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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

Tillable reconfigurable elastic metamaterial for vibration control (HiWi, BSc, MSc)

Metamaterials are artificial materials that inherit their unconventional behavior from their sophisticated, rationally designed internal architecture. The internal structure of elastic metamaterials helps them demonstrate very peculiar vibration behavior thanks to Bragg's scattering and local resonance phenomena. Therefore, by controlling internal structure, one may control elastic waves' propagation and attenuate specific frequency, for instance, to protect a sensitive payload.

Traditionally, the structure of the classical metamaterials is defined on the design step and cannot be altered post-fabrication. Therefore, already manufactured metamaterials cannot be then reused to attenuate the vibration on the frequency that was not considered during the original design. This project aims to eliminate this restriction by considering the elastic metamaterials with a set of various elements that can be inserted into the specific location of the metamaterial. By selecting proper unit cells and inserting them into the metamaterial matrix, one controls the overall performance of elastic metamaterial and can reprogram it repeatedly. Such metamaterials will be produced using the laser cutter and 3D printing. The testing will be performed in the lab using the modal shaker that can excite metamaterial with a specific frequency. The initial calculations for the design of tillable cells will be done using finite element analysis (FEA)

The skills that you can acquire during this project:

1. 3D printing (FDM, SLA, Polyjet)
2. Laser cutting
3. CAD modeling
4. Vibration testing

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

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Living, Adaptive and Energy-autonomous Materials Systems