

Hidden Computation, Real Consequences: Weird Machines and the Security of Critical Infrastructure



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Modern cyber-physical systems — from power grids to industrial control networks — are built from deeply interdependent, heterogeneous components that interact in ways their designers never anticipated. These interactions give rise to what researchers call **weird machines**: emergent computational models that allow adversaries to leverage existing code and hardware primitives to perform unintended, attacker-directed computations. While weird machines have been studied extensively in the context of software exploitation, their implications for operational technology (OT) and critical infrastructure remain poorly understood — and potentially far more dangerous. In OT environments, a single weird machine primitive exploited across interdependent grid assets can trigger cascading physical failures that no localized defense can contain.



In this talk, Dr. Sridhar presents a formal framework for discovering weird machine primitives before they can be weaponized and argues that this approach is urgently needed for energy systems. She connects this work to ongoing research at CESAR, UNC Charlotte's Center for Energy Security and Reliability.

Dr. Meera Sridhar is an Associate Professor in the Department of Cybersecurity at the University of North Carolina Charlotte, where she is the Founder and Director of the Center for Energy Security and Reliability (CESAR) — a multi-institution, multi-million-dollar research initiative advancing the security and resilience of critical power infrastructure. Her research program develops provably resilient, autonomous cyber-physical systems by combining the reasoning power of AI with the mathematical rigor of formal methods, with applications spanning energy grid security, IoT firmware, and high-assurance computing.

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