Renormalization Group Approaches for Dynamics on Irregular Networks

MADHURIMA NATH, Department of Physics, NDSSL, Virginia Tech, YIHUI REN, NDSSL, Virginia Tech, STEPHEN EUBANK, Department of Physics, NDSSL, Department of Population Health Sciences, Virginia Tech — Moore and Shannon’s reliability polynomial can be used as a global statistic to explore the behaviour of a diffusive process on a network that represents a finite sized interacting system. It depends on both the network topology and the dynamics of the process and gives the probability that the system has a particular desired property. The estimation of the reliability polynomials for large graphs is feasible using Monte-Carlo simulation. By analogy with the partition function of a physical system, it is possible to define renormalization group approaches that map the parameters of one network onto another keeping the network reliability invariant. This transformation suggests a canonical form for the network reliability that can be used as a measure for non-random structure for different graphs. Further, this information about the existence of certain structured patterns provides knowledge about the community structures in the network.

Madhurima Nath
Department of Physics, NDSSL, Virginia Tech

Date submitted: 07 Nov 2016