Abstract Submitted
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Origins of Shear Jamming for Frictional Grains[1] DONG WANG, Duke University, HU ZHENG, Hohai University, JIE REN, Merck Co., JOSHUA DIJKSMAN, Wageningen University, JONATHAN BARES, Laboratoire de Mecanique et de Genie Civil, Universite de Montpellier, ROBERT BEHRINGER, Duke University — Granular systems have been shown to be able to behave like solids, under shear, even when their densities are below the critical packing fraction for frictionless isotropic jamming. To understand such a phenomena, called shear jamming, the question we address here is: how does shear bring a system from a unjammed state to a jammed state, where the coordination number, Z, is no less than 3, the isotropic jamming point for frictional grains? Since Z can be used to distinguish jammed states from unjammed ones, it is vital to understand how shear increases Z. We here propose a set of three particles in contact, denoted as a trimer, as the basic unit to characterize the deformation of the system. Trimers, stabilized by inter-grain friction, fail under a certain amount of shear and bend to make extra contacts to regain stability. By defining a projection operator of the opening angle of the trimer to the compression direction in the shear, O, we see a systematically linear decrease of this quantity with respect to shear strain, demonstrating the bending of trimers as expected. In addition, the average change of O from one shear step to the next shows a good collapse when plotted against Z, indicating a universal behavior in the process of shear jamming.

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