M&C 2017
International Conference on Mathematics & Computational Methods
Applied to Nuclear Sciences & Engineering, April 16-20, 2017, Jeju, Korea

Special Session Description

Session Title: **Solving Inverse Problems for Nuclear Nonproliferation Applications**

Subject Areas: 13. Mathematics and Computational Methods for General Nuclear Applications

Supplemental: 3. Nuclear Data Evaluation and Assimilation of Integral Experiments
4. Subcritical System Analysis Methods
5. Uncertainty Quantification and Sensitivity Analysis

Organizers

John Mattingly
North Carolina State University
+1-919-515-0224
jkmattin@ncsu.edu

Imre Pázsit
Chalmers University of Technology
+46-31-772-30-81
imre@chalmers.se

Description

Mathematical and computational methods to estimate system inputs and/or system parameters from observations of system responses have valuable applications in nuclear nonproliferation, including:

- Detecting the presence of a radioactive source by identifying radiation detector responses that are inconsistent with naturally occurring background radiation
- Estimating the location of a radiation source from a collection of radiation detector responses
- Identifying the radionuclides present in an unknown sample of radioactive material from gamma spectroscopic measurements
- Estimating the mass and composition of an unknown sample of fissile material from gamma and/or neutron measurements
- Confirming the operational history of a reactor by inferring the initial enrichment, burnup, and cooling time of spent nuclear fuel from gamma and/or neutron measurements
- Detecting the diversion of fissile material from a nuclear fuel cycle by identifying anomalies in production history and shipper/receiver differences

This special session will cover recent developments in parameter estimation, model calibration, sensitivity analysis, and uncertainty quantification applied to the preceding and other problems relevant to monitoring states' compliance with nonproliferation obligations, detecting incipient proliferation activities, and mitigating the consequences of nuclear proliferation.

The session will include mathematical analyses, deterministic and stochastic modeling, and statistical inference methods to estimate system inputs and parameters from experimentally measured system responses. It will also include mathematical models of new measurement modalities that enable estimation of system inputs and parameters.