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Education

2005–2007 ..... University of California, Los Angeles. Department of Chemistry, **Doctorate in Chemistry** (Ph.D.)

2002–2005..... University of Massachusetts, Amherst. Graduate Department of Physics.

1998–2002..... University of Massachusetts, Amherst. **Bachelor of Science in Physics.**

Publication List

Articles in Preparation

1. Robert C. Brewster, Leonardo Silbert, Gary S. Grest, and Alex J. Levine *Two particle contact lifetimes and rheology in gravity driven granular flows*, Physical Review E.

2. Robert C. Brewster, Gary S. Grest, and Alex J. Levine *Velocity fields and rheology of cohesive granular flow in a rotating drum*, Physical Review E.

Submitted

3. Leonardo Silbert, Robert C. Brewster, Gary S. Grest, and Alex J. Levine *Contact lifetimes in dense granular flows* Submitted to Physical Review Letters (2006).

Published

4. Robert C. Brewster, James Landry, Gary S. Grest, and Alex J. Levine *Breakdown of Bagnold scaling in cohesive granular flows*, Physical Review E **72**, 061301 (2005).

Research Topics

- Cohesion in gravity-driven granular flow

Through large-scale granular dynamics simulations, we have studied the effects of interparticle cohesion on dense, gravity-driven granular flow. We find that the flow seperates into two regimes. Near the free surface there exists a solidlike region where the velocity has come to a plateau and the material flows together as a plug. The development of the plug is distinctly marked by a sharp jump in density and we find the thickness of the plug depends linearly on the cohesive energy. Below the plug region there exists a flowing region in which the standard Bagnold constitutive law that relates shear stress to the square of the strain rate ($\sigma_{xz} \propto \dot{\gamma}^2$) is no longer satisfactory for describing flow in the presence of cohesion. We have proposed a relation which is a combination of the standard shear term that is quadratic in strain rate (Bagnold rheology) and a linear term which allows for momentum transport through longer lasting (non-instantaneous) contacts within the flowing pile.

- Interparticle contact lifetimes of dense granular flow

Inspired by the premise of long-lived contacts allowing for linear momentum transport within a flowing pile, we have examined the relationship between the two particle contact-time distribution and the change in rheology as measured by the ratio of the linear stress to that of the standard Bagnold stress. In our simulations, we have found that both the rheology and the contact-time behavior depend heavily on the strength of the force law used to model the interparticle repulsive force. As such, we have defined the regime where one would expect to observe standard Bagnold flow properties both in simulation and in experiment and defined a scalar quantity measuring deviation from "pure" Bagnold rheology. We have also found

weaker dependence on particle parameters such as the coefficient of restitution and friction and studied the effects of altering angle of inclination.

- Granular flow in a rotating drum geometry

The dynamics of granular media in a rotating drum is of interest for any number of industrial purposes where mixing of granular materials is important. Much is known about the relation between angle of repose as a function of particle size, rotational speeds and drum thickness from experimental data. However, flow properties in the bulk are not easily accessible by experiment. Through granular dynamics simulations we have studied the flow behavior inside the bulk. Using our model for interparticle cohesion we examine how the velocity profiles, angle of repose and vortex position are effected by the presence of this force.

Teaching and Research Assistantships

- UCLA: Upper level Chemical Thermodynamics, Fall 2006 and Winter 2007.
  - Assisted with lectures and taunt a discussion section in an advanced physical chemistry course on thermodynamics.
- UCLA: General and Organic Chemistry Laboratory I, Spring 2006.
  - Taught two lab sections in an introductory chemistry laboratory.
- UCLA: Chemical Engergetics and Change, Winter 2006.
  - Taught two discussion sections in an introductory course covering phase behavior, chemical equalibrium and chemical kinetics.
- UCLA: Chemical Structure, Fall 2005.
  - Taught four discussion sections in an introductory course on the structure of molecules with an introduction to quantum mechanics.
- UMASS: Research Assistantship, Summer 2003 - Summer 2005.
  - Research on granular flow through large-scale granular dynamics simulations.
- UMASS: General Physics Laboratory I, Spring 2003.
  - Taught four general physics laboratory sections designed for Engineers and other science majors
- UMASS: Tutor for highschool physics and calculus, Fall 2001 - Spring 2002
  - Tutored two highschool students in honors physics and calculus
- UMASS: Society of Physics Students outreach program, Fall 1999 - Spring 2002
  - Visited local elementary schools to teach physics through heavy use of hands on demonstrations

Contributed Talks

Velocity Profiles in a Rotating Drum: The Effects of Cohesion, Meeting of the American Physical Society, Denver, CO. March 2007.

Two Particle Contact Lifetime Distribution in Gravity Driven Granular Flow, Meeting of the American Physical Society, Baltimore, MD. March 2006.

Breakdown of Bagnold Scaling in Cohesive Granular Flows, Meeting of the American Physical Society, Los Angeles, CA. March 2005.

Failure and Flow of Cohesive Granular Piles, Meeting of the American Physical Society, Montreal, QC. March 2004.

Rheology of Cohesive Granular Materials: Flow Down an Incline, 75^{th} Annual Meeting of the Society of Rheology, Pittsburg, PA. October 2003.

Professional Association Memberships

- American Physical Society
- Society of Rheology

References

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