



Mathematical Control Theory: Deterministic Finite Dimensional Systems (Texts in Applied Mathematics)

Eduardo D. Sontag

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This textbook, based on courses taught at Rutgers University, introduces the core concepts and results of control and system theory in a self-contained and elementary fashion. With an emphasis on foundational aspects, it is intended to be used in a rigorous, proof-oriented course to an audience consisting of advanced undergraduate or beginning graduate students. In developing the necessary techniques from scratch, the only background assumed is basic mathematics. An introductory chapter describes the main contents of the book in an informal manner and gives the reader a perspective of modern control theory. While linear systems are the focus of much of the presentation, most definitions and many results are given in a far more general framework. Although mostly elementary, the text includes illustrations of the applications in control of techniques from Lie groups, nonlinear analysis, commutative algebra and other areas of "pure" mathematics. With an emphasis on a complete and totally self-contained presentation and containing an extensive bibliography and index, "Mathematical Control Theory" may be used as a reference source as well. The book covers the algebraic theory of linear systems, including controllability, observability, feedback equivalence, families of systems, controlled invariant subspaces, realization and minimality, stability via Lyapunov as well as input/output methods, ideas of optimal control, observers and dynamic feedback, parameterization of stabilizing controllers, tracking, Kalman filtering (introduced through a deterministic version of "optimal observation"), and basic facts about frequency domain such as the Nyquist criterion. Several nonlinear topics, such as Volterra series, smooth feedback stabilization and finite-experiment observability, as well as many results in automata theory of relevance for discrete-event control, are also included. The text highlights the distinctions and the similarities between continuous and discrete time systems, as well as the sampling process that relates them.

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