Ausschreibung Bachelor- / Master-Arbeit am ITM-KM

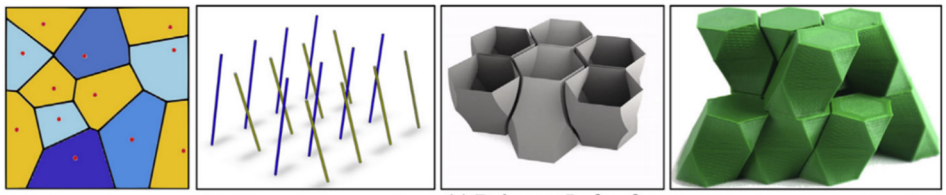
Allgemeine Informationen

Arbeitstitel des Projekts **Deutsch:** **Englisch:**	Modellierung von Festkörpern aus topologisch ineinandergreifenden Blöcken Modelling of solids tessellated into topologically interlocked blocks
Kooperationspartner	Prof. Yuri Estrin, Department of Materials Science & Engineering, Monash University, Australia
Betreuer	MSc Claudius Klein, Prof. Yuri Estrin, Prof. Böhlke
Typ	BSc-Arbeit: ☐ MSc-Arbeit: ☒
Methodischer Schwerpunkt	Theorie: ☒ Numerik: ☒ Experimente: ☐
Bearbeitungszeitraum verhandelbar	Ja: ☒ Nein ☐
Vertiefung im Fach Mechanik gewünscht	Ja: ☒ Nein ☐
FEM-Kenntnisse notwendig	Ja: ☒ Nein ☐

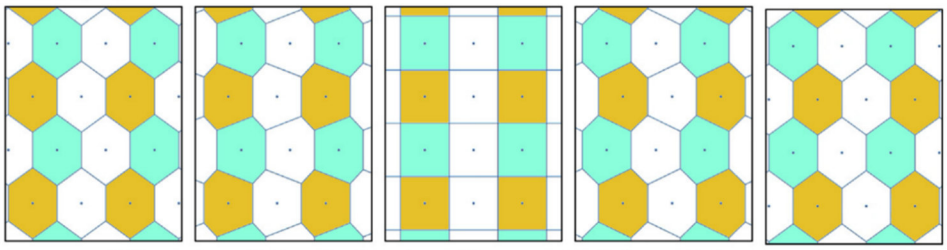
Themenbeschreibung

A promising trend in design and manufacture of novel materials is based on the concept of topological interlocking (TI) [1]. The properties of TI structures are largely governed by the geometry and mutual arrangement of the building blocks from which they are assembled. This approach broadens the materials design space and offers new properties and functionalities. The beneficial features of TI structures include their high fracture resistance, tolerance to local failures, great capacity to absorb impact energy and high sound absorption, as well as ease of assembly and disassembly. This property profile makes TI materials and structures to an attractive alternative to their monolithic counterparts.

Modelling the mechanical response of TI structures is a challenging task, and the focus of the Master Thesis will be an assessment of possible modelling techniques, including finite element modelling, discrete element modelling, and development of homogenised general continua models. Once the choice of the modelling approach is made by the student, numerical simulations of the response of some prototype TI structures to concentrated load and their sound absorption performance will have to be conducted. The outcomes of the simulations should elucidate the benefits of segmentation of a monolithic part into an assembly of topologically interlocked building blocks.



(a) Voronoi tessellation of a set of sites (red) (b) Line arrangement for Delaunay Lofts (c) Delaunay Lofts after layer-wise Voronoi tessellation (d) 3D printed assembly of Delaunay Lofts



(e) Voronoi tessellations for five selected layers used in Delaunay Loft construction.

Literature:

Y. Estrin, V. Krishnamurthy, E. Akleman, Design of architectured materials based on topological and geometrical interlocking, J. Mater. Res. Techn. 15, 1165 (2021)

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