Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Exploring the limits of multifunctionality in adaptable networks: comparing flow networks to mechanical metamaterials JASON W. ROCKS, HENRIK RONELLENFITSCH, ELENI KATIFORI, ANDREA J. LIU, Department of Physics and Astronomy, University of Pennsylvania, Philadelphia, PA, USA, SIDNEY R. NAGEL, Department of Physics, University of Chicago, Chicago, IL, USA — Previous work shows that spring networks are both adaptable and robust - via selective bond pruning, specific functions can be programmed precisely, efficiently and robustly [Rocks et. al., 2016, arXiv:1607.08562]. These functions include localized but long-range-correlated deformations reminiscent of allostery in proteins. Analogous functionality can be introduced into flow networks by controlling the current through a bond in response to a current applied elsewhere in the network. Here we explore the limits of multifunctionality. How many separate independent functions can be simultaneously tuned successfully into a network and how many different targets can be controlled by a single source? These questions can be classified as constraint-satisfaction problems that we study in both mechanical and flow networks.

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Date submitted: 20 Nov 2016 Electronic form version 1.4