PhD Oral Defense

Date: **28 September 2021 (Tuesday)** **Time:** **2:30pm**

Thesis Title

Consensus of Nonlinear Multi-Agent Systems with Directed Network and Its Applications

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Abstract

This thesis focuses on nonlinear multi-agent systems under a directed network. To cope with different scenarios, consensus criteria are theoretically established while their usages in real-world applications are explored. First of all, we consider the leader-following consensus of coupled nonlinear agents with intermittent control. By using multiple Lyapunov functions method and the algebraic graph theory, the second-order consensus is guaranteed just by pinning a subset of followers with mild assumptions. Next, we study a more general framework with time-varying control, which is useful to counteract denial-of-service (DoS) attacks. It is revealed that consensus is still achievable, provided that the average of the DoS attack duration over a certain length of time interval is upper bounded. Then, we explore the time-varying control in the presence of transmission delay over a communication network. Together with the agent dynamics and the underlying topology, the average of the control strength governs the largest admissible delay. To further reduce resource utilization, we propose both the state-dependent and time-dependent event-triggered protocols, respectively. Instead of specifying a lower bound for the control gain, as others suggested, our criteria rely on its time average and thus allow higher flexibility in controller design. Finally, a GP-DMPC approach is proposed to solve consensus problems with model uncertainty and practical constraints.