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Finite reversible nearest particle systems in inhomogeneous and random environments. (English) Zbl 0753.60099

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A family of interacting random processes is studied. Each random process is connected with any particle system on Z^1. The authors name these systems "finite reversible nearest particle systems in inhomogeneous and random environments". The systems are constructed by the following manner. A stochastic process $\eta_t(x)$ with state space $\{0,1\}$ is associated with each site $x \in Z^1$. The particle at x dies $(1 \to 0)$ at rate 1, independently of occupation of other sites. It is born at site x $(0 \to 1)$ at rate $\lambda_x\beta(l_x)\beta(r_x)/\beta(l_x + r_x)$. Here $\beta(\cdot)$ is a family of positive numbers with

$$\sum_{l=1}^{\infty}\beta(l) = 1, \quad l_x = x - \max\{y < x,\ \eta(y) = 1\}, \quad r_x = \min\{y > x,\ \eta(y) = 1\} - x.$$

λ_x is a positive function on Z^1. In particular the case in which λ_x is periodic is examined. The main subject of the article is the case in which λ_x is a family of identical independently distributed random variables. The λ_x are constant on time. The finite systems for which $\sum_x \eta_t(x) < \infty$ are considered. Let $A_t = \{x \mid \eta_t(x) = 1\}$, and $\rho^A = P(A_t \neq \emptyset$ for all $t > 0)$ is the survival probability. ρ^A is random if λ_x are random. Therefore in the random case the probability $E\rho^A$ is introduced. The system survives if $E\rho^x > 0$ and it dies out if $E\rho^x = 0$. The authors prove that each system of the family survives if $E\log\lambda_x > 0$ and dies out if $E\lambda_x < 1$. Both survival and extinction may happen when $E\log\lambda_x < 0$ and $E\lambda_x > 1$.

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MSC:

60K35 Interacting random processes; statistical mechanics type models; percolation theory

Keywords:

random environments; interacting random processes; reversible nearest particle systems; survival probability; extinction

Full Text: DOI