Abstract

The Kinetic Random Walk is one of the simple models of self-avoiding random walk. The elementary walk always takes a uniform step to one of the unvisited neighbors, and when there are no such neighbors, it gets killed. In the analysis, only the walks that survived a given large number of steps are considered, so, we are conditioning on the walk to survive.

According to old heuristic arguments and simulations in the physics literature, in the plane the trajectory of the Kinetic Random Walk has fractal dimension 3/2. That far differs from so-called the Smart Kinetic Random Walk, another self-avoiding random walk model, where the walk is in the square (with fixed length) lattice, starts at the South-West corner, and is taking a uniform step to one of those neighbors from where the walk can reach the North-East corner.

One of the main results was to see fractal dimension 3/2 via computer simulations. Paths for the Kinetic Random Walk were generated, and what was obtained is indeed 3/2. Another goal was to check so-called a number of occupied neighbors which was assumed 3 by other scientists. Statistical tests have shown that it is not exact number to be true. Empirical data shows that it is about 2.5. Moreover, uniform hitting distribution of the walk was measured along the circle. It somehow looks like a real uniform random variable showing us rotational invariance property. Another experiment was about counting a regularity hitting of a fixed level by the Kinetic Random Walk. Histogram data for it is the same as for Simple Symmetric Random Walk on $\mathbb{Z}^2$. Furthermore, to see the limiting distribution of hitting frequency, Simple Symmetric Random Walk was compared with Cauchy distribution. Simple Symmetric Random Walk hits with the regularity like Cauchy, but in the sense of Cauchy's discrete version. Therefore, we might say that the Kinetic Random Walk can also be analogous to Cauchy in discrete cases when the process is to measure hitting of one level.