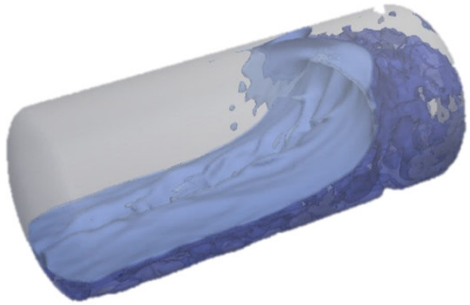
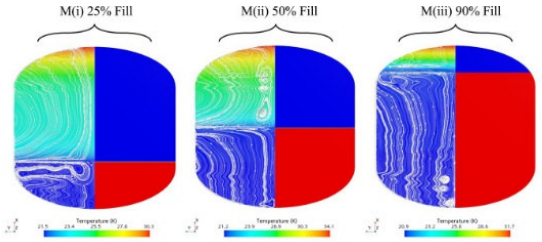
Simulation-based Investigation of Phenomena in Liquid Hydrogen Storage Vessels

Sloshing



Thermal stratification



Source:
https://www.sciencedirect.com/science/article/pii/S0017931025014024

Description:

For the use of liquid hydrogen (LH2) in mobility and aviation applications, a detailed understanding of the thermodynamic behaviour inside cryogenic storage tanks is essential. During operation, sloshing motions caused by vehicle dynamics or changing fill levels can interact with thermal stratification in the tank, affecting pressure build-up, boil-off behaviour, and the overall safety and performance of the storage system.

The aim of this thesis is to investigate the coupled effects of sloshing and thermal stratification in LH2 tanks using 3D CFD simulation. The work will focus on the development of suitable simulation setups, the analysis of transient flow and temperature fields, and the assessment of how operating and boundary conditions influence stratification and pressure evolution.

Tasks:

- Literature research on sloshing, thermal stratification, and LH2 tank behaviour (1 month)
- Definition of representative tank geometries and operating conditions (0.5 months)
- Development of a 3D CFD model for transient simulation of LH2 tank behaviour (1.5 months)
- Investigation of the influence of sloshing on temperature distribution, interface motion, and pressure build-up (1 month)
- Evaluation and discussion of the results with respect to LH2 tank design and operation (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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