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Cluster of Excellence *livMatS*
FIT – Freiburg Center for Interactive Materials and
Bioinspired Technologies,
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Indirect measurement of the effective mechanical properties for deformable components of 3D-printed bioinspired materials and mechanical metamaterials (HiWi)

Knowledge of the materials' properties is an essential part of creating complex systems that mimic natural materials. However, materials being part of the composite system behave very differently if compared with their standalone behavior. There are two main factors: (1) the material being part of the system is subjected to non-uniform deformation that cannot be directly superimposed in the standard standalone testing; (2) the inaccuracies associated with the fabrication process that contribute to the anisotropy or mixing zones between materials. Luckily, it is possible to indirectly measure the effective properties of the materials when they are already part of the composite system and then extend the obtained results for the larger structure.

This project aims to explore such an approach that can provide important characteristics of materials behavior without any force measurements. For specific structures, we will show that the tracking of the displacement might be enough to characterize material for the specific structure or mechanical metamaterial. We will start with the relatively simple structure and estimate the properties of the soft materials used for hinges based on their deformed shape and/or the elements' rotation using the simple testing platform that needs to be built by a student. The evaluated mechanical properties will then be compared with the mechanical properties obtained using standard methods. More sophisticated structures will be discussed later in the project.

The skills that you can acquire during this project:

1. 3D printing (Polyjet, DLP)
2. Characterization of deformable materials
3. Design of the simple testing device
4. Basic CAD skills

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

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Living, Adaptive and Energy-autonomous Materials Systems

