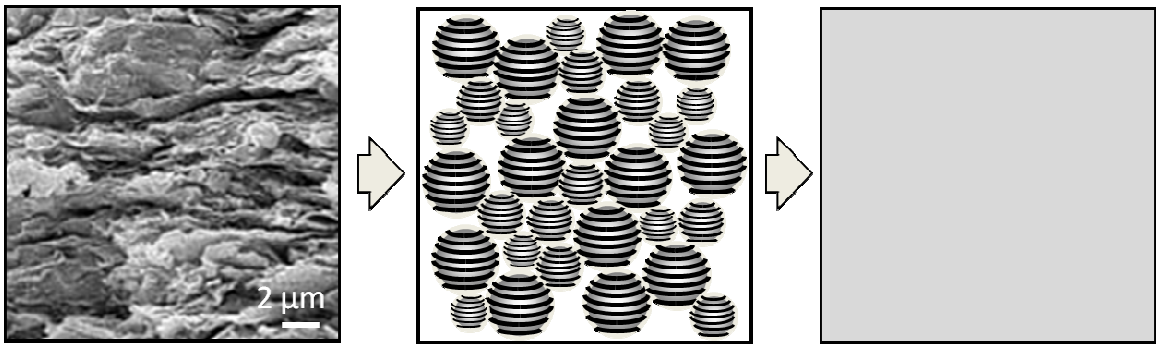
Fall 2009 Course Announcement

CE 794 – Micromechanics of Composite Materials



Most of the materials encountered in engineering applications are complex composite materials, composed of multiple individual material phases. Cement and concrete, rocks, composite metals, fiber-reinforced polymer composites, polymer-clay nanocomposites, and bones, shells, and bio-engineered composites may all be broadly understood as composite materials.

This course introduces the analytical tools of a field known as "micromechanics" to describe, quantify, and predict the mechanical behavior of these composite materials. A first part of the course is devoted to introducing continuum mechanics as a means of describing the stress and deformation within composite materials, and thermodynamics as a means of describing their physical behavior.

The course proceeds with development of elastic homogenization theories for solid composites, including the Eshelby inclusion problem, elasticity bounds, and other analytical homogenization schemes. Example applications are made to fiber-reinforced composites.

The course concludes with a discussion of poromechanics, as understood within the framework of micromechanics. Biot coefficients and Biot moduli are introduced, and may be predicted for the macroscopic composite with the help of additional analytical tools. Example applications for microporomechanics theories include cement, shale, and bone materials.

Students will be graded based on homework performance, a short project involving scientific literature relevant to each student's research interests, a mid-term exam, and a final exam.

Schedule: T/Th, 4:30 – 5:45
Instructor: Dr. Christopher P. Bobko
Credits/Grading: 3 credit hours, graded