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Finite temperature mechanical instability in disordered lattices LEYOU ZHANG, XIAOMING MAO, Univ of Michigan - Ann Arbor — Mechanical instability takes different forms in various ordered and disordered systems, and little is known about how thermal fluctuations affect different classes of mechanical instabilities. We develop an analytic theory involving renormalization of rigidity and coherent potential approximation that can be used to understand finite-temperature mechanical stabilities in various disordered systems. We used this theory to study two disordered lattices: randomly diluted triangular lattice and randomly braced square lattice. These two lattices belong to two different universality classes as they approach mechanical instability at $T = 0$. We show that thermal fluctuations stabilize both lattices. In particular, the triangular lattice displays a critical regime in which the shear modulus scales as $G \sim T^{1/2}$, whereas the square lattice shows $G \sim T^{2/3}$. We discuss generic scaling laws for finite T mechanical instabilities and relate to experimental systems including jamming and glass transitions.

Leyou Zhang
Univ of Michigan - Ann Arbor

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