MAR17-2016-020176

Abstract for an Invited Paper
for the MAR17 Meeting of
the American Physical Society

Stress Transmission in Granular Packings: Localization and Cooperative Response[1]

KABIR RAMOLA, Brandeis University

We develop a framework for stress transmission in two dimensional granular media that respects vector force balance at the microscopic level. For a packing of grains interacting via pairwise contact forces, we introduce local gauge degrees of freedom that determine the response of the system to external perturbations. This allows us to construct unique force-balanced solutions that determine the change in contact forces as a response to external stress. By mapping this response to diffusion in the underlying contact network, we show that this naturally leads to spatial localization of forces. We present numerical evidence for stress localization using exact diagonalization studies of network Laplacians associated with soft disk packings. We use this formalism to characterize the deviation from elastic behaviour as the amount of disorder in the underlying network is varied. We discuss generalizations to systems with large friction between grains and other networks that display topological disorder.

[1]This work has been supported by NSF-DMR 1409093 and the W. M. Keck Foundation.