Full-day Workshop: Fault/Intrusion Diagnosis of Massive Cyber-physical Control Systems

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Abstract:

Over the last decade, there has been a paradigm shift in computational infrastructures towards increased availability of networked, scalable, and resilient computational resources at lower cost. This paradigm shift has been a catalyst for ubiquitous deployment of networked control systems (NCSs) and supervisory control and data acquisition (SCADA) systems to remotely monitor and control large industrial infrastructures over private or public communication networks. As the connectivity of industrial machines with physical dynamics grows across spatially distributed physical areas, the "industrial network" will surpass today's

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consumer and enterprise networks in size by more than 20 folds.

The *main objective* of this workshop is to bring academics and industrial experts to discuss challenges and opportunities in fault diagnosis of cyber-physical control systems with massive sensor data, and propose next steps to cultivate growth of solution approaches through conference and journal publications, special sessions, and grant proposals. Towards achieving our goal, we propose to bring experts in 1) controls, 2) machine-learning, and 3) discrete-event systems covering topics including but not limited to:

- *Massively interacting systems*: Higher connectivity and network feedback control in cyber-physical systems require explicit modeling and understanding of the interaction and propagation of faults and anomalies (multi-agent systems + network control + prognostics)
- *Emergent faults*: Industrial machines operate over longer periods, and it is not uncommon to receive patches and updates to the operating system over the lifetime of the machine. A modification to the control software of one or more components give rise to an emergent fault at the system level.
- *Active diagnosis*: Design of control algorithms in conjunction with learning algorithms to enhance observability of hidden weak signatures while maintaining safe and performance guarantees.
- *Formal methods*: Formal methods provide a framework to analyze and design cyber-physical systems. Diagnosis of systems modeled by high-order logical constructs have been the topic of recent research.