Branching Random Walks and Their Applications to Population Studies

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Recent investigations have demonstrated that continuous-time branching random walks on multidimensional lattices give an important example of stochastic models in which the evolutionary processes depend on the structure of a medium and the spatial dynamics. It is convenient to describe such processes in terms of birth, death, and walks of particles on the lattice. The structure of a medium is defined by the offspring reproduction law at a finite number of generation centers situated on the lattice points. We consider models of branching random walks under different assumptions about underlying random walks: symmetric or non-symmetric, with or without the finite variance of jumps. The goal of the study is to analyze phase transitions for various models of branching random walks. We start by the classification of branching random walks depending on properties of the underlying random walks and the lattice dimension. Limit theorems for the numbers of particles at an arbitrary point of the lattice and for the particle population size are obtained. For investigation of the population front of particles the large deviation for branching random walks are studied.

Key Words: Non-homogeneous environments, limit theorems, large deviations.