COMPUTER SCIENCE & ENGINEERING
UNIVERSITY OF MICHIGAN

DISSERTATION DEFENSE

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Characterizing Laser Signal Injection and its Impact on the Security of Cyber-Physical Systems

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3725 Beyster
Hybrid – Zoom

ABSTRACT: Lasers can be used to inject adversarial-controlled signals into sensors used in cyber-physical systems. This capability is often unexpected, use physical mechanisms that were never considered, and exploit the blind trust in sensors. These laser signal injection attacks can allow adversarial influence or even control over a system's perception of the environment, leading to potentially harmful situations.

The purpose of this thesis is to characterize the laser signal injection vulnerabilities in sensors such as LiDAR in autonomous vehicles, MEMS microphones in smart speakers, and the variety of sensors used in small satellites. This characterization includes an in-depth investigation of attacker capabilities, the development of models to describe the vulnerability, and a description of the consequences on cyber-physical systems. This characterization is performed not just present the results of a single attack, but to fully understand the mechanisms that lead to vulnerabilities within these cyber-physical systems. This understanding is necessary to design future systems in a way that will be resistant to all forms of laser signal injection, allowing sensors and cyber-physical systems to be safer, more trustworthy, and more secure.

CHAIR: Prof. Kevin Fu and Prof. Mingyan Liu