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BOOK REVIEW

NETWORKED CONTROL SYSTEMS—THEORY AND APPLICATIONS. Fei-Yue Wang and Derong Liu, Springer, London, 2008. ISBN-13: 9781848002142

Networked control aystems (NCS) have received considerable attention in the last decade in both academic and industrial fields. Typical examples can be found in the remote control of several mobile units, arrays of microactuators, underwater acoustic, and even neurobiological and social–economical systems. A typical feature of these systems is that time division multiplexed computer networks are employed for exchanging information between spatially distributed plant components and the corresponding results on NCS are extensively scattered in the literature, see for example the special issue [1], survey papers [2, 3], and monograph [4].

The book under review, *Networked Control Systems—Theory and Applications* is an edited collection of contributions from various authors, which contains a wealth of material on control approaches for NCSs and presents a thorough treatment of both theory and applications. It is a research monograph in the area of networked control. All of the subject matters are selected by the editors with regard to coherence and the book is a contribution to the literature on NCSs.

The first two chapters provide overviews of NCSs and agent-based control and management for NCSs, respectively. Chapter 1 is a retrospect of NCS history, development, methods, and applications. Besides, it serves as an introduction and gives an insight into different challenges that come with building efficient, stable, and secure NCSs. This chapter meets the editors' objective well to be intriguing and enlightening to uninitiated readers. In Chapter 2, the issues of agent-based control and management for NCSs are illustrated and a paradigm shift from control algorithms to control agents is purposed. Its basic idea is to go from 'code on demand' in programming to 'control on demand' in automation and agent-based computing and control will be the mechanism for future automation and also a foundation for control theory and application development in the age of connectivity.

The other chapters concentrate on specific issues concerning NCS design, analysis, and implementation. Chapter 3 considers emulation-based design for NCSs, through which idealized continuous-time blocks can be implemented to digital systems to reduce the high expanse of results and design tools available in the continuous-time domain. An emulation-based approach is introduced in analogy with sampled-data control system design for the analysis and design of NCSs. Chapter 4 focuses on the analysis and design problems of NCSs with random communication time delay. To deal with the problem, a novel control strategy termed networked predictive control is addressed and applied to a servo control system through the Ethernet. Analytical criteria are obtained for both fixed and random communication time delays with the off-line and real-time simulation of the networked predictive control systems detailed.

In Chapter 5 efforts are devoted to the design of a robust H_∞ controller and H_∞ filter for uncertain NCSs considering both network-induced delay and data dropout in the model. A new method for H_∞ performance analysis of NCSs is developed by introducing some slack matrix variables and exploring the lower bound information of the network-induced delay. Chapter 6 proposes a switched output feedback control scheme for NCSs and applies it on client–server architectures where the feedback control loop is closed over a general purpose wireless communication channel between the plant (server) and the controller (client).

In Chapter 7, a guaranteed cost networked control method for Takagi–Sugeno fuzzy systems with time delay is developed, and sufficient conditions for robust stability with guaranteed H_∞ performance are obtained. Chapter 8 explores a discrete-time jump fuzzy system for the modeling and control of a class of nonlinear NCSs with communication delays and packets dropout. Chapter 9 investigates the problem of boundary control of damped wave equations using a boundary

measurement in an NCS setting. The Smith predictor is applied to this problem and the scheme is proved to be robust against a small difference between the assumed delay and the actual delay. In the end, the coordination mechanism of multi-agent systems using an adaptive velocity strategy is surveyed in Chapter 10 and the robust synthesis problem for strictly positive real transfer functions is studied in Chapter 11.

Besides all the positive comments, one fact should also be mentioned. Some chapters of the book have concentrated more on the technical details than the explanation and motivation of the arguments used therein. Throughout the book one may have difficulties finding practical examples except from Chapter 4. The lack of transitions from one chapter to another might also cause confusions to nonspecialist readers. In addition, a chapter presenting the industrial applications of NCSs is recommended to help the readers better comprehend the theory.

To conclude, this book is an excellent integration of the state-of-the-art advances on analysis, design, and applications of NCS. It covers a broad range of NCSs' topics of important academic value, with a lot novel ideas, fresh observations, and rigorous results. The book is thus highly recommended to serve as a reference for researchers and engineers in the system, control, and communication communities. The book can also serve as a complementary reading for complex system theory at the post-graduate level.

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