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Phase Transitions in the Quadratic Contact Process on Complex Networks CHRIS VARGHESE, RICK DURRETT, Duke University — The quadratic contact process (QCP) is a natural extension of the well studied linear contact process where a single infected (1) individual can infect a susceptible (0) neighbor and infected individuals are allowed to recover ($1 \to 0$). In the QCP, a combination of two 1's is required to effect a $0 \to 1$ change. We extend the study of the QCP, which so far has been limited to lattices, to complex networks as a model for the change in a population via sexual reproduction and death. We define two versions of the QCP – vertex centered (VQCP) and edge centered (EQCP) with birth events $1-0-1 \to 1-1-1$ and $1-1-0 \to 1-1-1$ respectively, where '$-$' represents an edge. We investigate the effects of network topology by considering the QCP on regular, Erdős-Rényi and power law random graphs. We perform mean field calculations as well as simulations to find the steady state fraction of occupied vertices as a function of the birth rate. We find that on the homogeneous graphs (regular and Erdős-Rényi) there is a discontinuous phase transition with a region of bistability, whereas on the heavy tailed power law graph, the transition is continuous. The critical birth rate is found to be positive in the former but zero in the latter.

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