

Upper Bounds for Bond Percolation Thresholds of Stacked Lattices

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We derive upper bounds for bond percolation thresholds of three-dimensional stacked lattices by a growth process approach. The approach describes the growth of a cluster in an unsolved 3D lattice bond percolation model by a Markov process and relates it to a standard bond percolation process on a 2D planar lattice via a natural projection, an identical-distribution replication, and stochastic ordering. In particular, the bond percolation thresholds of the stacked triangular lattice and the stacked hexagonal lattice are considered, establishing the upper bounds 0.27455 and 0.45213 respectively.

Keywords: bond percolation threshold, stacked lattice, Markov chain, stochastic ordering