ADVANCES IN ANALYSIS AND CONTROL OF TIME-DELAYED DYNAMICAL SYSTEMS

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Preface

Analysis and control of time-delayed systems have a large number of application areas including mechanical, control, transportation, economic, and biological systems. There has been a steady increase in the interest in time-delayed dynamic systems as demonstrated by a number of published articles on the subject shown in the figure below. This book presents a collection of papers presented at the International Workshop on Recent Advances in Analysis and Control of Time-delayed Dynamical Systems in Tianjin, China on July 2 to 4, 2012. The book takes a snap shot of this active research area, and contains the research work and survey articles from the world leading experts on analysis and control of dynamic systems with time delay.

The trend of number of publications on dynamic systems with time delay in the past twelve years, based on a SCI search in June, 2012.

The chapters in the book cover a broad range of important topics. The complete quadratic Lyapunov stability conditions are discussed in Chapter 1, which offer necessary and sufficient conditions for stability of time-delayed dynamical systems. Chapter 2 describes recent advances in analysis and numerical methods of delayed differential equations (DDEs) with state-dependent time delay. State-dependent time delay can find important applications in complex dynamical systems, particularly in the systems with human interactions such as car following. Engineering applications of time-delayed dynamical systems are indeed plenty. Chapter 3 is focused on time-periodic time-delayed systems, and reports stimulating applications in machining process. Chapter 8, on the other hand, presents a methodology study of the Chebyshev spectral continuous time approximation for estimation and

control of time-delayed dynamical systems. We have organized a few chapters on complex dynamics of time-delayed systems including synchronization in complex networks (Chapter 4), delay induced resonances (Chapter 6), Hopf bifurcation of time-delayed systems with complex coefficients (Chapter 7), and noise-induced dynamics of time-delayed systems (Chapter 9). Control problems of time-delayed systems have received a great deal of attention in the literature. This is reflected in the chapters of the book. Chapter 5 presents stochastic optimal control of quasi integrable Hamiltonian systems with delayed feedback control. Chapter 10 presents an overview of theoretical and experimental research on analysis, control, and time-delayed identification of structural systems. Chapter 11 deals with switching controls of uncertain linear and nonlinear dynamical systems with time delay, including supervisory control and sliding mode control.

The topics covered by the chapters are of broad interests to the research community of dynamics and control. The book can therefore be a good reference to the researchers in the community of dynamics and control including mechanical, civil, structural, aerospace, naval, and electrical engineers, and can serve as a study guide to graduate students pursuing research in the area of dynamics and control with a special interest in time-delayed dynamical systems.

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