PERCOLATION OF FORCE NETWORKS AND DEFORMATION PROPERTIES OF GRANULAR MATTER

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Granular media as well as other amorphous materials show a peculiar mechanical behavior including the possibility of exhibiting jammed configurations that can eventually yield under shear stress. In the last few years, it has been known that force networks in this system play the role of the cytoskeleton in a living cell, thus determining its mechanical response and stability. Several recent experimental and theoretical investigations address this question and relate jamming and yielding to structural changes in contact force networks. Borrowing concepts and techniques from percolation theory, here we study the topological properties of force networks characteristic of several simple models of granular media under various loading conditions. Proceeding this way, we can establish quantitative correlations between mechanical properties and the behavior of force clusters. Moreover, we obtain universal features characterizing the behavior of force clusters in both isotropic and anisotropic model systems.