Fitting three-dimensional Laguerre tessellations by hierarchical marked point process models

Filip Seitl

(*Charles University, Prague*)

We present a general statistical methodology for analysing a Laguerre tessellation data set viewed as a realization of a marked point process model. In the first step, for the point, we use a nested sequence of multiscale processes which constitute a flexible parametric class of pairwise interaction point process models. In the second step, for the marks/radii conditioned on the points, we consider various exponential family models where the canonical sufficient statistic is based on tessellation characteristics. For each step, parameter estimation based on maximum pseudolikelihood methods is tractable. For model selection, we consider maximized log pseudolikelihood functions for models of the radii conditioned on the points. Model checking is performed using global envelopes and corresponding tests in both steps and moreover by comparing observed and simulated tessellation characteristics in the second step. We apply our methodology for a 3D Laguerre tessellation data set representing the microstructure of a polycrystalline metallic material, where simulations under a fitted model may substitute expensive laboratory experiments.

Jointly with Jesper Møller, Aalborg University and Viktor Beneš, Charles University.