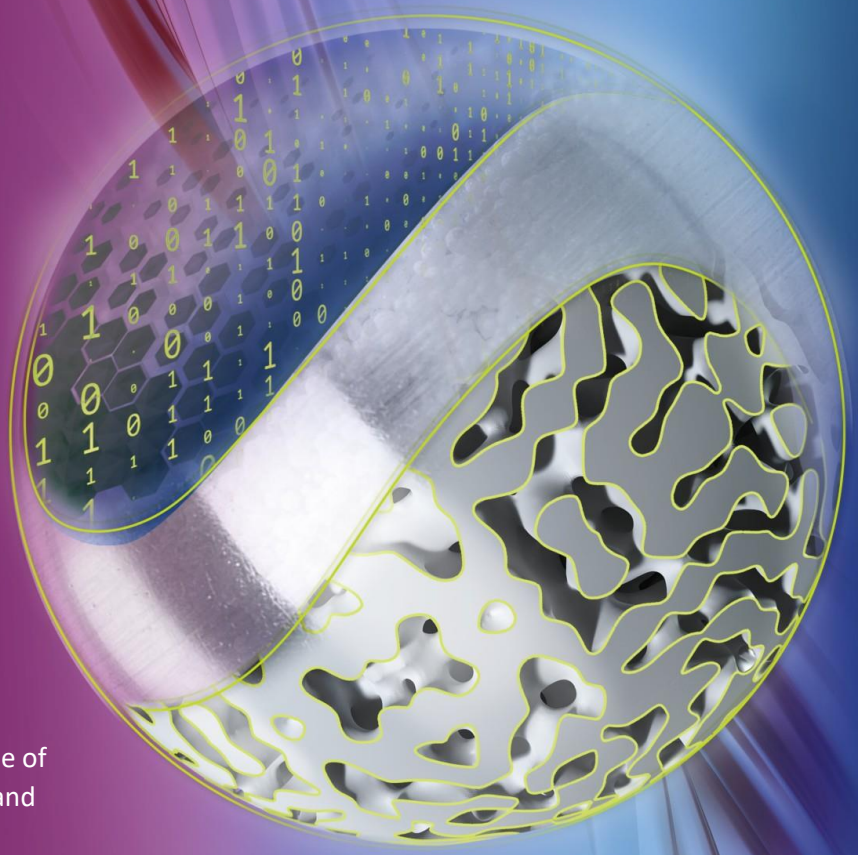
TECHNISCHE UNIVERSITÄT DRESDEN

D³ GRK 2868

Offer for a student assistant project – *compatible with master thesis*

Characterization of mechanical properties of different hyperuniform and hyperuniform-like structures

Motivation: One important part of the current scientific research focuses on new kinds of structures that can be applied in material science. The D³ project strives to achieve disordered material organizations exhibiting high resilience and interesting mechanical and physical properties. One of the focuses of our research is the concept of hyperuniformity, that is organization only showing order when considered on large scales. It is already possible to generate such structures and to give rise to geometrically different arrangements, as well as to create hyperuniform-like configurations. The next step is now to determine and quantify the mechanical differences between these structures.



You will work on properties affected by peculiar geometries of metamaterials. This includes physical and mechanical properties, like the prototypical spreadability of a solute or stiffness. Simulations will be performed using spectral methods and the finite element method. You will focus on materials featuring a specific class of disordered-correlated arrangements that are called hyperuniform. The goal will be to evaluate if hyperuniformity leads to enhanced properties such as superior mechanical properties. In particular, in this work, you will focus on the very specific case of hyperuniform non-overlapping disks in 2D and you will observe how the different kinds of hyperuniformity may have an influence on the considered physical properties. Computer programs to generate these arrangements will be provided as well as an introduction to hyperuniformity and relevant topics. The following tasks are to be completed:

- Perform simulations of physical properties for given structures (simple metamaterials).
- Analyse your results to assess structure-property relations.
- Develop an advanced understanding of hyperuniform structures.

Prerequisites are the following completed subjects or modules:
Skills in programming (for example: Python). Some knowledge of mechanical simulation is an advantage.

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