

Systems and Control Seminar
Fujita and Hatanaka Group
Tokyo Institute of Technology

Robust Design of Cooperative Systems against Attacks

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Abstract

While the use of a communication network facilitates the implementation of cooperative control in a networked system to achieve consensus dynamics, it comes at a price in that the system becomes vulnerable to data attacks by an adversary. Typically, the attacker would insert external (bounded) injections at nodes in the network to intercept communication signals and corrupt the local state feedback of the system with the intent of destabilizing the consensus dynamics. In this talk, we explore a new approach for protecting cooperative networked systems with strongly connected directed communication graph against such attacks. Our approach involves introducing a hidden network, interconnected with the original consensus network, designed to maintain stability of the overall system after the attack but without requiring any information about the adversary or nature of the injections. Lyapunov analysis and design methods are presented which provide an explicit rule on how to interconnect both the original consensus and hidden networks to accomplish the desired stability. Furthermore, using a similar analysis and design framework we show that the nodes that are being attacked can also be identified in a distributed manner. An example, which includes several scenarios, is used to illustrate the results.