You are cordially invited to attend the following seminar sponsored by the Department of Mechanical Engineering:

Friday, May 11, 2007
114 Spencer Lab, 12:15 P.M.

Dr. Anthony M. Waas
University of Michigan

"Microstructural Instabilities in Braided Textile Composites: Experiments and Analyses"

Abstract:

Textile composites are being considered as a viable alternative for structural applications in the aerospace and automotive industries. Consequently, the deformation response of these composites and their failure characteristics are of importance. In particular, there is a need to develop an appropriate mechanism based failure prediction capability. In this seminar, experimental and analytical results for the response of a 2D flat triaxial braided composite (2DTBC) under conditions that are similar to those encountered when a tubular structural member undergoes axial compressive crush will be presented.

Experiments on flat 2DTBCs were carried out under two types of load states: compression/tension (C/T) and bending/compression (B/C). C/T tests were carried out on a special planar biaxial load frame. Full field planar incremental strain fields were captured via digital speckle photography (DSP) throughout the loading history simultaneously with load and strain gage data. Failure mechanisms were investigated and supplemented by post experiment microscopy. Similar diagnostics were acquired from the B/C tests, which was based on a novel eccentric "Elastica" experimental configuration. The experimental results provided fundamental insight into the failure mechanisms of 2DTBCs and motivated the development of robust micromechanics based stiffness and strength models for the 2DTBCs. The experimental results showed that a microstructural instability was a strength limiting mechanism under a variety of stress states. A micromechanics based finite element (FE) model of the 2DTBC, that incorporates varying degrees of length scales, was developed to predict the compressive *strength* of 2DTBC under multiaxial stress states, based only on constituent properties and geometry as the input. The predictions of these models captured the details of the experimentally observed failure mechanisms and were found to be in good agreement with the experimental data.

Refreshments will be served