

Master's Thesis

Stress Concentration Handling in Topology Optimization for Lightweight Assemblies and Mechanical Connections

Keywords: Topology Optimization, Connection Design, Computational Mechanics



Background:

Generative design is becoming increasingly important in engineering, with topology optimization offering significant potential for developing lightweight structures. However, integrating practical assembly requirements, such as mechanical connections and tool accessibility, introduces additional challenges. In particular, geometric features required for fasteners and tool access can lead to local stress concentration, compromising structural integrity and limiting the applicability of optimized designs.

This thesis focuses on developing a topology optimization approach that accounts for local stress concentrations arising from mechanical connection design and tool accessibility requirements. By integrating stress-based constraints into the optimization process, the aim is to achieve lightweight structures that ensure sufficient mechanical performance while maintaining accessibility for assembly tools. The resulting methodology will contribute to the development of structurally efficient, assembly-aware designs.

Task Description:

- Development of methods and algorithms for mathematical optimization in MATLAB and Python.
- Benchmarking and comparison to state-of-the-art approaches.
- Proof-of-concept via detailed FEM analysis or testing.

Required skills:

We are looking for highly motivated individuals who are keen to work on industry-relevant problems.

- Computational Mechanics, Mechanical Engineering or similar master's program
- Interest in topology optimization
- Previous experience with MATLAB or Python
- Independent and reliable work

We offer:

- Insights into research on relevant future technologies
- Freedom to follow new ideas and directions
- Industry insights and networking

Contact:

Sergi Pagès

Phone: +49 (89) 289-15157

Room: 5506.02.640

sergi.pages@tum.de