

Control Parameter for Phase Transition of Granular Materials

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Granular materials demonstrate both fluid and solid behaviors. Several studies showed that transition from a solid state to a fluid state can happen by changing solid concentrations and/or shear rate. The solid concentration is particularly influential to this transition. Micromechanically, it is not known why such transition occurs. In this study we utilize a Discrete Element simulation to study an assembly of non-uniform spheres under simple shear. We identify the key micromechanical parameter that controls the transition from solid to fluid state. Details of the transition as the concentration or the shear rate changes are discussed. The regime map that shows the demarcation of the domain of physical parameters dictating the state of the granular materials is presented.

Keywords: granular materials, phase transition, constitutive equation