Thesis project available

Development of a neural network for Critical Heat Flux predictions

(duration: 8-10 months, starting period: February-April 2023)

❖ Title of the research:

Development of a neural network for Critical Heat Flux predictions

❖ Context of the research

The Critical Heat Flux (CHF) is a physical phenomenon that may cause the deterioration of the heat transfer in the core of nuclear reactors, potentially leading to core damage. Its accurate prediction is therefore a crucial issue in nuclear reactor safety.

❖ Objectives of the research

The proposed internship concerns the development of a neural network to predict the occurrence of the CHF. It will be realized in preparation of an international OECD/NEA project on the development and application of Artificial Intelligence methodologies for nuclear engineering.

❖ Work Phases

- Perform a preliminary literature review on artificial intelligence methodologies.
- Analyze the available experimental CHF database to understand the physical phenomenon and to verify the coherence and exploitability of the experimental data.
- Test the existing CHF correlations and the prediction on the selected database of the thermal-hydraulic code CATHARE, the reference code for the safety analysis of French nuclear reactors.
- Develop a neural network to predict as accurately as possible the CHF. Different approaches (e.g. different split in training and validation database, number of neurons) will be tested to determine the optimal solution.
- Compare the performance of the newly developed neural networks against the existing models and identify the advantage/disadvantages associated to the usage of artificial intelligence.

- Present and discuss his/her work during technical meetings and write a final report.

❖ **Internship description**

The internship work will be conducted at the Department of Thermal-hydraulics and Fluid dynamics (STMF – Service de Thermohydraulique et de Mécanique de Fluide) within the Energy Division (DES - Direction des Énergies). The department develops and qualifies the simulation tools for the design and the safety analysis of the French nuclear power systems, such as the system thermal-hydraulic code CATHARE. These studies are performed within the framework of internal CEA projects or in collaboration with several industrial partners (e.g. EDF, Framatome and TechnicAtome) and international partners.

For further information, please contact:

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