# Abstract

We study a generalization of the classical contact process (SIS epidemic model) on a directed graph G. Our model is a continuous-time interacting particle system in which at every time, each vertex is either healthy or infected, and each oriented edge is either active or inactive. Infected vertices become healthy at rate 1 and pass the infection along each active outgoing edge at rate $\lambda$. At rate $\alpha$, healthy individuals deactivate each incoming edge from their infected neighbors, and an inactive edge becomes active again as soon as its tail vertex becomes healthy. When $\alpha = 0$, this model is the same as the classical contact process on a static graph. We study the persistence time of this epidemic model on the lattice Z, the n-cycle $Z_n$, and the n-star graph. We show that on Z, for every $\alpha > 0$, there is a phase transition in $\lambda$ between almost sure extinction and positive probability of indefinite survival; on $Z_n$ we show that there is a phase transition between poly-logarithmic and exponential survival time as the size of the graph increases. On the star graph, we show that the survival time is $n^{\Delta+o(1)}$ for an explicit function $\Delta(\alpha, \lambda)$ whenever $\alpha > 0$ and $\lambda > 0$. In the cases of Z and $Z_n$, our results qualitatively match what has been shown for the classical contact process, while in the case of the star graph, the classical contact process exhibits exponential survival for all $\lambda > 0$, which is qualitatively different from our result. This model presents a challenge because, unlike the classical contact process, it has not been shown to be monotonic in the infection parameter $\lambda$ or the initial infected set.