MSc thesis proposal abroad
(in collaboration with Institute for Risk and Reliability of Leibniz University of Hannover and with part of the thesis developed at such Institute)

❖ **Title of the research**

Advanced methods of dynamic risk assessment for energy systems

❖ **Objectives of the research**

The goal of this thesis project is to develop a dynamic risk assessment modelling approach capable of considering in an integrated manner the physical behavior of the system together with the stochastic occurrence of possible failure events of its components. In order to do this, two sub-models, deterministic and stochastic, need to be developed and linked together to create an overall hybrid model.

Furthermore, as the values of the parameters of the models are highly uncertain due to natural unit-to-unit variability occurring during component manufacturing, assembly and operation, it is necessary to account for such uncertainty.

The thesis project involves a number of steps:

- Study of the concept of dynamic reliability methods.
- Investigation of techniques for the solution of the dynamic reliability model.
- Investigation of uncertainty analysis methods, including subjective probability and probability bounds analyses, with efficient solutions by Augmented Space Integral.
- Implementation of the developed algorithms in a suitable programming language, e.g. Matlab, Python.
- Application to energy systems.

References

Vasyliev, A. et al., Dynamic Reliability Assessment of PEM Fuel Cell Systems, Reliability Engineering and System Safety 210 (2021) 107539.

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Flage R. et al., A comparison between a probability bounds analysis and a subjective probability approach to express epistemic uncertainties in a risk assessment context – A simple illustrative example, Reliability Engineering and System Safety 169 (2018) 1-10.

M. Marseguerra, E. Zio, J. Devooght, P.E. Labeau, "A Concept Paper on Dynamic Reliability via Monte Carlo Simulation", Mathematics and Computers in Simulation, Vol. 47, No. 2-5, 1998, pp. 371-383.

For further information, please contact
Prof. Enrico Zio, enrico.zio@polimi.it , 02 2399 6340