

Graduate Research Seminar

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3:30 pm | PHYS 114

Overview of the PUR-1 Digital Twin

Abstract

This seminar presents an overview of the digital twin developed for the Purdue University Reactor (PUR-1), a high-fidelity virtual replica that integrates physics-based models, real-time reactor data, and advanced control algorithms to replicate and predict reactor behavior. The digital twin combines neutronics, thermal-hydraulics, and instrumentation models with live sensor inputs from PUR-1 to enable monitoring, diagnostics, and predictive analysis of reactor operations. The platform serves as a cyber-physical testbed for research in autonomous reactor control, anomaly detection, and digital instrumentation and control systems. The seminar will highlight the architecture of the digital twin, its integration with the PUR-1 control system, and its applications in research, operator training, and the development of next-generation nuclear reactor monitoring technologies.

Vasileios Theos is a PhD candidate at the School of Nuclear Engineering at Purdue University, advised by Prof. Stylianos Chatzidakis. He holds a BSc in Mechanical Engineering from the National Technical University of Athens and an MS in Nuclear Engineering from Purdue University. His research focuses on Digital Twins (DTs), neutronics and multiphysics simulation, remote control, and cybersecurity in nuclear reactor environments. Additional interests include ML-based surrogate modeling, along with validation and uncertainty quantification of DTs.