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Consensus Problem of Delayed Linear Multi-agent Systems

Analysis and Design

 Springer

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To my family

Cheng-Lin Liu

Preface

Consensus behavior of multi-agent systems with distributed coupling interaction exists extensively in physics and in biology and has broad engineering applications, including clock synchronization, multi-motor synchronization, and smart grid. In distributed multi-agent systems, moreover, time delays are always within the communication, computing, and sensing processes, so determining and decreasing the delay impact on consensus seeking is worth of further investigation.

The objective of this monograph is to provide thorough analysis on the delay robustness of consensus collective behavior for homogeneous and heterogeneous linear multi-agent systems. For the dynamical consensus seeking of linear multi-agent systems with communication delay, some innovative consensus algorithms are designed to decrease or eliminate the communication delays' impacts on the consensus behavior.

Chapter 2 is concerned with consensus problem of delayed homogeneous multi-agent systems, e.g., two coupled first-order and second-order agents with both communication and input delays, second-order multi-agent systems with diverse time delays, and general linear multi-agent systems with both identical communication and input delays. In Chap. 3, we take into account the consensus problem of mixed system with two-class agents and fully heterogeneous multi-agent systems. Inspired by time-delayed feedback control and delay compensation design, difference-compensated and predictor-based consensus algorithms are designed in Chaps. 4 and 5, respectively, to deal with the dynamical consensus problems of the first-order, second-order, and high-order multi-agent systems.

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