



POLITÉCNICA

Ciclo de Investigadores Distinguidos Fronteras de la Ingeniería Civil



Theoretical and numerical modeling of dry and wet granular flows

Dr. Bodhinanda Chandra

University of California Berkeley, USA



Accurate and efficient modeling of dry and wet granular media is essential for many engineering industries, including manufacturing, pharmaceuticals, food processing, and construction. The Discrete Element Method (DEM) and Contact Dynamics (CD) are among the most widely used techniques to study intergranular microscopic interactions. However, it is well known that their computational cost increases rapidly with the number of grains, making simulations of fine powders particularly challenging. Meanwhile, extensive research in continuum mechanics in the past decades has focused on modeling granular materials in their solid and liquid-like phases. Nevertheless, limited efforts have been made to coherently capture their gas-like behavior and the transitions between these three phases. These transitions, particularly during separation (solid–liquid–gas) and reconstitution (gas–liquid–solid), are critical for accurately modeling granular dispersal, reconsolidation, and soil–structure interactions in low-confinement regions.

Modeling cohesive grains is particularly challenging due to the hysteretic nature of interparticle attractive forces. In the current study, we propose a constitutive theory and rheology for cohesive–frictional granular materials that incorporate shear-induced dilation and hysteretic granular separation for assemblies composed of stiff grains. The proposed constitutive model is implemented in an open-source Material Point Method (MPM) code developed for multiphase simulations with a wide range of capabilities. This work presents the theoretical formulation, numerical implementation, and simulation results that demonstrate the model's capabilities.



Fecha: Viernes 24 de octubre de 2025 a las 11:00h.

**Lugar: ETSI Caminos, Canales y Puertos (Ciudad Universitaria). Sala
Torres Quevedo**