Potts model with invisible states: changeover to the percolation transition

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Within scarcely a decade of its appearance, the Potts model with invisible states (ISPM) [1] attracted significant interest (see a review on this model for more details [2]). This interest is due to the prominent feature of the model that allows changing the strength and even the order of the phase transition by continuously tuning the model parameters, keeping other global features like space dimensionality, interaction range and symmetry unchanged. It has been used to interpret the possible changes in the order of the percolation transition. Although the percolation transition is known to be a continuous one [3], in the real world there exist connectivity problems that are clearly abrupt and need conceptual understanding and quantitative treatment [4]. The results obtained for ISPM on the complete graph [5] and on an annealed scale-free network [6] prove that the addition of invisible states can lead a phase transition in the percolation limit $q \rightarrow 1$ of the standard Potts model to become a first order transition. In this way one more mechanism is suggested to achieve a discontinuous percolation transition. This mechanism differs from those of explosive percolation, bootstrap percolation, cascade of failures in inter-dependent networks and hybrid percolation on multiplex interdependent Erdős–Rényi networks.

References

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