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Publications

a) In journals

1. **S. S. Manna** and Robert M. Ziff, *Bond percolation between k separated points on a square lattice*, Physical Review E, 101, 062143, 2020

Areas of Research

Statistical Physics

We consider a percolation process in which k points separated by a distance proportional the system size L simultaneously connect together ($k > 1$), or a single point at the center of a system connects to the boundary ($k = 1$), through adjacent connected points of a single cluster. These processes yield new thresholds pck defined as the average value of p at which the desired connections first occur. These thresholds not sharp, as the distribution of values of pck for individual samples remains broad in the limit of L . We study p_{ck} for bond percolation on the square lattice and find that p_{ck} are above the normal percolation threshold $p_c = 1/2$ and represent specific supercritical states. The p_{ck} can be related to integrals over powers of the function P (p) equal to the probability a point is connected to the infinite cluster; we find numerically from both direct simulations and from measurements of P (p) on $L \times L$ systems that for L , $p_{c1} = 0.517\ 55(5)$, $p_{c2} = 0.532\ 19(5)$, $p_{c3} = 0.544\ 56(5)$, and $p_{c4} = 0.555\ 27(5)$. The percolation thresholds p_{ck} remain the same, even when the k points are randomly selected within the lattice. We show that the finite-size corrections scaleas $L_{-1/\ k}$ where k = /(k + 1), with = 5/36 and = 4/3 being the ordinary percolation critical exponents, so that 1 = 48/41, 2 = 24/23, 3 = 16/17, 4 = 6/7, etc. We also study three-point correlations in the system and show how for $p > pc$, the correlation ratio goes to 1 (no net correlation) as L , while at p_c it reaches the known value of 1.022.