Streamable Generalized Voronoi Tessellation Model for Tomographic Images

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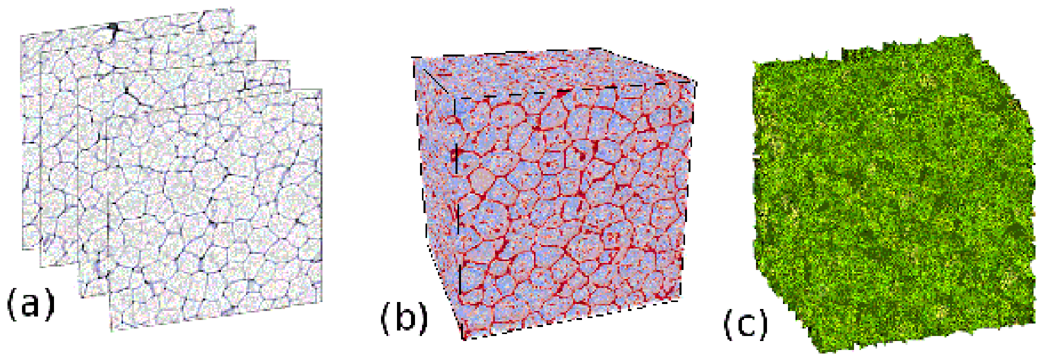
ABSTRACT

Assessing the mechanical behaviour of foams is far from being trivial [1, 2]. The two main classes of existing numerical models are deterministic models [1, 3] and stochastic models [2, 4]. They generally require extensive image analyses from foam samples and/or statistical estimations of their most significant geometrical parameters[5, 6].

The present contribution is a tool to generate deterministic tessellations based on ellipsoidal approximations of foam cells. The conventional image analysis steps [6] are partially replaced by a Hessian-based removal and by a clustering of local maxima of the distance transform. Clusters are then approximated by ellipsoids which are expanded in order to match cell walls. This method allows processing of very large 3D-images by slicing them and possibly distribute them on a cluster of computers. Then, a generalized Voronoi diagram using the ellipsoids as seeds is generated and allows the idealized geometric model to take into account the anisotropy of the cells. Finally, a mesh is generated from this model using conventional mesh generation algorithms. Figure 1 shows a tessellation applied on a 670x670x670 3D-image: (a) X-ray tomographic images as provided by E. Plougonven (Department of Applied Chemistry, University of Liège), (b) 3-dimensional rendering and (c) 3D tetrahedral mesh of the idealized geometry. Finite element simulations based on the obtained result will be validated through experimental measures.



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