

The Department of Mechanical Engineering/College of Engineering and Applied Sciences  
Stony Brook University

## Mechanical Engineering Seminar



**K.T. Ramesh**

Professor

Department of Mechanical Engineering  
The Johns Hopkins University

**Lecture Title: Soft, Squishy and Fibrous: a Cellular-Level Injury Criterion  
for Traumatic Brain Injury in Humans**

Friday, May 6, 2011, 2 PM, Room 173 Light Engineering

### Abstract

Computational models are often used as a tool to study traumatic brain injury (TBI). They are utilized to develop protective restraints in automobiles, to design protective helmets in sports and military applications, and to develop a better understanding of the mechanisms that lead to TBI. The fidelity of such models relies heavily on the accurate representation of the internal structure, an accurate description of the behavior of the materials involved, and the use of an appropriate measure of injury. Diffuse axonal injury (DAI) accounts for a large percentage of deaths due to brain trauma and is characterized by damage to neural axons. This talk develops a measure of diffuse axonal injury based on an axonal strain injury criterion. This neural damage occurs primarily in the deep white matter regions of the brain. We model the white matter as a nonlinear anisotropic material, and use diffusion tensor imaging to incorporate the structural orientation of the neural axons into the computational model. It is shown that the degree of injury that is predicted in a computational model of DAI is highly dependent on the incorporation of the axonal orientation information and the inclusion of anisotropy into the constitutive model for white matter.

### Biography

K.T. Ramesh is the Alonzo G. Decker Jr. Chair in Science & Engineering at Johns Hopkins University. His research interests are in nanostructured materials, high strain rate behavior and dynamic failure of materials, the dynamics of human tissues, and planetary scale impact problems. Prof. Ramesh received his doctorate from Brown University in 1987. After a short stint as a postdoctoral fellow at the University of California, San Diego, he joined the Department of Mechanical Engineering at Johns Hopkins in 1988, becoming Department Chair from 1999-2002 and Director of the Center for Advanced Metallic and Ceramic Systems in 2001. He has published one book, *Nanomaterials: Mechanics and Mechanisms* (Springer) and threatens to write another. Finally, he is an avid amateur astronomer.

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