SOME VARIATIONS ON THE BOOLEAN MODEL

by *Dominique Jeulin*

The Boolean model is one of the most popular models of random sets. Its success comes from its wide flexibility for applications. In this presentation, we will focus on three types of extensions of this model, illustrated by examples of application.

- The Cox Boolean model is defined from the replacement of the Poisson point process by a Cox point process for the location of germs used in the Boolean model. It allows us to generate random sets with local fluctuations of morphological properties and multi-scale random sets [1].
- Replacing the point process by Poisson varieties, random sets with long range interactions are generated, like Poisson fibres or Poisson thick planes in 3D. Their local average properties, like the local volume fraction, show a slow decrease of variance with respect to the scale of observation, requiring very large representative volumes in simulations [2].
- The generalization of the Boolean model to random functions was originally developed for the simulation of rough surfaces. With a judicious choice of primary random functions, it is possible to define and to simulate random tessellations from Boolean random functions. By this process, generalizations of Voronoi, Johnson-Mehl, and Laguerre tessellations, as well as tessellations where cells own complex non convex shapes, are obtained [3, 4].

References

[1] Jeulin D. (2012) Morphology and effective properties of multi-scale random sets: A review, Comptes rendus de l'Académie des Sciences, Paris, doi:10.1016/j.crme.2012.02.004, Vol. 240 (4-5), pp. 219-229.

[2] Jeulin D. (2015) Power Laws Variance Scaling of Boolean Random Varieties, Methodology and Computing in Applied Probability, pp. 1-15.

[3] Jeulin D. (2014) Random tessellations generated by Boolean random functions, Pattern Recognition Letters, vol. 47, 139-146.

[4] Altendorf H., Latourte F., Jeulin D., Faessel M., Saintoyant L. (2014) 3D reconstruction of a multiscale microstructure by anisotropic tessellation models,

Image Analysis and Stereology, Vol. 33, pp. 121-130, doi:10.5566/ias.v33, pp.121-130.