

Abstract Submitted  
for the MAR15 Meeting of  
The American Physical Society

**Four Parameter Characterization of Network Reliability and Analysis of Critical Point Phenomenology** MADHURIMA NATH, STEPHEN EUBANK, MINA YOUSSEF, YASAMIN KHORRAMZADEH, SHAHIR MOWLAEI, Virginia Tech — A new characterization of network structure as represented by the reliability polynomial is introduced that requires only four parameters. Exact evaluation of the polynomial is not feasible for large graphs. Approximation to within a specified error is feasible, but a complete specification of the polynomial still requires many parameters. However, it turns out that a two-parameter family of functions fits the non-trivial part of the reliability polynomial to within approximation error. We demonstrate this by fitting the reliability polynomials of both random graphs with different sizes and synthetic social networks to the error function. The network reliability can be viewed as a partition function of a physical system, for example percolation on a network. This method produces a good analytical approximation to the partition function for a given network and suggests a way to explore critical point phenomenology.

Madhurima Nath  
Virginia Tech

Date submitted: 14 Nov 2014

Electronic form version 1.4