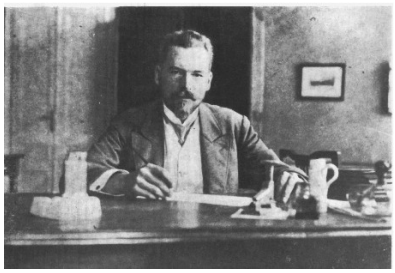

Contribution ID: **18** Type: **Regular talk**

Learning from onion to balance between order and chaos

Saturday, 17 September 2022 15:55 (25 minutes)

Recent progress in fabrication methods draws attention to lattice materials. Thanks to their structure lattice materials frequently offer superior performance compared to bulk materials. However, most of them suffer from shear bands. These strain localizations, diagonal to the load direction, are the main mode of failure for lattice materials. Sear bands are due to a very organized periodic structure of lattice materials. Introducing randomness to the lattice structure helps to eliminate shear bands but introduces force chains - an unwelcome feature typical for materials with a random structure, such as sand or paper. In this presentation, we show a bio-inspired material that is neither completely random nor periodic. Such engineered material should be immune to problems of both periodic and chaotic materials. This honeycomb material has a structure inspired by the epidermis tissue of an onion. This tissue is characterized by large fluctuations in cell sizes. There is a threefold difference in the length of the cells. However, the cells are not completely randomly distributed. There is a certain correlation between the cells so as to avoid stiff connections that lead to unwanted force chains. We aim to build a “tissue generator ” which will create a cellular structure mimicking the onion epidermis in every aspect. In order to select the algorithm that mimics the onion tissue most faithfully, we test several algorithms that lead to onion-like cell structure using statistical methods. The structure that passes the tests is 3D printed and tested mechanically to determine its failure modes. It is modeled using the finite element method to investigate the stress distribution.

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