

# Master`s Thesis, Term Project, Bachelor`s Thesis

## Fatigue Analysis of Composite Hydrogen Pressure Vessels.

With the new objectives for greenhouse gas reduction set by the European Union, the use of green hydrogen fuel to power vehicles or aircraft (as presented by Airbus with the ZEROe) is getting more and more interest in the industry. One of the main challenges towards the broader application of hydrogen is the improvement of onboard storage solutions. The Chair of Carbon Composites (TUM-LCC) performs research activities on the design and manufacturing of Composite Overwrapped Pressure Vessels (COPV) for hydrogen applications (automotive, truck, or aerospace). We aim to use carbon composites' full lightweight potential to reduce pressure vessels' weight, increase storage capacity, and thus enable green hydrogen mobility.

Within the scope of this work, the previously developed composite layup of a COPV will be analyzed for cyclic loading. For this purpose, the existing numerical model of the COPV for static analysis will be extended. The model will be used to study the performance under thermo-mechanical cyclic loading. An essential part of the thesis is the definition and selection of a suitable method to model the fatigue life of the COPV in a computationally efficient way. Finally, the work will be validated against experimental data.

This thesis will allow you to **gain experience with simulation software** and **programming**, representing a **definite advantage in your personal development for future engineering activities**.



Figure 1: Zero-emission concept aircraft [Airbus]

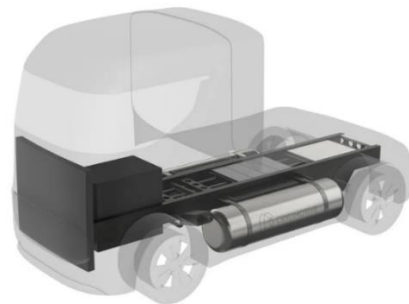


Figure 2: Hydrogen-powered truck concept [Cryomotive]

### Research focus

- Extension of an existing numerical model of a COPV
- Selection of suitable methods to model thermo-mechanical cyclic loading
- Investigation of potential fatigue life increasing factors (layup, autofrettage processing)

### Requirements

- Reliable and independent way of working
- Good knowledge of structural mechanics
- Experience with FE-Software (Abaqus) is beneficial
- First programming experience is beneficial

**Starting date:** Flexible

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