

INTERNSHIP PROPOSAL

Machine Learning-Driven Reliability Constraints in Topology Optimized Lattice Structures

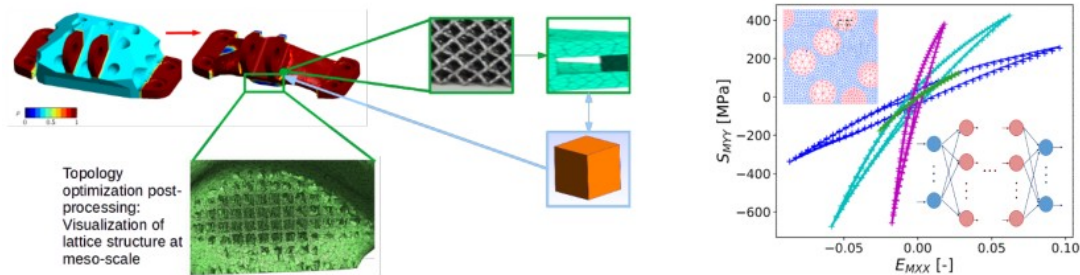


Figure 1: Left: Topology optimization of graded lattices structures – Cenaero©. Right: Recurrent Neural Network-accelerated multi-scale simulations in elasto-plasticity – Uliege©

Topology optimization allows the creation of innovative designs by maximizing efficiency while simultaneously minimizing mass and complying with the limitations of industrial manufacturing. Transitioning from traditional methods to lattice design enhances structures with lighter weights, anisotropic properties, and improved mechanical performance. However, ensuring reliability, particularly damage tolerance in additively manufactured lattice structures, remains challenging due to the computational cost of damage simulations.

Artificial Neural Networks (NNWs) are developed to replicate micro-scale behaviors in solid mechanics efficiently, focusing on history-dependent material behaviors. Utilizing finite element simulation data, NNWs accurately predict structural responses, significantly reducing computational time compared to traditional multi-scale simulations.

Pairing lattice structure topology optimization with machine learning-derived metamodels appears promising for designing damage-resilient structures.

Objectives

The objective is to integrate machine learning-derived metamodels in the framework of lattice structure topology optimization to enhance the reliability of lightweight structures.

Profile

- **Required: Bachelor + ongoing Master's studies in Mechanical, Electromechanical, or Aeronautical Engineering or data science.**
- *Languages: English and/or French.*
- *Pre-requisites: notions of structural mechanics + programming (Python).*
- *Motivation, creativity and team spirit!*

Duration

The length of the internship can vary from 4 months to 6 months, depending on your university or school regulations.

Contact

Interested candidates should send a cover letter, quoting reference number of the offer, and a resume to rh_be-ip-2024-007@cenaero.be