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Investigating the stability of jammed systems with respect to generalized boundary deformations SAMUEL SCHOENHOLZ, CARL GOODRICH, OLEG KOGAN, ANDREA LIU, University of Pennsylvania, SIDNEY NAGEL, University of Chicago — At zero temperature and applied stress, amorphous packings of spheres exhibit a jamming transition as a function of packing fraction. Above the jamming transition, systems of repulsive spheres have a nonzero bulk moduli. However, some jammed states prepared with periodic boundary conditions are unstable to shear. These instabilities motivate several questions: How does the fraction of systems that exhibit instabilities scale with packing fraction and system size? Are there other classes of boundary deformations with respect to which jammed packings could be unstable, and if so, how can they be explored? We answer these questions by considering each finite packing with periodic boundary conditions in d dimensions as the basis of an infinite hypercubic lattice. We study the properties of modes that do not respect the periodicity of the initial system and thereby characterize the linear response to a large class of boundary deformations. In this way we systematically explore the effects of system size and packing fraction on stability with respect to these boundary deformations, and show that our results can be understood in terms of competition between plane waves and anomalous vibrational modes associated with the jamming transition.

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