Universität Stuttgart
Institut für Kernenergetik
und Energiesysteme

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Lehrstuhl für Kerntechnik
und Reaktorsicherheit

Master Thesis

CFD Analysis of Passive Safety Condenser

Objective:
Development and Assessment of a CFD-based model for heat transfer in a generic passive safety condenser for nuclear industrial design application.

Background:
Passive safety systems are increasingly investigated and implemented in nuclear applications to enhance reactor safety through heat removal mechanisms requiring limited or no active intervention.
This thesis focuses on the CFD analysis and optimization of a generic passive safety condenser. Representative boundary conditions will be derived from recent studies on passive safety systems in nuclear applications. The influence of operating conditions, non-condensable gases and pool temperature on condensation and heat removal will be investigated, with the aim of identifying parameters and design features that can improve condenser performance. CFD results will also be compared with integral quantities obtained from the ATHLET/AC^2 system-code model.

Approach:
- Development of a simplified CFD model of a condenser tube.
- Definition of boundary conditions from nuclear passive safety systems.
- Parametric analysis of flow conditions, pool temperature and non-condensable gases.
- Evaluation of heat transfer, pressure drop and condenser performance.

Requirements:
- Basic knowledge of thermodynamics, heat transfer and fluid mechanics. Experience with CFD or numerical simulation is beneficial.
- Experience with Python or MATLAB is beneficial.
- Fluency in English is required.

Start: October 2026 or later

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