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Reversibility and rearrangements in sheared 2D systems: probing saddle points in the energy landscape PETER MORSE, LISA MANNING, Syracuse University, MARTIN VAN HECKE, Leiden University, SVEN WIJTMANS, Syracuse University, MERLIJN VAN DEEN, Leiden University — Under shear, a jammed packing of particles transitions between mechanically stable states. An open question is whether these transitions are one-to-one with changes to the particle contact network; the answer is important for characterizing energy barriers to rearrangements and understanding the role that small force distributions play in scaling theories for marginal stability. To answer the question, we analyze all contact change events in simulations of a sheared 2D disks and find they can be grouped into two types: One type, which we call a network event, is associated with a smooth change in stress but a discontinuous change in the shear modulus, while the other, called a rearrangement event, is accompanied by a drop in the stress and significant particle displacements. This suggests that not all contact changes are associated with saddle points, although all saddle points are accompanied by contact changes. We also examine the eigenvalues of the dynamical matrix, and find that different particle interaction potentials exhibit different signatures at these events. Finally, at high pressures, we find that network events are reversible under cyclic strain, while rearrangements are not, although the situation becomes messier at low pressures close to jamming.

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