Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Cascading Failures and Stochastic Analysis for Mitigation in Spatially-Embedded Random Networks[1] NOEMI DERZSY, XIN LIN, ALAA MOUSSAWI, BOLESLAW K. SZYMANSKI, GYORGY KORNISS, Rensselaer Polytechnic Institute — In complex information or infrastructure networks, even small localized disruptions can give rise to congestion, large-scale correlated failures [1], or cascades, – a critical vulnerability of these systems. Recent studies have demonstrated that flow-driven cascading overload failures in spatial graphs, such as the power grid, are non-self-averaging, hence predictability is poor and conventional mitigation strategies are largely ineffective [2]. In particular, we have shown that protecting all nodes (or edges) by the same additional capacity (tolerance) can actually lead to larger global failures, i.e., "paying more can result in less", in terms of robustness [2]. Here, we explore stochastic methods for optimal heterogeneous distribution of resources (node or edge capacities) subject to a fixed total cost. In addition to random geometric graphs, we also investigate cascading failures on the UCTE European electrical power transmission network. [1] A. Bernstein, D. Bienstock, D. Hay, M. Uzunoglu, and G. Zussman, http://arxiv.org/abs/1206.1099 (2011). [2] A. Asztalos, S. Sreenivasan, B.K. Szymanski, and G. Korniss, PLOS One 9(1): e84563 (2014).

[1]Supported in part by DTRA, NSF, and ARL NS-CTA

Noemi Derzsy
Rensselaer Polytechnic Institute

Date submitted: 11 Nov 2014 Electronic form version 1.4