UDC 519.218

MATEMATICHESKIE TRUDY
2011, V. 14, N 2, 28–72

CATALYTIC BRANCHING RANDOM WALKS IN $\mathbb{Z}^d$ WITH BRANCHING AT THE ORIGIN

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A time-continuous branching random walk on the lattice $\mathbb{Z}^d$, $d \geq 1$, is considered when the particles may produce offspring at the origin only. We assume that the underlying Markov random walk is homogeneous and symmetric, the process is initiated at moment $t = 0$ by a single particle located at the origin, and the average number of offspring produced at the origin is such that the corresponding branching random walk is critical. The asymptotic behavior of the survival probability of such a process at moment $t \to \infty$ and the presence of at least one particle at the origin is studied. In addition, we obtain the asymptotic expansions for the expectation of the number of particles at the origin and prove Yaglom-type conditional limit theorems for the number of particles located at the origin and beyond at moment t.

Key words and phrases: catalytic branching random walk, a homogeneous and symmetric time-continuous multidimensional Markov random walk, Bellman–Harris branching process with two types of particles, renewal theory, limit theorem.

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Received
April 27, 2010

Translated into English:
Siberian Advances in Mathematics, V. 23, N 2, 123–153 (2013).