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MetaLab Research Group
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Cluster of Excellence *liv***Mat**S
FIT – Freiburg Center for Interactive Materials and Bioinspired Technologies,
IMTEK, University of Freiburg

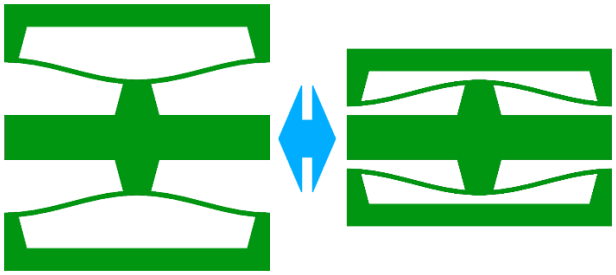
Mechanical metamaterials with programmable nonlinear stiffness (HiWi, BSc, MSc)

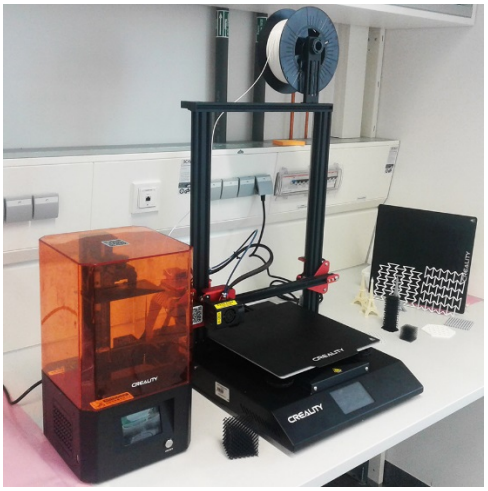
Mechanical metamaterials are man-made materials engineered to achieve extreme mechanical properties, often beyond those found in most natural materials. The unconventional properties of mechanical metamaterials originate in their sophisticated internal architecture, usually fashioned from repeating unit cells. Therefore, one may program and control the mechanical response of metamaterials by wisely selecting the underlying architecture.

This project aims to develop mechanical metamaterials with highly nonlinear stiffness by combining the unit cell with different mechanical responses. The materials with nonlinear stiffness are in high demand in industrial practice, where the specific passive response depending on the external force is required to widen the operational conditions. The proposed mechanical metamaterials will be inspired partially by the design of the Belleville spring that can demonstrate nonlinear response thanks to its geometry. The developed metamaterials will be fabricated using 3D printers and then tested on compression and tension. The possibility of employing machine learning to refine the design or achieve better agreement between experiments and modeling will be considered.

The skills that you can acquire during this project:

1. CAD modeling
2. 3D printing (SLA, FDM, and Polyjet)
3. Material testing
4. Basic mathematical modeling skills





Please feel free to contact us if you have any questions.

Dr. Viacheslav Slesarenko, PI

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