RANDOM TESSELLATIONS - VERSATILE MODELS FOR MATERIALS' MICROSTRUCTURES

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The strut system of open foams can be modelled by the dilated edge system of a random tessellation. For the cell system of the foam, Laguerre tessellations generated by dense packings of spheres are often considered. For some foams, subsequent relaxation of the tessellation by using Brakke's surface evolver is beneficial. In particular, the relaxation results in more concentrated distributions of edge lengths and facet shapes. In addition, the models can be varied by choosing the cross section shape and thickness distribution of the struts. Partially closed foams are obtained by closing some facets of the tessellation. In the talk, we present a modelling framework that takes these effects into account. We illustrate its application for predicting transport properties of virtual foam samples.

In addition, we demonstrate new ideas for tessellation-based modelling in 3d. First, we present a flexible method for modelling crack structures in concrete. It includes the computation of a set of connected Voronoi facets and a discretization procedure to embed the structures in real computed tomography images of concrete. Secondly, we model the particle systems of active protective coatings using cells extracted from Gibbs-Laguerre tessellations. Cell size, shape and the correlation between these characteristics can be controlled such that they fit those of the observed particles. The centres of the cells are determined by a random sequential adsorption algorithm so that the cells do not overlap.