11th. World Congress on Computational Mechanics (WCCM XI)
5th. European Conference on Computational Mechanics (ECCM V)
6th. European Conference on Computational Fluid Dynamics (ECFD VI)
July 20 - 25, 2014, Barcelona, Spain

STREAMABLE LAGUERRE–VORONOI TESSELLATION MODEL FOR TOMOGRAPHIC IMAGES

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Key words: *Tomography, Tessellation, Laguerre, Streamable, Computing Methods.*

Introduction. Nowadays, the interest in foam materials is growing in several engineering fields [1]. Foams can exhibit a nonlinear mechanical behavior [2], which is highly dependent on their microstructure [3]. Thus designing foams with specific mechanical properties can be very challenging. The present contribution is part of the *ARC-Bridging* project [4], whose objective is to predict the mechanical behavior of complex microstructured materials via numerical simulations. A possible classification of foam models into two groups is: random models and deterministic models [5]. The random models frequently require statistical estimations of their parameters [6], whereas the deterministic models generally require numerically expensive image analyse. Indeed, classical analysis steps involve a distance tranform, a watershed and, optionally, a h-minima transform [5, p. 22], which can be computationally demanding [7, 8, 9].

Contribution. In the present Laguerre–Voronoi tessellation model, the image analysis part neither involes the watershed transform, nor the h-minima transform. Instead, following the original idea of A.M. Lopez-Reina et E. Béchet [10], these two transforms are respectively replaced by a Hessian-based removal of spurious extrema and a clustering of the remaining maxima. This substitution allows the processing of large 3D-images by slices, i.e. “streaming”. The only limitation is enforced by the distance transform: the “feature” voxel of a given voxel should belong to the same slice. For foam images, this condition is fulfilled as long as the slice’s thickness is larger than the maximal foam cell’s size. Figure 1 shows a tessellation result on a 670^3 3D-image.

Conclusion and perspectives. The aim of this contribution is to provide an efficient tessellation model for tomographic images of foams. From input tomographic images, this model provides a geometry model which will be used as an input for finite element simulations under the *ARC-Briding* project [4]. Simulation results will be compared with experimental measures.

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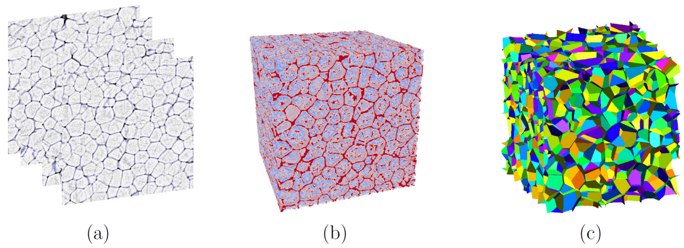

Figure 1: Computed geometry of a closed polymeric foam: (a) X-ray tomographic images provided by E. Plougonven (Department of Applied Chemistry, University of Liège), (b) 3-dimensional rendering by image superposition and (c) tessellation result.

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