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Abstract

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On distributional properties of geometric functionals of fractal percolation

Joint with Michael Klatt.

Fractal percolation is a family of random self-similar sets suggested by Mandelbrot in the seventies to model certain aspects of turbulence. It exhibits a dramatic topological phase transition, changing abruptly from a dust-like set of isolated points to a system spanning cluster. The transition points are unknown and difficult to estimate, and beyond the fractal dimension not so much is known about its geometry.

We introduce geometric functionals for the fractal percolation process F. These random variables arise as suitably rescaled almost sure limits of intrinsic volumes of finite approximations of F. We establish the existence of these limit functionals and obtain in some cases explicit formulas for their expectations and variances as well as for their finite approximations. The approach is similar to fractal curvatures but in contrast the new functionals can be determined explicitly and approximated well from simulations.