Abstract Submitted
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A predictive, nonlocal rheology for granular flows KEN KAMRIN, MIT, DAVID HENANN, Brown University — We propose a continuum model for flowing granular matter and demonstrate that it quantitatively predicts flow and stress fields in many different geometries. The model is constructed in a step-by-step fashion. First we compose a relation based on existing granular rheological approaches (notably the "inertial" granular flow rheology) and point out where the resulting model succeeds and where it does not. The clearest missing ingredient is shown to be the lack of an intrinsic length-scale. To tie flow features more carefully to the characteristic grain size, we compose a nonlocal model that includes a new size-dependent term (with only one new material parameter). This new nonlocal model resolves some outstanding questions in the granular flow literature — of note, it is the first model to predict all features of flows in split-bottom cell geometries, a decade-long open question in the field. In total, we will show that this new model, using three material parameters, quantitatively matches the flow and stress data from over 160 experiments in several different geometries.

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