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Stellingen

Propositions belonging to the thesis

The parabolic Anderson model and long-range percolation

by Dirk Erhard

1. In the parabolic Anderson model, if the potential ξ is sufficiently mixing in space and time and the diffusion constant κ is large enough, then the main contribution to the Feynman-Kac formula comes from those random walk paths that pick up typical values of ξ. [see Section 1.4.2.]

2. In the parabolic Anderson model, if the potential ξ is sufficiently mixing in space and time, then the exponential growth rate does not change when the random walk in the Feynman-Kac formula is restricted to stay inside a box that slowly increases to $\mathbb{Z}^d$ as $t \to \infty$. [see Chapter 3]

3. In the model of Brownian percolation, for all dimensions $d \geq 4$ there is a critical time $t_*(d-1) \in (0, \infty)$ such that, for all $t > t_*(d-1)$, the occupied set intersected with $\mathbb{R}^{d-1} \times \{0\}$ contains an unbounded cluster. [see Section 5.2.2.]

4. In the model of Brownian percolation, there are constants $C_1, C_2 > 0$, possibly depending on the dimension d, such that for all $d \geq 5$ the bounds $C_1 r^{(4-d)/2} \leq t_c(r) \leq C_2 r^{(4-d)/2}$ hold for the critical percolation time $t_c(r)$ as the radius r of the Wiener sausages tends to zero. [see Chapter 5]

5. In the random interlacement model, there is a critical value $u(d) > 0$ such that $u(d)/u_*(d) \to 1$ as $d \to \infty$, and for all $0 < u < u(d)$ the graph distance on the infinite connected component $\mathcal{V}_\infty^u$ of the vacant set is comparable to the graph distance on $\mathbb{Z}^d$. [see Chapter 6]

6. Consider the two type Richardson model on $\mathbb{Z}^d$, $d \geq 2$, where each vertex gets infected with an infection of type $i \in \{1, 2\}$ at a rate $\lambda_i \in (0, \infty)$ times the number of infected neighbors of type i. If $\lambda_1 \neq \lambda_2$, then with probability one only one of the infections grows unboundedly.

7. Let $\mathcal{E}$ be a Poisson point process on $\mathbb{R} \times [0, h]$, $h > 0$. Consider a wiper that removes points from $\mathcal{E}$ in a greedy manner, namely, it jumps to the point closest to its current position and removes that point. Then, with probability one as $t \to \infty$, all points of $\mathcal{E}$ are eventually removed.

8. Doing a PhD in mathematics can help you to gain a better understanding of languages. For instance, I learned from my colleagues in South America that the english phrase “I do it now” actually means “I intend to do it soon”.

9. The most beautiful mathematical proofs are those that are “completely obvious”. Unfortunately, it is very difficult to produce such proofs.