Lehrstuhl für Carbon Composites
TUM School of Engineering and Design
Technische Universität München

Master's Thesis

Automated FE Modeling for Redundant Composite Structures of Aircrafts

The automation of finite element modeling (FEM) in the preliminary design phase of lightweight aircrafts' structures plays a crucial role in enhancing efficiency and accuracy in the development process. In conventional design approaches, the transition from conceptual design to detailed structural analysis is often time-consuming and requires manual intervention, leading to delays and inconsistencies. By automating this process, it is possible to generate detailed knowledge about the structural integrity, manufacturability, and economic viability of a design at an early stage. A graph-based design tool, known as the Design Cockpit 43, provides an initial geometry design proposal based on predefined boundary conditions. However, to fully assess the feasibility of the design, a FEM analysis is required by an automated simulation workflow. This automation not only ensures consistency in the evaluation of different design iterations but also enables the integration of optimization algorithms to enhance structural performance.

This thesis aims to contribute to the automation of the FEM process by developing an interface script to bridge the gap between the Design Cockpit and FEM analysis. The study will focus on automating meshing, solver preparation, and post-processing to create a closed-loop structural optimization framework. The final objective is to integrate the developed tools into a highly automated workflow that allows for efficient evaluation and optimization of lightweight structures.

Abbildung : Light weight aircraft

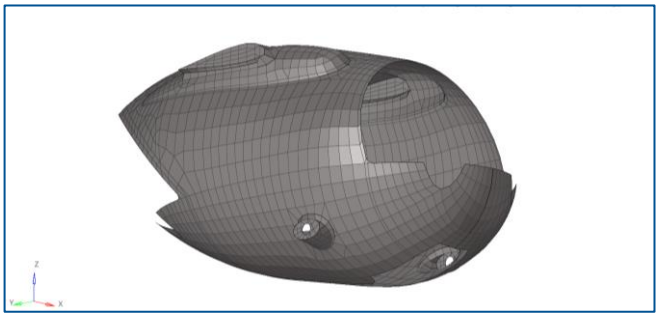

Abbildung: FEM model of an aircraft's fuselage

Tasks

- Automated Meshing: Develop a tool for geometry import and automatic mesh generation using a Python-compatible meshing software (e.g. GMSH) with a focus on mesh quality and efficiency.
- Solver Integration: Implement a mechanism to automatically import meshed geometries into solver software (e.g., Abaqus) and apply predefined model settings.
- Post-Processing Automation: Develop a script to extract key structural responses.

Requirements

- Good in Python, and Python scripting
- Motivation to learn new meshing tools such as GMSH.
- Basic knowledge of FEM software such Abaqus.
- Good analytical and problem-solving skills.

Bearbeitungsbeginn: Ab Sofort

Bei Interesse oder Fragen einfach melden bei:
Zaid Al-Qadhi, Raum 5504.01.438, Garching, zaid.al-qadhi@tum.de