Community Stability of Heterogeneous Networks

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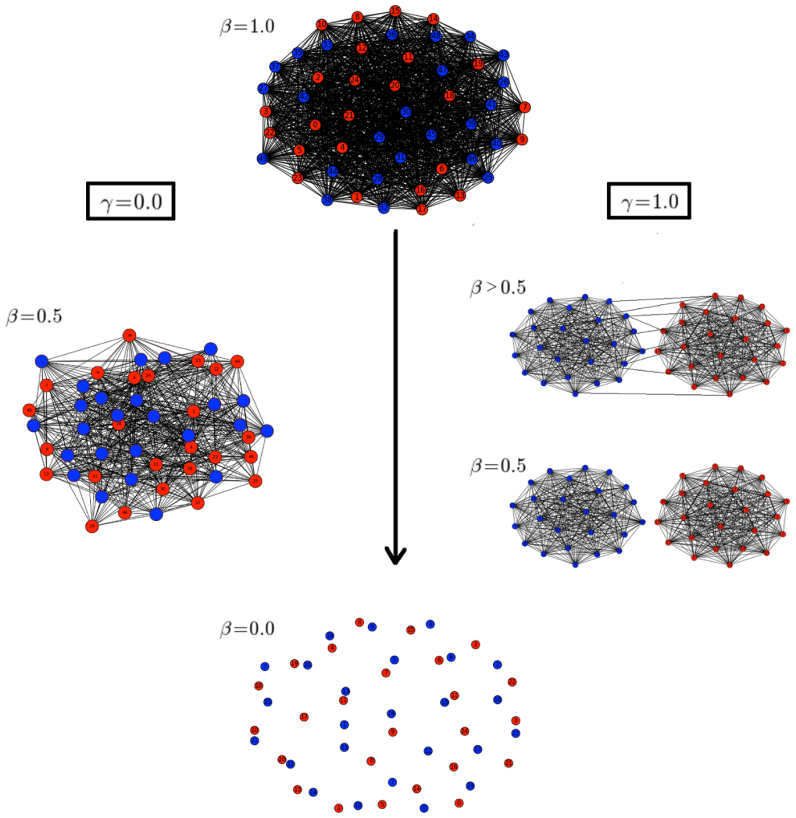
The dynamics and behaviour of ferromagnets have a great relevance even beyond the domain of statistical physics. In this work, we propose a Monte Carlo method, based on random graphs, for modelling their dilution.

In particular, we focus on ferromagnets with dimension equal/greater than 4, which can be approximated by the Curie-Weiss model. Since the latter has as counterpart a complete graph, *a dilution can be in this case viewed as a pruning process*. Hence, in order to exploit this mapping, the proposed strategy uses a modified version of the *Erdős-Renyi graph model*. In doing so, we are able both to simulate a continuous dilution, and to realize diluted ferromagnets in one step.

The proposed strategy is studied by means of numerical simulations, aimed to analyse main properties and equilibria of the resulting diluted ferromagnets. In addition, we show its application in the area of complex networks, with a particular emphasis on the **stability of communities**. The latter plays a relevant role in different networks, as social networks and, as shown here, it has a direct relation with the **network heterogeneity**.



Dilution process via ER-L, achieved in two different ways: on the left, without any control (i.e. $\gamma = 0$), and on the right with maximum control (i.e. $\gamma = 1$). The arrow indicates the direction of the process, starting from the top with a complete graph, up to the bottom with non-connected nodes. Along the dilution path, are shown the related graphs achieved by the different strategies previously described. Different colors indicate different spin values.