

Stability and stabilization of time-delay systems: an Eigenvalue-based approach

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Abstrak

Time-delays are important components of many dynamical systems that describe coupling or interconnection between dynamics, propagation or transport phenomena, and heredity and competition in population dynamics. This monograph addresses the problem of stability analysis and the stabilization of dynamical systems subjected to time-delays. It presents a wide and self-contained panorama of analytical methods and computational algorithms using a unified eigenvalue-based approach illustrated by examples and applications in electrical and mechanical engineering, biology, and complex network analysis. This text bridges the fields of control (analysis and feedback design, robustness, and uncertainty) and numerical analysis (explicit algorithms and methods). The authors present solutions of the (robust) stability analysis and stabilization problem of linear time-delay systems, which are the result of this cross-fertilization of control theory, numerical linear algebra, numerical bifurcation analysis, and optimization. The book is organized into three parts: Part I addresses the analysis of linear time-delay systems from a stability point of view. Part II is devoted to synthesis problems with the focus on stabilization. In Part III the authors present a wide class of applications, including congestion analysis in high-performance networks, output feedback stabilization using the delays as controller parameters, predictor-type controllers, consensus problems in traffic flows, and stability analysis of various delay models in the biosciences.