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

Propagation of elastic signal in 2.5D mechanical metamaterials* (MSc)

Mechanical metamaterials inherit their unconventional mechanical behavior from their rationally designed internal architecture, usually consisting of the unit cells assembled in a periodic manner. Following the recent advances in this field, internal architecture can be rethought as a media that enables the interaction between unit cells. If some particular unit cells can switch between several stable states, then such a transition may perturb the surrounding cells. For the rationally designed metamaterials, such perturbation can be sustained, facilitating the propagation of the elastic signal through the architecture. As a result, the remote unit cells can exchange their states through the architecture of the metamaterial.

While previously proposed mechanical metamaterials capable of elastic signal propagation are limited by 2D planar configuration, this project aims to expand the design space by stacking metamaterials in the third dimension. 2.5D metamaterials will enable creating more sophisticated pathways for the signal enabling the layer-to-layer transition in the nodal points. The proposed metamaterials will employ a "rotating squares" concept, while the local energy landscape will be programmed through the embedment of permanent magnets. Mechanical metamaterials will be fabricated using a multimaterial 3D printer, and then by stacking the layer in a different configuration, the involved signal propagation paths will be realized

The skills that you can acquire during this project:

1. CAD modeling
2. 3D printing (Polyjet, SLA)
3. Post-processing of the video recording (Python, Matlab)

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

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Living, Adaptive and Energy-autonomous Materials Systems

