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Contact Processes on Random Regular Graphs

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ABSTRACT

In this dissertation we mainly study the contact process on random regular graphs with growing sizes. Since the local geometry of a random regular graph resembles that of a regular tree $\mathbb{T}^d$, the appropriate analogue of the supercritical regime on $\mathbb{T}^d$ is to choose the infection parameter $\lambda > \lambda_1(\mathbb{T}^d)$, the lower critical value on $\mathbb{T}^d$. We show in this case, for two typical vertices u, v on a typical graph G, a contact process initiated from u will infect v before time $(C-\epsilon)\log n$ with vanishing probability, while it will infect v at time $(C+\epsilon)\log n$ with a fixed positive probability.

A closely related problem is to study the extinction time τ_n, the first time a contact process started from the full occupancy state reaches $\emptyset$ on a graph of size n. When $\lambda > \lambda_1(\mathbb{T}^d)$, we show that τ_n grows exponentially with n. Then, we show that the normalized extinction time, $\tau_n/\mathbb{E}_G\tau_n$, converges in law to a unit exponential distribution. We also determine the density of the infections of the quasi-stationary state.

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