Universität Stuttgart
Institut für Kernenergetik
und Energiesysteme

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HiWi / Student Project / Master's Thesis

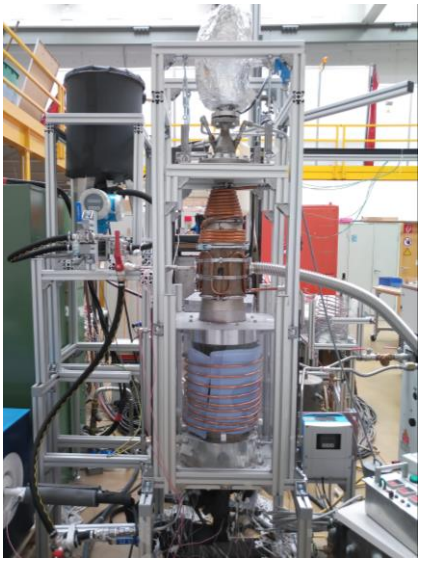
Optimization of a optical measurement system for capturing quench front propagation in superheated particle beds with machine learning and neural networks

Aim:
The aim of the work is to develop a machine learning or neural network model to optimize the optical measurement system for capturing the quench front propagation of superheated particle beds.
Therefore, a training data basis for model development is obtained from exemplary unheated experiments on the FLOAT test facility.

Background:
During severe reactor accidents involving loss of coolant, the reactor core may melt, forming a particle bed through interaction with residual water in the Reactor Pressure Vessel. For the rapid cooldown of particle beds multi-dimensional two-phase flows occur, understanding of which is crucial to predict the coolability of particle beds. In the context of reactor safety research, the investigation of the removal of decay heat from a debris bed is of crucial importance in order to be able to make predictions about the long-term coolability of particle beds and to prevent further accident progression. In this context, experiments are carried out at IKE which, serve to validate numerical models of the IKE simulation code COCOMO-3D.

Procedure:
- Familiarization with the camera and data acquisition system
- Assisting in conducting exemplary experiments
- Post-processing of visual data obtained from the exemplary experiments
- Development of a machine learning or neural network model for optimization of the optical measurement system
- Written elaboration, presentation of work

Prerequisites:
- Proficient in programming language e.g. Python
- Experience with relevant libraries and frameworks e.g. TensorFlow, PyTorch or scikit-learn.
- Experience with supervised and unsupervised learning techniques.
- Knowledge of deep learning architecture & neural network
- Skills in data processing, familiarity with data analysis tools and libraries (e.g. Panda, NumPy)
- Ability to design, train and evaluate AI models for specific tasks.
- Capacity to troubleshoot and optimize machine learning models.



FLOAT Test Facility

Start: Immediately

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