STOCHASTIC SPATIAL MODELS FOR SOME NATURALLY OCCURRING PHENOMENON

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ABSTRACT. We will discuss about four models of stochastic dynamics on relevant spatial models.

The first one is the *contact process* on *random graphs* on n vertices with power law degree distributions. In this process, sites are infected/healthy, each site heals at rate 1 and each edge has infection transmission rate λ. Disproving conclusions in the physics literature, we show that the critical value λ_c is zero, and we estimate the probability of an epidemic for any $\lambda > 0$

The second one is a *threshold contact process* (in which sites with at least one *occupied* input at time t becomes occupied at time $t+1$ with probability q, and remains *vacant* otherwise) on a random graph on n nodes with specified in-degree/out-degree distribution $\mathbf{p}$, which models activities in *gene regulatory networks*. We characterize the phase transition curve segregating the 'chaotic' and 'ordered' behaviors of the networks.

The third one is related to a *long distance dispersal*, where any $\mathbf{x}, \mathbf{y} \in \mathbb{Z}^d$ communicates at rate $r(||\mathbf{x} - \mathbf{y})$ for a given decreasing function $r(\cdot)$ and any Euclidean norm $||\cdot||$. We characterize different regimes for the behavior of the associated first-passage percolation metric.

The final one is a model for *collaborative innovation*, in which we assume that the each node of an Erdős-Rényi graph has a unique piece of a Jigsaw puzzle and they try to solve the puzzle collaboratively. We find values of p for which certain puzzles are solvable/unsolvable.