Master's Thesis

Control of projected shape in homogenization-based topology optimization

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Background: Bone-like trabecular structures, see Figure 1, can be found in various natural structures, which are characterized by their particularly good mechanical properties and low weight. Such principal stress-oriented structures can be generated by computer-aided methods such as topology optimization and used for engineering applications.
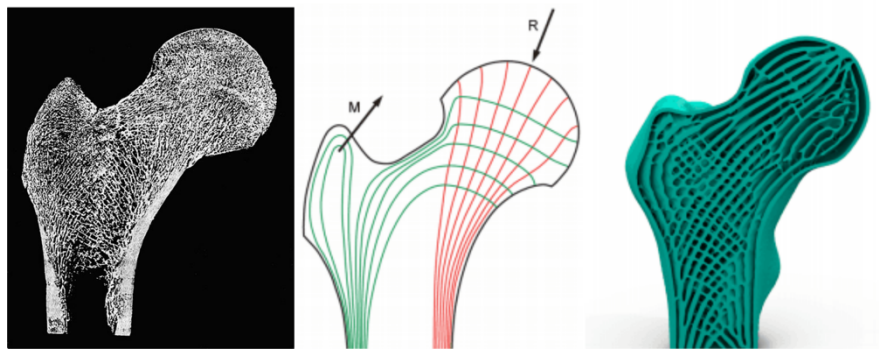

Figure 1: left: Cross section of a human femur bone. Center: Representation of the principal stress directions. Right: Cross-section of an optimized porous structure. [1]

Tasks: In this master thesis, the following tasks are to be completed:

- Generating de-homogenized topologies with a given code in Matlab.

- Performing a finite element analysis for the optimized structure.

- Implementation of an iterative scheme to remove solids with a low strain energy and apply a morphological filter to maintain a minimum feature size of solids.

- Run typical benchmarks with the programmed code.

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Literature:

[1] – Wu et al. 2018. Infill Optimization for Additive Manufacturing -Approaching Bone-like Porous Structures