

ME DEPARTMENTAL SEMINAR

Friday, September 23, 2005

1:00pm – 2:00pm

2233 GG BROWN

**Professor Michael Yu Wang
Department of Automation & Computer-Aided Engineering
The Chinese University of Hong Kong**

***“Physical Modeling and Optimization of Heterogeneous Solids:
Implicit Models and Level Set Methods”***

Abstract:

A heterogeneous object is referred to as a solid object made of different constituent materials. The object is of a finite collection of regions of a set of prescribed material classes of continuously varying material properties. These properties have a discontinuous change across the interface of the material regions. We present a variational framework for a well-posed formulation for the design of the heterogeneous solids. We discuss two approaches to the modeling and optimization problem of free-discontinuities: a multi-phase discrete level-set model and a partition-of-unity radial basis function model, both to represent the discontinuities implicitly. These models yield a computational system of coupled geometric evolution and/or partial differential equations. Promising features of the proposed method include strong regularity in problem formulation, topological flexibility, and inherent capabilities of geometric, physical and material modeling, incorporating dimension, shape, topology, material properties, and even micro-structures within a common framework for design and optimization of the heterogeneous solids. The proposed methods are illustrated with several examples of optimization of multi-material structures, materials design, and compliant mechanism synthesis. Further applications in tissue modeling, flexonic MEMS, and drug diffusion and delivery MEMS will be discussed.