Chair of Carbon Composites
TUM School of Engineering and Design
Technische Universität München

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

Design and 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). Our goal is to use the full lightweight potential of carbon composites to reduce the weight of pressure vessels, increase the storage capacity, and thus enable green hydrogen mobility.

Within the scope of this work, an optimum composite layup is to be developed concerning the burst pressure and other requirements. For this purpose, a detailed numerical model of the COPV for damage analysis will be developed. This includes the representation of the actual fiber architecture (fiber paths, layer thickness), resulting from the manufacturing process, in the numerical model. Different modeling approaches are to be compared with each other. Finally, a validation based on large-scale test data has to be performed.

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]

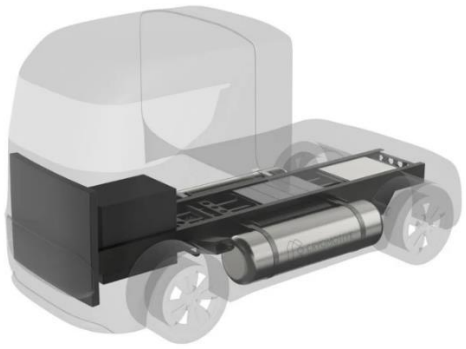

Figure 2: Hydrogen powered truck concept [Cryomotive]

Research focus

- Numerical modeling of a COPV based on previous work
- Implementation of a routine to represent the actual fiber architecture in the model
- Comparison of different modeling approaches
- Optimization of the composite layup

Requirements

- Reliable and independent way of working
- Experience with FE-Software is beneficial
- First programming experience is beneficial

Starting date: Flexible

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