LMS Seminar

1 June 2023 at 2:00 pm - Room Jean Mandel

Homogenized metrics in multiscale random sets and applications to plasticity

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ABSTRACT

We examine the length of geodesics spanning heterogeneous media in the continuum, in two dimensions. Our focus is on media containing randomly-distributed particles embedded in a matrix. These particles act as either “porous” inclusions that can be crossed at no cost or “rigid” obstacles that can not be crossed, whereas the metric is the Euclidean distance in the embedding matrix. Minimal paths spanning random sets are relevant to homogenization problems studied in theoretical mechanics, in particular perfectly-plastic porous and rigily-reinforced materials. Our main interest here is on the effect of a multiscale random dispersion of particles with vanishingly small density. Hierarchical Boolean random sets of disks are considered to simulate multiscale dispersions, as well as random sequential adsorption models. Upper-bounds are derived for different types of microstructures, making use of random set theory. These bounds are compared with “exact” numerical computations, performed by means of specialized algorithms that avoid any discretization. Comparisons are also made with other known bounds and exact results obtained by nonlinear homogenization theories.

BIOGRAPHY

F. Willot has held his PhD in mechanics in 2007 in Polytechnique, France and has worked in Mines Paris since then. He specializes in image analysis, random set and integral geometry for applications in material science, and in so-called "FFT-based methods" in micro-mechanics and for transport phenomena. He organize the Athens courses "Physics and Mechanics of Random Media" in Mines Paris.