

Frog model on $\mathbb{Z}$ with random survival parameter

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We study the frog model on $\mathbb{Z}$ with geometric lifetimes, introducing a random survival parameter. Active and inactive particles are placed at the vertices of $\mathbb{Z}$. The lifetime of each active particle follows a geometric random variable with parameter $1 - p$, where p is randomly sampled from a distribution π . Each active particle performs a simple random walk on $\mathbb{Z}$ until it dies, activating any inactive particles it encounters along its path. In contrast to the usual case where p is fixed, we show that there exist non-trivial distributions π for which the model survives with positive probability. More specifically, for $\pi \sim \text{Beta}(\alpha, \beta)$, we establish the existence of a critical value $\beta = 0.5$, that separates almost sure extinction from survival with positive probability. Furthermore, we show that the model is recurrent whenever it survives with positive probability.

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