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Rigidity percolation in generic and regular isostatic lattices LEYOU ZHANG, D. ZEB ROCKLIN, Univ of Michigan - Ann Arbor, BRYAN CHEN, Instituut-Lorentz, Leiden University, XIAOMING MAO, Univ of Michigan - Ann Arbor — Rigidity percolation, the emergence of rigidity as bonds are randomly added to a structure, has been studied using various models, yielding a rich variety of behaviors including continuous/discontinuous transitions as well as mean field/anomalous scalings. Here we present our study of rigidity percolation in isostatic lattices, which are at the verge of mechanical instability and thus adding a vanishing fraction of next-nearest-neighbor bonds ("braces") can rigidify the lattice. However, we find that how the lattice rigidifies as braces are added depends on the lattice architecture in interesting ways. We study this problem in both regular (periodic, with bonds following straight lines) and generic (sites are randomly moved, keeping only the topology of the connectivity) versions of isostatic square and kagome lattices via simulation. We discover that (1) rigidity percolation in generic isostatic lattices is discontinuous, with a sudden emergence of a rigid bulk, before which no stress can appear, sharing intriguing similarities with jamming, and (2) regular isostatic lattices, in contrast, show mixed features of continuous and discontinuous transitions. We propose analytic theories to explain our observations.

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