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Task
Bachelor-/Master Thesis with the title:

2D-CFD investigation for thermo-hydraulic mixing of hydrogen-injected natural gas in pipelines

Background

Injecting hydrogen into natural gas pipelines is a promising way to decarbonize, but it raises practical questions: How quickly does hydrogen mix, how uniform is the mixture downstream, how high is the pressure drop through mixing devices, and how do temperature differences (injection or wall heating/cooling) affect transport?
This work creates a **2D-CFD-model** of hydrogen injection into a pipeline-like geometry and calculates mixing and thermohydraulic performance under various operating conditions.

Your Tasks:

- Literature review and research on the topic; development of a 2D pipeline mixing model with hydrogen injection.
- Generation of a computational mesh suitable for CFD simulations and performance of a mesh independence study.
- Formulation of species transport and energy equations (non-isothermal mixing) and execution of a baseline CFD case.
- Validation of the results using the provided experimental data based on the established mesh.
- Conducting a targeted parametric study (2–3 parameters such as hydrogen fraction, injection velocity/momentum ratio, wall temperature, or injection temperature).
- Written documentation of the results.

- Optional – (training of a lightweight AI model)

Required Skills:

- Fundamentals of fluid mechanics and heat transfer (internal flows, convection).
- Basic understanding of species transport and mixing in CFD.
- Practical experience with, or willingness to learn, ANSYS Fluent or OpenFOAM.
- Familiarity with post-processing tools such as Python, MATLAB, etc.

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