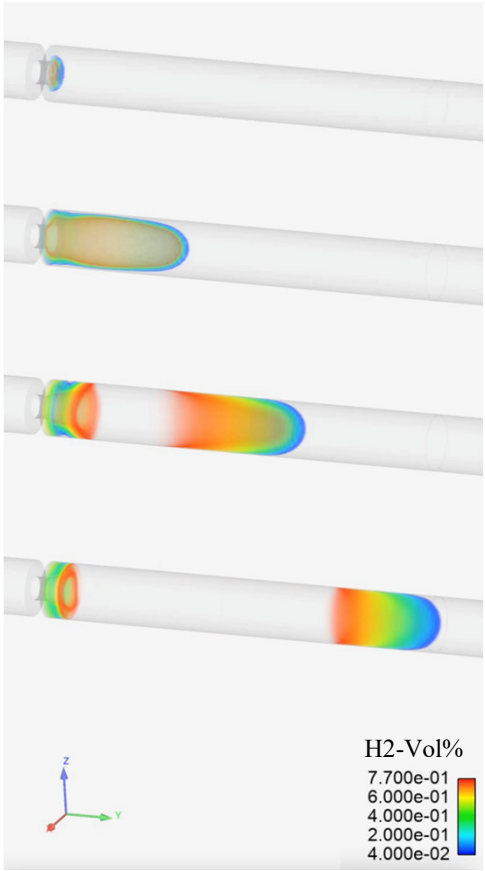
Development of a CFD Workflow in OpenFOAM for the Simulation of Venting Processes in H_2 Tank Systems



Figures: Lower and upper explosion limit in venting line simuliert mit Ansys Fluent

Description:

The use of hydrogen as an energy carrier plays a central role in the future sustainable energy supply. In particular, safe and efficient processes along the entire value chain, from storage to transport, are of major importance. Numerical flow simulations, such as computational fluid dynamics, provide a powerful tool for analysing and optimising complex physical processes.

As part of this Master's thesis, a transferable workflow for CFD simulations using OpenFOAM shall be developed. The objective is to establish a structured approach for the modelling, execution and evaluation of simulations, particularly suited for applications in hydrogen research and industry. A special focus will be placed on the simulation of venting processes in hydrogen tank systems. This includes the investigation of flow phenomena inside the tanks as well as flow through valves. In addition, the integration of multiphase phenomena, such as gas-liquid interactions or phase changes, into the modelling approach may be considered.

The thesis comprises both the methodological development of the workflow and its application to practice-relevant research questions. Previous experience in numerical simulation is beneficial.

Tasks:

- Literature review on the development of a workflow for H_2 simulations using OpenFOAM (1.5 months)
- Creation and meshing of 3D geometries for tank systems and valve flows (0.5 months)
- Implementation of suitable physical models, including multiphase models if applicable (1.5 months)
- Execution of venting simulations and analysis of valve flow behaviour (0.5 months)
- Evaluation of the results and derivation of workflow recommendations (1 month)
- Documentation and written preparation of the Master's thesis (1 month)

Start: as of now

Duration: ca. 6 months

Compensation: paid master thesis

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