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The thermodynamics of dense granular flow KEVIN LU, PIROUZ KAVEHPOUR, MAE, UCLA — We propose a thermodynamics description of quasi-static granular flow where the partition function samples states of a potential energy landscape. The equilibrium fictive temperature $\sim 10^{-7}$ Joules scales as material volume, where the temperature corresponds to the packing density determined by the structural relaxation time. The theory predicts that the compressibility of granular fluids and the effective viscosity are $\sim 10^{-4}$ Pa^{-1} and ~ 1 Pa-s, respectively. These values fit the data from steady-state shear flow experiments spanning over 5 decades in velocity and 2 decades in pressure. Furthermore, we show that our equation-of-state match the Vogel-Tammann-Fulcher relation of glass-transition in an effort to reconcile the disparate amorphous systems of molecular and granular origin.

Pirouz Kavehpour
MAE, UCLA

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