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GRANULAR AND MULTIPHASE FLOWS

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Mechanics Research Communications and the Granular Science Laboratory

Prof. James T. Jenkins

Walter S. Carpenter, Jr. Professor of Engineering
Department of Theoretical and Applied Mechanics
Cornell University
Ithaca, NY 14853

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11:30 a.m. – 1:00 p.m.
Mechanical Engineering Center - Room 224

Dense Inclined Flows of Granular Materials

Hydrodynamic equations that result from classical kinetic theory, modified to incorporated energy lost in collisions, have been applied with success to dilute and moderately dense collisional granular flows. However, for inclined flows of identical sphere with concentrations above 49 per cent, its predictions do not agree with what is seen in numerical simulations and physical experiments. In this talk, we present a slightly modified hydrodynamic theory for inelastic spheres. The modification is the introduction of a length other than the diameter in the expression for the rate of collisional dissipation. This length is determined by a simple algebraic balance between the creation and destruction of particle chains. We apply the theory to dense collisional flows down rigid, bumpy inclines and determine profiles of particle concentration, mean velocity, and fluctuation energy for steady, fully-developed flows of identical spheres. The profiles exhibit the features seen in the numerical simulations, and the integration of the energy balance through the depth of the flow results in an improvement of a velocity scaling employed in the interpretation of the physical experiments.

Dr. Jenkins received a BS in Mechanical Engineering from Northwestern University and a PhD in Mechanics from the Johns Hopkins University. After post-doctoral years in France and Scotland, he joined the Department of Theoretical and Applied Mechanics at Cornell University, where he has occupied every academic rank, served as Chair, and is presently the Walter S. Carpenter, Jr. Professor of Engineering. In 2001, he was awarded an honorary doctorate from the University of Rennes 1, France. His interests in granular materials evolved from his dissertation research on liquid crystals and other anisotropic fluids; and, for the past thirty years, he has been engaged in developing models to describe their static and dynamic behavior.

For further information, please contact Dr. A. Rosato, ME Department (rosato@adm.njit.edu; 973-596-5829)