Abstract Submitted
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Soft modes and elasticity of nearly isostatic lattices: randomness and dissipation[1] XIAOMING MAO, TOM LUBENSKY, Department of Physics and Astronomy, University of Pennsylvania — Isostatic periodic lattices, such as the square and kagome lattices in spatial dimension $d = 2$, are systems at the onset of rigidity. They are marginally stable with coordination number $z = 2d$, and they may exhibit a non-extensive number of soft modes that can be removed by adding an infinitesimal number of additional bonds. Randomly packed frictionless spheres at the jamming point J represent an important isostatic system that, because of its randomness, exhibits complexities beyond those of periodic systems. To study the effects of randomness on phonon response, propagation, and damping, we constructed model lattices near isostaticity by adding randomly distributed next-nearest and second-nearest neighbor bonds to the isostatic square and kagome lattices, respectively. We calculated a number of properties of these models using the CPA approximation and found them to resemble those of jammed solids near the point J. In particular, the phonon density of states crosses over from Debye-like at low frequency ω to the flat frequency-independent behavior of a one-dimensional systems at a characteristic frequency ω^* that scales as the density of additional random bonds Δz. The real and imaginary part of the effective random-bond spring constants become equal at ω^*. We also identify a characteristic length that scales as $(\Delta z)^{-1}$.

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