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A trans-phase granular continuum relation and its use in simulation KEN KAMRIN, SACHITH DUNATUNGA, HESAM ASKARI, MIT — The ability to model a large granular system as a continuum would offer tremendous benefits in computation time compared to discrete particle methods. However, two infamous problems arise in the pursuit of this vision: (i) the constitutive relation for granular materials is still unclear and hotly debated, and (ii) a model and corresponding numerical method must wear "many hats" as, in general circumstances, it must be able to capture and accurately represent the material as it crosses through its collisional, dense-flowing, and solid-like states. Here we present a minimal trans-phase model, merging an elastic response beneath a fictional yield criterion, a mu(I) rheology for liquid-like flow above the static yield criterion, and a disconnection rule to model separation of the grains into a low-temperature gas. We simulate our model with a meshless method (in high strain/mixing cases) and the finite-element method. It is able to match experimental data in many geometries, including collapsing columns, impact on granular beds, draining silos, and granular drag problems.

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