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Cooperative Control of Multi-Agent Systems: A Consensus Region Approach (Automation and Control Engineering)

Zhongkui Li, Zhisheng Duan

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Distributed controller design is generally a challenging task, especially for multi-agent systems with complex dynamics, due to the interconnected effect of the agent dynamics, the interaction graph among agents, and the cooperative control laws. **Cooperative Control of Multi-Agent Systems: A Consensus Region Approach** offers a systematic framework for designing distributed controllers for multi-agent systems with general linear agent dynamics, linear agent dynamics with uncertainties, and Lipschitz nonlinear agent dynamics.

Beginning with an introduction to cooperative control and graph theory, this monograph:

- Explores the consensus control problem for continuous-time and discrete-time linear multi-agent systems
- Studies the H∞ and H2 consensus problems for linear multi-agent systems subject to external disturbances
- Designs distributed adaptive consensus protocols for continuous-time linear multi-agent systems
- Considers the distributed tracking control problem for linear multi-agent systems with a leader of nonzero control input
- Examines the distributed containment control problem for the case with multiple leaders
- Covers the robust cooperative control problem for multi-agent systems with linear nominal agent dynamics subject to heterogeneous matching uncertainties
- Discusses the global consensus problem for Lipschitz nonlinear multi-agent systems

Cooperative Control of Multi-Agent Systems: A Consensus Region Approach provides a novel approach to designing distributed cooperative protocols for multi-agent systems with complex dynamics. The proposed consensus region decouples the design of the feedback gain matrices of the cooperative protocols from the communication graph and serves as a measure for the robustness of the protocols to variations of the communication graph. By exploiting the decoupling feature, adaptive cooperative protocols are presented that can be designed and implemented in a fully distributed fashion.

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