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Edge Effects in Jammed Systems CARL GOODRICH, WOUTER ELLENBROEK, ANDREA LIU, University of Pennsylvania — Packings of spheres at zero temperature and shear stress exhibit a jamming/unjamming transition as a function of density. For spheres that repel when they overlap and do not otherwise interact, packings are jammed with a nonzero static shear modulus at high densities. As density decreases towards the unjamming transition, the number of interacting neighbors per particle, z, decreases towards a critical value z_c, so that at the unjamming transition the system just has the minimum number of interacting neighbors to be mechanically stable. In 2005, Wyart, et al. [1] proposed that there is a diverging length scale, l^*, associated with this transition, that can be understood from a "cutting argument." Thus, if one cuts a cluster of linear dimension L, the cluster will have zero-frequency vibrational modes (soft modes) only for $L < l^*$, where l^* scales as Δz^{-1}, where $\Delta z = z - z_c$. This cutting argument successfully describes the scaling of jammed systems. However, we find numerically that there are soft modes confined to the surface of the cut system, which should be present even in arbitrarily large cut systems. Naively, this would suggest that $l^* \to \infty$ at all packing fractions. Given this complication, we set out to generalize the cutting argument to understand its success in describing scaling properties near the jamming transition.
[1] M. Wyart, S.R. Nagel, T.A. Witten, *Europhys. Lett.* **72**, 486 (2005).

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