Abstract

Percolation theory is a model that is very useful for studying critical phenomena. A percolating system is made of two components in a fixed specified ratio, which are randomly distributed in space. This random distribution generates nanoclusters of one species. The system undergoes through a phase transition when the concentration of one species is increased. The critical point for the phase transition is reached exactly at the moment when the small nanoclusters coalesce and form a giant cluster, spanning the entire system. There are many applications of this theory, such as with porous or magnetic materials, but also with networks of social relations, transportation networks, or even the internet itself. In 2009, it has been proposed by Achlioptas et al. a new type of percolation processes, known as *Achlioptas processes*. This new type gives an alternate way of forming the nanoclusters and it is performed according to a product rule in a way leading to an "explosive" rather than a smooth transition of the system. After that, many publications followed upon this rule trying to create first order transitions.

In this work we used Monte Carlo simulations on lattices with sizes from $10^2 - 10^3$ for classical percolation and for explosive percolation based on '*Achlioptas processes*' in order to distinguish between the two types of transition and draw useful conclusions about their applicability. Also a new more general model is being proposed in order to give explosive percolation. The model is based on the idea that occupation probability of sites or bonds added is inverse proportional to the size of the clusters that the sites or bonds form $p = \frac{1}{S}$. These results will lead to a further implications and development in the field.