Abstract

The subject of this thesis is a stochastic model called *a random walk in a sparse random environment* (RWSRE). We consider a single particle performing a nearest-neighbour random walk on the set of integers. The movement is symmetric apart from some sites marked by a two-sided renewal process, in which random drifts are imposed. That is, the environment is split into blocks of random lengths; within each block, the particle performs a symmetric random walk, while at the endpoints a random drift occurs. Therefore the RWSRE may be considered as being in-between two well-known models: a classic, simple symmetric random walk (SSRW) and a random walk in i.i.d. random environment (RWRE), and, depending on the distribution of the environment, it may manifest properties resembling one or the other.

One of the goals of the thesis is to examine how this dichotomy may be observed in the limiting behaviour of the walk. The first part of the thesis concerns quenched limit theorems for the position of the walk and the sequence of first passage times. We begin by presenting the case in which the strong quenched central limit theorem holds for the position of the walk, generalizing results known for the RWRE. Next we focus on the case in which the sparsity of the environment plays a dominant role in governing the limiting behaviour of the RWSRE and present weak quenched limit theorems for the sequence of first passage times. In this case the RWSRE exhibits properties not observed for the RWRE.

In the last part of the thesis we examine the sequence of maximal local times of the walk, i.e. the amount of time spent by the particle in its favourite sites. We present the annealed limit theorems for this sequence in two cases: the case of dominating drift and the case of dominating sparsity. In the former, we obtain results that may be seen as a generalization of those known for the RWRE. In the latter, the nature of the favourite sites is different because of the presence of long blocks on which the walk is symmetric.