Progress Towards Resilience Through Data-Driven Intelligently-Designed Control

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ABSTRACT

Control systems are increasing in capabilities and connectivity to continue to meet the performance goals required by our critical infrastructure. Due to these increases there is an resultant increased risk of hazards, like cyber-attacks, failing communication infrastructure, emergent failure conditions due to complex interactions. To mitigate these risks, controls must be designed for resilience to these adverse conditions and operate around them. In support of this goal, PNNL has started a research program called Resilience through Data-drive, Intelligently Designed Control (RD2C) to develop resilient controls through empirical exploration and phenomenological understanding of system behavior under adverse conditions and using control theory, data-driven algorithmic, and co-design approaches. An overview of this new research program will be presented with in-depth discussions of a few of the current projects and some early results.

BIOS

Thomas Edgar is a cyber security research scientist at PNNL. During his 15+ years at PNNL, Edgar has worked in the fields of secure communications protocols, cryptographic trust management, insider threat, security standards, and scientific approach to security. Edgar is the principal investigator for a cyber-physical testbed to enable controlled experimentation in high-fidelity environments. He is also the thrust lead for the Resilience Through Data-driven, Intelligently Designed Control (RD2C) initiative, focused on increasing our understanding of cyber-physical systems through the creation and use of controlled experimentation capabilities and methods. His expertise lies in scientific process, critical infrastructure security, protocol development, cyber deception, and network security. Edgar authored a textbook, Research Methods for Cyber Security, which he taught at Washington State University as an adjunct professor. Thomas has a BS and MS in computer science, with a specialization in information assurance.

Dr. Veronica Adetola is a chief research scientist at PNNL. She has more than 12+ years of experience in research, development, and demonstration of advanced control solutions for high-performing buildings, grid-interactive distributed energy resources, transport refrigeration, and aerospace systems. She is currently the principal investigator for multiple Department of Energy-funded projects developing model-based and data-driven control solutions to improve energy systems’ efficiency, reliability, and resiliency. She is also the thrust lead for the Resilience Through Data-driven, Intelligently Designed Control (RD2C) initiative, focused on sensing, control and coordination of cyber-physical systems. Adetola has authored a book, three book chapters, and more than 40 peer-reviewed journal publications and conference papers. Adetola was a board of governors member of the IEEE Control Systems Society in 2019 and currently serves as associate editor for IEEE Transactions on Control Systems Technology. She has a PhD in engineering (control systems).