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The frequency distribution of mechanically stable packings GUO-JIE GAO, JERZY BLAWZDZIEWICZ, COREY O'HERN, Yale University — We generate mechanically stable packings of soft particles in 2D using an algorithm in which we successively grow or shrink purely repulsive grains and minimize the total energy at each step until particles are just at contact and at rest. We focus on small systems of up to 20 particles, and thus we are able to enumerate nearly all of the possible mechanically stable packings. Complete enumeration allows us to factorize the probability distribution, $P(\phi)$, for obtaining a mechanically stable state at packing fraction ϕ into algorithm-dependent and independent contributions, $\beta(\phi)$ and $\rho(\phi)$. $\rho(\phi)$ is the probability density to obtain a distinct mechanically stable packing at ϕ, while $\beta(\phi)$ is the frequency with which each distinct state occurs. We found several remarkable features of the frequency distribution. For example, the frequency averaged over bins of width $d\phi$ grows exponentially with increasing packing fraction. In addition, distinct mechanically stable packings within $d\phi$ can occur with frequencies that differ by orders of magnitude. We also add thermal fluctuations to these stable configurations to understand the relationship between the frequency and shape of the potential landscape near the stable configurations.

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