Robust Consensus of Uncertain Multi-Agent Systems

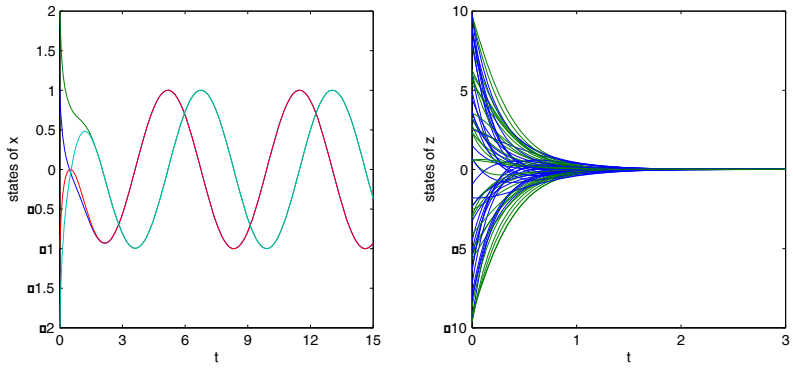
Background

Consensus , as well as the related term “synchronization“, refers to a variety of phenomena in natural science, engineering and social life. Bird flocking, fish schooling and firing of neurons are few of numerous examples in real world. The interesting point is that this cooperative behavior can not be well investigated by only studying one single intelligent. Especially in recent years, researchers are interested in the coordination motion of uncertain multi-agent systems where the interaction amongst agents are disturbed by uncertainties. Then, the term “robust consensus“ appears for a group of intelligent systems with disturbance and uncertain behavior.

Description

The main problem in this area is to check the consensusability of uncertain multi-agent systems with parametric uncertainties. It is usually assumed that this kind of uncertainty is existing in the communication and interaction amongst agents to stand for the perturbation and disturbance of the environment. By setting the uncertain parameters in a constrained set, the model of uncertain multi-agent system can be obtained.

Contraction theory is a powerful tool for trajectory stability. By constructing contraction matrix, the contraction behavior can be ensured. This theory can be adopted to robust synchronization problem by using partial contraction method, i.e., an auxiliary method especially for synchronization problem. Via proposing more general contraction matrix, less conservative results can be obtained for robust consensus of nonlinear complex systems.



Tasks

- Give a general model of uncertain multi-agent systems
- Study the rational Lyapunov function
- Propose the robust consensus conditions
- Test results with numerical examples

References

[1] E. M. Aylward, P. A. Parrilo, and J.-J. E Slotine. Stability and robustness analysis of nonlinear systems via contraction metrics and sos programming. *Automatica*, 44(8):2163–2170, 2008.

[2] D. Han and G. Chesi. Robust synchronization via homogeneous parameter-dependent polynomial contraction matrix. *Circuits and Systems I: Regular Papers, IEEE Transactions on*, 61(10):2931–2940, 2014.

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