

**SMU Department of Mechanical Engineering**  
**SEMINAR**

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**San Antonio, Texas**

**“NANOMECHANICS AND FRAGILITY FRACTURES OF  
BONE”**

**Friday, October 30, 2009**  
**3:00 – 4:00 p.m.**  
**Huitt Zollars**

**ABSTRACT:** Age-related and osteoporotic bone fractures are a major concern for the health care of elderly and postmenopausal women. One of the leading causes for such fractures is the reduced toughness of bone, which is mainly related to its post-yield behavior. Due to the highly hierarchical structure, elucidation of the post-yield behavior of bone has become challenging to biomechanists. Recent evidence has evinced that bone may experience two distinct stages in the post-yield deformation: it begins with acute increases in microdamage accumulation and viscous response, and then is dominated by the plastic deformation and saturated viscous response. Such a behavior appears to be very similar independent of loading modes. In addition, internal strains of the individual mineral and collagen phases have been found to decrease sharply as bones yield. Moreover, it has been shown that hydration plays a significant role in sustaining the toughness of bone. In general, elderly bones tend to fail prematurely with very limited permanent (or plastic) deformation. In this presentation, it is intended to explore the relationship between the bulk and ultrastructural behavior of bone based on the current understanding on this issue reported in the literature and from our studies. Several topics will be discussed: 1) Bulk post-yield behavior of bone and its relationship with the ultrastructural response using a novel progressive loading protocol; 2) A nanomechanics and probabilistic fracture mechanics based simulation of microdamage accumulation in bone; 3) Evaluation of in situ mechanical behavior of bone using synchrotron x-ray scattering techniques; and 4) hydration and interfacial behavior between the mineral and collagen phases and its contribution to the post-yield behavior of bone.

**BIO:** Dr. Xiaodu Wang acquired his B.S. and M.S. in Mechanical Engineering at Beijing Institute of Aeronautics and Astronautics, China in 1982 and 1985, and PhD in Mechanical Engineering and Materials Science at Yokohama National University, Japan in 1990. Currently, he is Professor of Mechanical and Biomedical Engineering at UTSA. Dr. Wang’s research interests are in the areas of biosolid mechanics, nano mechanics, bone remodeling, probabilistic fracture mechanics, and prediction/prevention of age related bone fractures.