**MSc thesis proposal**

**(in collaboration with ENEA and Politecnico di Torino)**

* **Title of the research**

**Inverse uncertainty quantification of nuclear thermal-hydraulic codes for safety analysis of Integral Effect Tests nuclear power facilities**

* **Objectives of the research**

In the past few decades, there has been an increasing interest in the use of Best Estimate Plus Uncertainty (BEPU) methodologies for the safety analyses of Nuclear Power Plants (NPPs), when simulated with Best-Estimate Thermal-Hydraulic (BE-TH) system codes (e.g., ATHLET, CATHARE, RELAP, SPACE, TRACE, etc). A crucial issue is the quantification of the input uncertainties associated to the physical models in the code. When such quantification is performed relying on the available experimental data, it is called Inverse or Input Uncertainty Quantification (IUQ). Bayesian analysis can be used to establish the IUQ problem based on experimental data, embedding surrogate models based, for example, on Polynomial Chaos Expansion (PCE), Kriging, etc., typically collected from Separate Effect Tests (SETs) facilities and not on Integral Effects Tests (IETs) facilities, due to both the complexity of these latter model and the lack of experimental data.

The purpose of this thesis is to develop innovative methods to advance the IUQ methodologies, capable of upscaling the results of the IUQ performed on the IETs for their application to the IET. The thesis is performed within a Nuclear Energy Agency (NEA)/ Committee on the Safety of Nuclear Installations (CSNI)/ Working Group on the Analysis and Management of Accidents (WGAMA) international project called ATRIUM (Application Tests for Realization of Inverse Uncertainty quantification and validation Methodologies in thermal-hydraulics) whose scope is benchmarking the developed methods with respect to some physical phenomena relevant that occur during an intermediate break LOCA. (i.e., critical flow at the break and post-CHF heat transfer phenomena).

The methods will be developed within in tight collaboration between Politecnico di Milano, Politecnico di Torino and ENEA.

References

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