PURDUE UNIVERSITY | Nuclear Engineering
COLLEGE OF ENGINEERING

Nuclear Engineering Seminar

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Safety and Nonproliferation Aspects of Spent Nuclear Fuel from Nuclear Power Reactors

Abstract

The future of nuclear energy depends on our ability to manage spent nuclear fuel and high-level radioactive waste without compromising safety or spreading the threat of nuclear weapons. However, expansion of nuclear energy, including small modular and advanced reactors, and delays in construction of permanent disposal repositories will unavoidably create increased pressure to ensure that spent nuclear fuel remains safe and secure. New approaches that exploit the possibilities of Artificial Intelligence and Deep Learning and recent advances in sensors and algorithms for remote verification have the potential to address critical gaps and enable the expansion of clean, safe, and economical nuclear power. This presentation will cover safety and nonproliferation aspects during storage, transportation and disposal of spent nuclear fuel and an overview of on-going research activities including new state-of-the-art remediation techniques, progress in cosmic ray muon tomography for nonproliferation, and AI-based monitoring approaches to support spent nuclear fuel management.

Stylianos Chatzidakis is currently R&D Staff and Weinberg Distinguished Fellow within the Reactor and Nuclear Systems Division at Oak Ridge National Laboratory (ORNL). His research focuses on developing novel non-destructive and AI-based technologies to address challenges associated with the safety and nonproliferation of nuclear fuel cycle with particular expertise in spent nuclear fuel. Stylianos received his Ph.D. in Nuclear Engineering from Purdue University. He also holds a M.Sc. in Energy Physics from the Institut National Polytechnique de Grenoble (INPG) in France, and a Diploma in Mechanical Engineering (5-year program) from the National Technical University of Athens. He has served as the principal investigator and technical lead for several projects sponsored by DOE Office of Science and Office of Nuclear Energy including the ongoing development of a first-of-a-kind Mobile Examination and Remediation Fixture (MERF) which has the capability to perform remote and automated remediation of spent fuel containers. He has 17 research papers published in internationally circulated peer-reviewed journals, 26 conference proceedings, co-authored 6 book chapters, and several technical reports that have been used for policy and decision making in organizations around the world, including reports for the IAEA and DOE.