, including state space approach and transfer function realizations System design Kalman filters Nonnegative systems Adaptive control Neural networks The book focuses mainly on applications in electrical engineering, but it provides examples for most branches of engineering, economics, and social sciences. What's New in the Second Edition? Case studies drawn mainly from electrical and mechanical engineering applications, replacing many of the longer case studies Expanded explanations of both linear and nonlinear systems as well as new problem sets at the end of each chapter Illustrative examples in all the chapters An introduction and analysis of new stability concepts An expanded chapter on neural networks, analyzing advances that have occurred in that field since the first edition Although more mainstream than its predecessor, this revision maintains the rigorous mathematical approach of the first edition, providing fast, efficient development of the material. Linear Systems Theory enables its reader to develop his or her capabilities for modeling dynamic phenomena, examining their properties, and applying them to real-life situations.

This book is the result of our teaching over the years an undergraduate course on Linear Optimal Systems to applied mathematicians and a first-year graduate course on Linear Systems to engineers. The contents of the book bear the strong influence of the great advances in the field and of its enormous literature. However, we made no attempt to have a complete coverage. Our motivation was to write a book on linear systems that covers finite dimensional linear systems, always keeping in mind the main purpose of engineering and applied science, which is to analyze, design, and improve the performance of phy sical systems. Hence we discuss the effect of small nonlinearities, and of perturbations of feedback. It is our on the data; we face robustness issues and discuss the properties hope that the book will be a useful reference for a first-year graduate student. We assume that a typical reader with an engineering background will have gone through the conventional undergraduate single-input single-output linear systems course; an elementary course in control is not indispensable but may be useful for motivation. For readers from a mathematical curriculum we require only familiarity with techniques of linear algebra and of ordinary differential equations.

Uses simple and efficient methods to develop results and design procedures, thus creating a non-exhaustive approach to presenting the material; Enables the reader to employ the results to carry out design. Thus, most results are discussed with an eye toward numerical computation; All design procedures in the text can be carried out using any software package that includes singular-value decomposition, and the solution of linear algebraic equations and the Lyapunov equation; All examples are developed for numerical computation and are illustrated using MATLAB, the most widely available software package.

Mathematics of Computing -- General.

An extensive revision of the author's highly successful text, this third edition of Linear System Theory and Design has been made more accessible to students from all related backgrounds. After introducing the fundamental properties of linear systems, the text discusses design using state equations and transfer functions. In state-space design, Lyapunov equations are used extensively to design state feedback and state estimators. In the discussion of transfer-function design, pole placement, model matching, and their applications in tracking and disturbance rejection are covered. Both one- and two-degree-of-freedom configurations are used. All designs can be accomplished by solving sets of linear algebraic equations. The two main objectives of the text are to: 1. use simple and efficient methods to develop results and design procedures 2. enable students to employ the results to carry out design All results in this new edition are developed for numerical computation and illustrated using MATLAB, with an emphasis on the ideas behind the computation and interpretation of results. This book develops all theorems and results in a logical way so that readers can gain an intuitive understanding of the theorems. This revised edition begins with the time-invariant case and extends through the time-varying case. It also starts with single-input single-output design and extends to multi-input multi-output design. Striking a balance between theory and applications, Linear System Theory and Design, 3/e, is ideal for use in advanced undergraduate/first-year graduate courses in linear systems and multivariable system design in electrical, mechanical, chemical, and aeronautical engineering departments. It assumes a working knowledge of linear algebra and the Laplace transform and an elementary knowledge of differential equations.

Linear and Non-Linear System Theory focuses on the basics of linear and non-linear systems, optimal control and optimal estimation with an objective to understand the basics of state space approach linear and non-linear systems and its analysis thereof. Divided into eight chapters, materials cover an introduction to the advanced topics in the field of linear and non-linear systems, optimal control and estimation supported by mathematical tools, detailed case studies and numerical and exercise problems. This book is aimed at senior undergraduate and graduate students in electrical, instrumentation, electronics, chemical, control engineering and other allied branches of engineering. Features Covers both linear and non-linear system theory Explores state feedback control and state estimator concepts Discusses non-linear systems and phase plane analysis Includes non-linear system stability and bifurcation behaviour Elaborates optimal control and estimation

This book addresses two primary deficiencies in the linear systems textbook market: a lack of development of state space methods from the basic principles and a lack of pedagogical focus. The book uses the geometric intuition provided by vector space analysis to develop in a very sequential manner all the essential topics in linear state system theory that a senior or beginning graduate student should know. It does this in an ordered, readable manner, with examples drawn from several areas of engineering. Because it derives state space methods from linear algebra and vector spaces and ties all the topics together with diverse applications, this book is suitable for students from any engineering discipline, not just those with control systems backgrounds and interests. It begins with the mathematical preliminaries of vectors and spaces, then emphasizes the geometric properties of linear operators. It is from this foundation that the studies of stability, controllability and observability, realizations, state feedback, observers, and Kalman filters are derived. There is a direct and simple path from one topic to the next. The book includes both discrete- and continuous-time systems, introducing them in parallel and emphasizing each in appropriate context. Time-varying systems are discussed from generality and completeness, but the emphasis is on time-invariant systems, and only in time-domain; there is no treatment of matrix fraction descriptions or polynomial matrices. Tips for using MATLAB are included in the form of margin notes, which are placed wherever topics with applicable MATLAB commands are introduced. These notes direct the reader to an appendix, where a MATLAB command reference explains command usage. However, an instructor or student who is not interested in MATLAB usage can easily skip these references without interrupting the flow of text.

Linear Systems and Signals, Third Edition, has been refined and streamlined to deliver unparalleled coverage and clarity. It emphasizes a physical appreciation of concepts through heuristic reasoning and the use of metaphors, analogies, and creative explanations. The text uses mathematics not only to prove axiomatic theory but also to enhance physical and intuitive understanding. Hundreds of fully worked examples provide a hands-on, practical grounding of concepts and theory. Its thorough content, practical approach, and structural adaptability make Linear Systems and Signals, Third Edition, the ideal text for undergraduates.