NRG is looking for an MSc thesis student for:

Probabilistic Pressurized Thermal Shock

The Nuclear Research and Consultancy Group (NRG) is responsible for operating the High Flux Reactor (HFR) and for a continued nuclear research effort in the Netherlands. To this respect, the largest nuclear research program financed by the Dutch government is carried out at NRG.

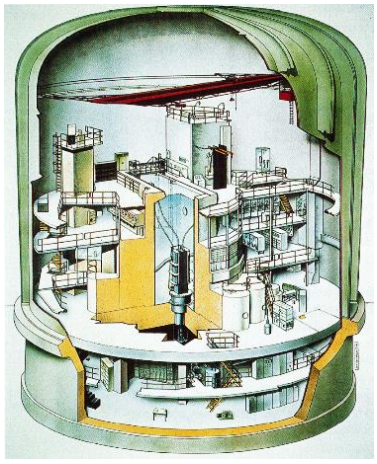

Figure 1: HFR drawing.

An important field of research at NRG is performed in the context of Long Term Operations (LTO) of existing nuclear reactors and the development of new reactor types. The safety of existing and future reactors hinges on the prevention of meltdown in all circumstances. Simulating accident scenarios and their effects is part of the strategy to ensure safe operation. On such accident scenario is the event of a loss of coolant accident (LOCA). In the event of a LOCA, emergency cooling of the pressurized water system of the reactor is applied, which cools the fuel, water and the structural components of the reactor. The accident scenario is called pressurized thermal shock (PTS), since the reactor under pressure while it is thermally loaded.

Combining computational fluid dynamics (CFD) and large finite-element models (FEM), allows a prediction of the formation of catastrophic brittle cleavage cracks. Such models are computationally very expensive and suited for the analysis of a known transient, and a known set of boundary conditions. In reality however much faster models are required in order to perform a full probabilistic analysis of cleavage fracture for all relevant transients.

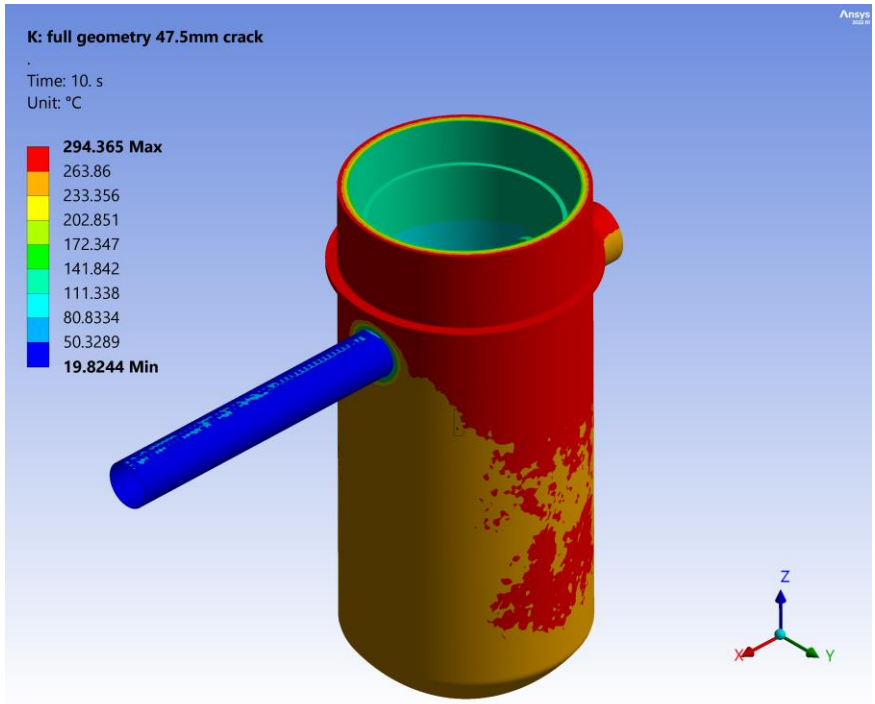

Figure 2: Temperature distribution contour plot for a cracked RPV during a postulated PTS transient.

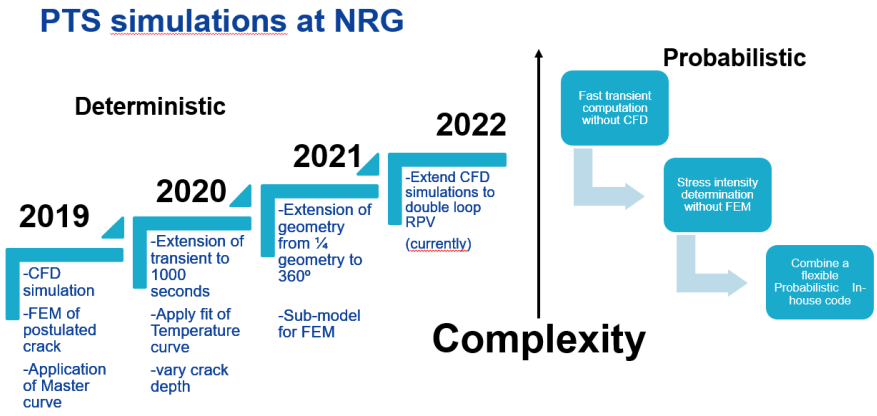

Figure 3: Overview of PTS development at NRG

Your work will focus on developing better and more sophisticated models. Particularly the efforts will be concentrated on speeding up the current approach in order to allow for probabilistic analyses. You will develop/implement a 1D structural mechanics code and replace the current CFD method with a faster 1D model. Everything then will be validated. You will work in collaboration with NRG experts.

Objectives/Results:

- Identify the possible ways of improving the speed of the analyses.
- Replace the current CFD and FEM methods with a faster methods and validate the new approach.
- Extend existing radiation embrittlement models.
- Couple the developed code with a probabilistic software.
- Summarize the work in a report.

Your profile:

- MSc. student in industrial engineering (Nuclear, Mechanical, Aerospace, Energy,…).
- Fluency in written and spoken English.
- Good analytical and problem solving skills.
- Dedicated, good communication and social skills, independent.
- Basic knowledge of the software and codes that will be used: Python, MATLAB and Ansys Wb.
- Available for a 6 month internship in Petten, The Netherlands.

Our offer:

- A challenging thesis project with a scientific scope, to be executed within a successful team with an informal atmosphere and an excellent reputation.
- Strong support from enthusiastic members of the team.
- Monthly allowance.
- Housing and transportation compensation for the period of stay.
- Publication in conference proceedings (ASME PVP, SMIRT, RRFM,…).

Contact details:

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