Title
A Graph Theoretic Characterization of Perfect Attackability for the Secure Design of Distributed Control Systems

Presenter
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Abstract
This talk considers the problem of secure design in Distributed Control Systems to ensure the detection of stealthy integrity attacks. Distributed Control Systems consist of many heterogeneous components such as sensors, controllers, and actuators and may contain several independent agents. The presence of many heterogeneous components and agents in a system increases the attack surfaces for potential adversaries, making Distributed Control Systems vulnerable to stealthy and malicious behavior. The goal of this article is to consider the design of Distributed Control Systems to ensure the deterministic detection of attacks. To do this, we leverage existing results which state that ensuring deterministic detection of a fixed set of malicious agents is equivalent to structural left invertibility. We extend the notion of structural left invertibility to consider attacks from all possible sets of malicious agents using the concept of vertex separators. Vertex separators are then used to formulate and solve optimization problems which aim to minimize the size of communication networks while also ensuring that a resource limited adversary cannot generate undetectable attacks. Optimal bounds on communication and sensing are obtained and polynomial time algorithms are provided for design.