Title: Toward High-Confidence System-Level Tamper Detection Using Impedance Sensing

Speaker: Tahoura Mosavirik, PhD student, WPI

Abstract:
With the globalization of electronic systems' fabrication, different steps of design, fabrication, and packaging may no longer be completed under the same roof. Hence, adversaries can tamper with PCBs through different stages of the supply chain, from manufacturing and assembling to their deployment in the field. The conventional physical verification methods are time-consuming, costly, unscalable, and error-prone. In this talk, we present a unified and systematic framework for high-confidence PCB verification and system-level tamper detection by demonstrating how the impedance characterization of the system's power distribution network (PDN) can detect various classes of tamper events in different layers of abstractions. Our solutions make the verification generic and applicable to virtually all electronic systems. The first solution, "ScatterVerif," is a holistic PCB verification framework based on the characterization of the PCBs' PDN. We show that different classes of physical attacks affect the overall impedance of a PCB differently in various frequency ranges. Hence, the reflection response of the PCB provides a unique hardware signature to differentiate between genuine and counterfeit/tampered samples by a single measurement. The second approach, "ImpedanceVerif," enables the verifier to detect different classes of tampering activities using on-chip network analyzers. These embedded network analyzers can be deployed on FPGAs to extract the frequency response of the PDN without any modifications to the system. The on-chip impedance sensing reveals different classes of tamper events from board to chip level, even environment-level tampering activities, such as the proximity of contactless EM probes to the IC package or slightly polished IC package.

Bio:
Tahoura Mosavirik received the M.Sc. degree in electrical engineering from Iran University of Science and Technology (IUST), Tehran, Iran in 2020, where she was a research assistant at antenna and microwave research laboratory. Since 2021, she is pursuing the Ph.D. degree in electrical engineering with Worcester Polytechnic Institute (WPI), Worcester, MA, USA, in Vernam applied cryptography and secure embedded systems laboratory. Her research interests include hardware security, physical characterization of electronic systems, and signal/power integrity.