Karlsruher Institut für Technologie

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Bereich Innovative Reaktorsysteme
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Task
Master Thesis (m/f/d) with the title:

CFD study of hazardous gas cloud formation and dissipation for hydrogen-blended natural gas (HBNG) in confined spaces

Background:

Hydrogen-blended natural gas (HBNG) is increasingly relevant for decarbonization, but its safety in confined spaces depends strongly on leakage and ventilation behavior. This project builds on published CFD work that models low-pressure HBNG leakage and ventilation in a confined room, validates against experiments using similarity criteria, and introduces a quantitative “hazardous gas cloud volume” definition based on LEL thresholds.

Your Tasks:

- Reproduction and validation of a CFD case for HBNG leakage and ventilation in a confined space.
- Set up and run a verification study: mesh refinement (≥3 meshes) and time-step/Courant sensitivity.
- Validate key outputs against experimental/reference data (sensor concentration histories, global hazard metrics).
- Implement post-processing to compute hazardous gas cloud volume.
- Run a focused parametric study (e.g. hydrogen blending ratio and ventilation configuration).
- Prepare results in a publication-ready format (figures, methodology summary, key findings).

Required Skills:

- Strong basics in fluid mechanics and transport (buoyancy, mixing, dispersion).
- Practical CFD experience (meshing, BCs, transient runs, convergence/stability).
- Confidence with at least one CFD tool (OpenFOAM, ANSYS Fluent).
- Python and Paraview for post-processing, plotting, and automation.
- Ability to work systematically (Git/version control and knowledge of AI is a plus).

Contact Person:

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