Hard-core random networks as an effective model of bond percolation on real networks

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The degeneracy of a network's subgraphs, i.e. its decomposition in k-cores where all nodes have at least k edges among one another, has been employed for over three decades as a powerful tool in the empirical study of complex networks, although its use in theoretical models has remained somewhat limited. Recently however, it was shown that a node's coreness, and not its degree, was the better indicator of a node's chance of participating in a percolation process [1]. Following up on this finding, we present a model of Hard-core Random Networks (HRN) which respects both a given degree distribution *and* a k-core connection structure. This model provides fast and precise estimates of percolation results on real networks. In fact, our model offers better estimates than the classic Configuration Model (CM) [2] and even improves upon those of the Correlated Configuration Model (CCM) [3] while requiring less information. Finally, we show how to map the HRN model to a CCM with multiple types of nodes and links. This allows the use of an analytical formalism based on generating functions which exactly solve the bond percolation problem.

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[3] A. Vázquez,and Y. Moreno, Resilience to damage of graphs with degree correlations, *Phys. Rev. E* , 67:015101(R), 2003.

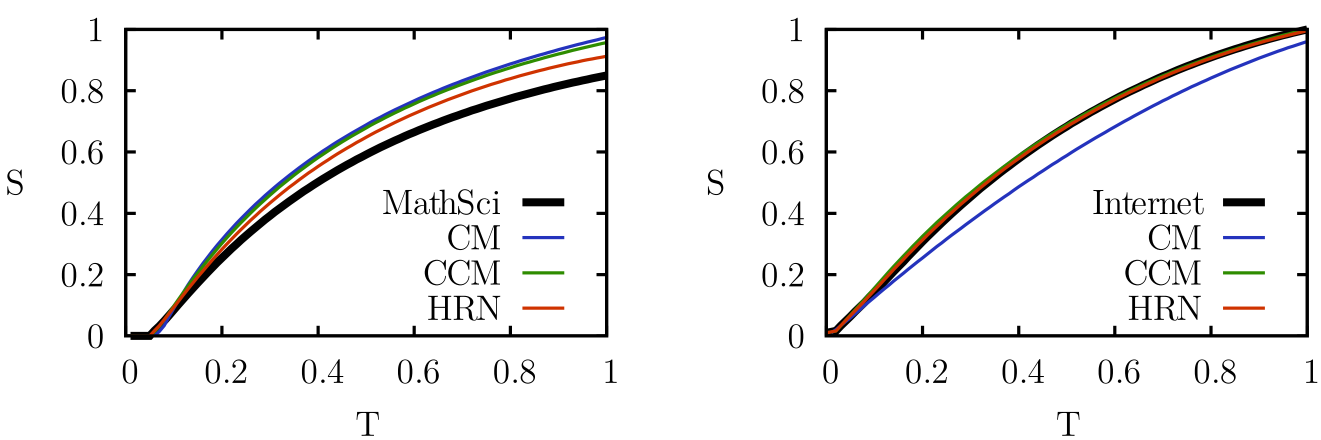

Figure 1: **Size *S* of the giant component after bond percolation process.** Results of bond percolation on the MathSciNet co-authorship network (left) and the Internet at the level of autonomous systems (right). The results are compared to results obtained with the Configuration Model (CM, in blue), the Correlated Configuration Model (CCM, in green) and our Hard-core Random Networks (HRN, in orange).