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Network Destabilizations with Inverted Mechanical Responses¹ ZACK NICOLAOU, ADILSON MOTTER, Northwestern University — A solid ma-

ZACK NICOLAOU, ADILSON MOTTER, Northwestern University — A solid material can be regarded as a large mechanical network, with nodes representing the constituent particles and links representing interactions between nearby particles. Assuming the temperature is sufficiently low, the total force on each particle is nearly zero. In response to an applied force, the network rearranges itself so that the force exerted by the surface of the material counteracts the applied force. This reaction can be described as a flow of forces through the network. When the applied force changes, we expect a deformation to result in the direction of the change in applied force. In elastic materials, this behavior is guaranteed. However, when the assumptions of elasticity fail, as is often the case when the material undergoes finite strains, this intuition need not hold. We show that under a finite change in applied force, a stress-induced phase transition can occur which results in a deformation of the network from its initial configuration which is opposite the direction of the change in force. A potential applications is the design of new materials which expand under compression or contract under tension.

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