20th Workshop on Stochastic Geometry, Stereology and Image Analysis

2–7 June, 2019, Sandbjerg Estate, Denmark

Abstract

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On integral geometric formulas for excursion sets of random fields

If Z is a continuous stationary (isotropic) real-valued random field on the Euclidean space then the excursion set $A_r := \{t : Z(t) \geq r\}$ is a stationary (isotropic) random closed set for any r. If Z has a.s. C^2 trajectories then, under mild nondegeneracy assumptions, A_r has C^2 boundary and its curvature densities can be determined. In the particular case of zero mean stationary Gaussian processes, the curvature densities are functions of the second order partial derivatives of the covariance function at the origin and translative (kinematic) integralgeometric formulas can be used to obtain the mean values of the total k-th curvature $\mathbb{E}C_k(A_u \cap W)$ of A_u intersected with a bounded window W. A basic reference is the book of Adler and Taylor (Springer, 2007). Our aim is to discuss possible extensions of the results by relaxing the smoothness assumptions, using recent kinematic formulas of integral geometry.