MSc thesis proposal

(in collaboration with ENEA and Politecnico di Milano)

- **Title of the research**

Inverse uncertainty quantification of nuclear thermal-hydraulic codes for the safety analysis of nuclear power plants

- **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). However, when using Best-Estimate Thermal-Hydraulic (BE-TH) system codes (e.g., ATHLET, CATHARE, RELAP, SPACE, TRACE, etc) the issue is the identification of the uncertainties affecting the code results. These are due to the physical models implemented in the code and its inputs. The quantification of the latter is performed relying on available experimental data, within a data analysis framework called Inverse Uncertainty Quantification (IUQ). Probabilistic Bayesian analysis can be used for IUQ problem supported by surrogate models based, e.g., Polynomial Chaos Expansion (PCE), Kriging, etc., to reduce the computational burden.

Within this framework, the purpose of this thesis is to develop innovative methods to advance IUQ methodologies. The thesis is performed within an international project called ATRIUM (Application Tests for Realization of Inverse Uncertainty quantification and validation Methodologies in thermal-hydraulics) launched by the Nuclear Energy Agency (NEA)/ Committee on the Safety of Nuclear Installations (CSNI)/ Working Group on the Analysis and Management of Accidents (WGAMA). The scope of the project is benchmarking the different IUQ methodologies with respect to physical phenomena relevant to intermediate break LOCA. (i.e., critical flow at the break and post-CHF heat transfer phenomena).

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

References

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