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Nonlinear Control of Dynamic Networks (Automation and Control Engineering)

Tengfei Liu, Zhong-Ping Jiang, David J. Hill

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Significant progress has been made on nonlinear control systems in the past two decades. However, many of the existing nonlinear control methods cannot be readily used to cope with communication and networking issues without nontrivial modifications. For example, small quantization errors may cause the performance of a "well-designed" nonlinear control system to deteriorate.

Motivated by the need for new tools to solve complex problems resulting from smart power grids, biological processes, distributed computing networks, transportation networks, robotic systems, and other cutting-edge control applications, **Nonlinear Control of Dynamic Networks** tackles newly arising theoretical and real-world challenges for stability analysis and control design, including nonlinearity, dimensionality, uncertainty, and information constraints as well as behaviors stemming from quantization, data-sampling, and impulses.

Delivering a systematic review of the nonlinear small-gain theorems, the text:

- Supplies novel cyclic-small-gain theorems for large-scale nonlinear dynamic networks
- Offers a cyclic-small-gain framework for nonlinear control with static or dynamic quantization
- Contains a combination of cyclic-small-gain and set-valued map designs for robust control of nonlinear uncertain systems subject to sensor noise
- Presents a cyclic-small-gain result in directed graphs and distributed control of nonlinear multi-agent systems with fixed or dynamically changing topology

Based on the authors' recent research, **Nonlinear Control of Dynamic Networks** provides a unified framework for robust, quantized, and distributed control under information constraints. Suggesting avenues for further exploration, the book encourages readers to take into consideration more communication and networking issues in control designs to better handle the arising challenges.

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