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Sommario/riassunto

This textbook provides a mathematical introduction to linear systems, with a focus on the continuous-time models that arise in engineering applications such as electrical circuits and signal processing. The book introduces linear systems via block diagrams and the theory of the Laplace transform, using basic complex analysis. The book mainly covers linear systems with finite-dimensional state spaces. Graphical methods such as Nyquist plots and Bode plots are presented alongside computational tools such as MATLAB. Multiple-input multiple-output (MIMO) systems, which arise in modern telecommunication devices, are discussed in detail. The book also introduces orthogonal polynomials with important examples in signal processing and wireless communication, such as Telatar's model for multiple antenna transmission. One of the later chapters introduces infinite-dimensional Hilbert space as a state space, with the canonical model of a linear system. The final chapter covers modern applications to signal processing, Whittaker's sampling theorem for band-limited functions, and Shannon's wavelet. Based on courses given for many years to upper undergraduate mathematics students, the book provides a systematic, mathematical account of linear systems theory, and as such will also be useful for students and researchers in engineering. The prerequisites are basic linear algebra and complex analysis.