Special Guest Lecture by:

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Baton Rouge, LA

Thursday, April 13, 2006
Mason Building, Room 142
11:00 to 12:00 p.m.

TOPIC:

"Micro Characterization of Strain Localization in Granular Materials"

ABSTRACT:

The strength and deformation characteristics of most engineering materials such as metals, polymers, and cementitious composites (concrete, rocks, etc.) are mainly derived from strong internal chemical and physico-chemical forces of interaction that bonds the atoms, molecules, and particles together. On the other hand, strength properties and instability phenomena of uncemented granular materials are to a large extent derived from the fabric or geometry of the grain structure and inter-particle friction resulting from normal forces acting on particles or particle groups. Particle bonding by weak electrostatics and short or long-range Coulomb forces may also play a role to a certain extent; however, the main source of the constitutive and localization properties of granular materials is inter-particle friction, dilatancy effects, particle rearrangement, interlocking, and particle crushing if the material is tested at very high effective stresses.

A comprehensive experimental investigation was conducted to investigate the influence of particles micro properties, density, and confining pressure on strength properties and localization phenomena in sands tested under Plane Strain (PS) loading condition. Lade's constitutive model was modified to account for particles rotation within the framework of Cosserat or micro-polar theory. The modified model was implemented into ABAQUS finite element program. The presentation will discuss the influence of particles' micro-fabric properties (i.e., particles texture, shape and sphericity) on the failure mode and shear band properties of the PS specimens. In addition, the results of a series of axisymmetric triaxial compression experiments tested under very low confining pressures (0.05– 1.30 kPa) abroad the NASA Space Shuttle will be presented. Computed tomography was used to study the internal structure of the specimens. A comparison between the deformation modes of the triaxial and PS experiments will be presented and discussed.