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What causes the emergence of force chains in granular materials? KRISHNARAJ KP, PRABHU R NOTT, Indian Institute of Science — A dense collection of grains may be viewed as a network of contacts which transmit forces. Force transmission in this network is influenced by constraints of geometry and packing, making it significantly different from information, transportation, or power networks. Experiments on two-dimensional disks report the presence of anisotropic quasi-linear structures called force chains, which are assumed to be the cause of their uncommon macroscopic behaviour. Studies have tried to quantify the properties of these structures, but the problem largely remains unresolved. We show using a simple discrete model, that force chain-like features are generic to any Euclidean packing of particles. The packing structure is sufficient to predict the essential features of the force network, regardless of the external forcing or boundary conditions. Using a novel method to study the structure of packing, we quantify the long range correlations in the system. The method reveals important, phase transition-like, properties in particle packings, the critical parameters and exponents of which characterize the geometry of the particle arrangements.

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