Fraunhofer KIT Karlsruher Institut für Technologie
MIKROTRIBOLOGIE CENTRUM µTC

IAM Institute for Applied Materials

MASTERS THESIS

Cartilage-Inspired Metamaterial Design

Background

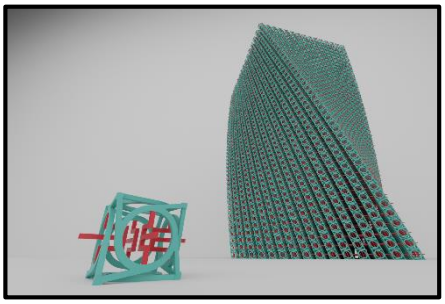
To this day no man-made material has been able to capture the complex and unparalleled tribological performance of articular cartilage. Friction and wear govern the reliability, energy consumption and operating limitations of virtually every mechanical device, including the human body.

Recent advances in additive manufacturing let us take the active role of building intelligent structures from the microscopic scale up to practical dimensions. The central aspect of this project is that the metamaterial design process is function-driven, inspired by biomimicry.

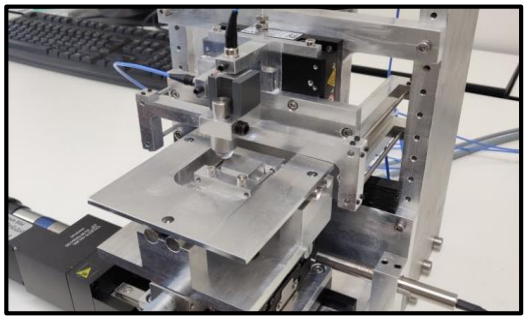
Tasks

A Master's thesis will focus on one of the aspects from the execution chain of the larger project, which consists of the following tasks:

1. Acquaintance with the mechanics of articular cartilage tribology
2. Expansion of currently existing numerical model which captures cartilage's function
3. Engineering a finite element analysis of a biphasic (solid and liquid) unit cell
4. Selecting and optimizing a metamaterial design, and its 3D printing
5. If time permits: tribological experimental testing



Rationally designed metamaterial



Load-adjustable Friction and Wear Tester

Requirements

Students in the fields of mechanical engineering, materials science or similar. Previous knowledge in the fields of tribology and metamaterials is not necessary. A conscientious and independent way of working, as well as interest of integrating computational and experimental work are of central importance.

Possible start: as soon as possible

Contact

Since the thesis requires both experimental and computational expertise, it will be co-advised at Institut für Angewandte Materialien (IAM-CMS); if interested please *cc* both:

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