School of Industrial Engineering

CENTER FOR MATERIALS PROCESSING AND TRIBOLOGY DISTINGUISHED SEMINAR

Mechanics of metallic glasses and granular materials: constitutive equations and strain localization

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Potter 234, The K.S. Fu Room

Abstract When a metallic glass is deformed at ambient temperatures its inelastic deformation is characterized by the formation of intense localized shear bands. The plastic deformation of amorphous metallic glasses is fundamentally different from that in crystalline solids because of the lack of long-range order in the atomic structure of these materials. Molecular-dynamic computer simulations in the literature show that at a micromechanical level, inelastic deformation in metallic glasses occurs by local shear transformations in clusters of atoms (~ 30 to 50 atoms); and topologically, such shear transformations require a local inelastic dilatation that produces an elastic strain field in the surrounding material that auto-catalytically then initiates similar shear transformations in neighboring volume elements, leading to the formation of shear bands.

From a continuum point of view, a metallic glass represents a highly cohesive granular material. In this talk I will present a continuum-level constitutive theory which may be specialized to describe not only the response of cohesive metallic glasses, but also the response of cohesionless granular materials such as sands.

Biosketch Lallit Anand is the Rohsenow Professor of Mechanical Engineering at MIT. He obtained his PhD from Brown University, and began his career in 1975 as a Research Scientist in the Mechanical Sciences Division of the Fundamental Research Laboratory of U.S. Steel Corporation. He joined the MIT faculty in 1982. His research concerns continuum mechanics of solids, with focus on inelastic deformation and failure of engineering materials. In 1992, Prof. Anand was awarded the Eric Reissner Medal for "Outstanding contributions to the field of mechanics of materials" from the International Society for Computational Engineering & Sciences. In 2007, he received the Khan International Medal for "Outstanding lifelong contributions to the field of plasticity" from the *International Journal of Plasticity*. He is a Fellow of the American Society of Mechanical Engineers (ASME). In 2010, he co-authored a book titled *The Mechanics and Thermodynamics of Continua* with Morton Gurtin and Eliot Fried.

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