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Effect of degree correlations on controlability of complex networks MARTON POSFAI, YANG LIU, Center for Complex Network Research and Department of Physics, Northeastern University, Boston, Massachusetts 02115, USA, JEAN-JAQUES SLOTINE, Nonlinear Systems Laboratory, Massachusetts Institute of Technology, Cambridge, Massachusetts, 02139, USA, ALBERT-LASZLO BARABASI, Center for Complex Network Research and Department of Physics, Northeastern University, Boston, Massachusetts 02115, USA — While significant effort was made during the past decade to understanding the structure, evolution and function of complex networks, little is known about our ability to control them. A system is considered controllable if by imposing appropriate external signals on a set of its nodes, called driver nodes, the system can be driven from any initial state to any desired final state in finite time. The controllability of a network can be quantified by calculating the minimal number of driver nodes needed to obtain complete control. We study the effect of degree correlations on network controllability via both numerical simulations and analytical calculations. Numerical simulations are preformed by systematically adding correlations to model networks using appropriate rewiring schemes inspired by simulated annealing. Analytical results are derived using the cavity method originally developed in spin glass theory. The numerical and analytical results enable us to give qualitative predictions of controllability for any networks based on their degree correlation profiles. We test our predictions on several real networks and find consistent results.

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