Spring 2009
560.741 Theoretical and Computational Plasticity
Instructor: A. Anandarajah, Professor of Civil Engineering (*6-8682, Rajah@jhu.edu)

Recommended Texts
- Plasticity Theory by Jacob Lubliner, 1990, Publisher: Pearson (QA931 .L9391 1990)

Course Outline
1. Mathematical preliminaries
   - Basic tensor operations
   - Analysis of stresses and strains; Invariants of stresses and strains
   - Finite element analysis of solids
2. Elastic constitutive relations
   - General relations for isotropic materials
   - Two-dimensional relations (plane strain, plane stress and axi-symmetric)
3. Constitutive modeling
   - Introduction
   - Classes of behavior
   - Theory of rate-independent plasticity
   - Examples of yield surfaces
   - Examples of hardening rules
   - Solution uniqueness
4. Nonlinear finite element analysis
   - Newton’s method
   - Modified Newton’s method
   - Application of Newton-Raphson method to nonlinear finite element analysis
5. Integration of elasto-plastic constitutive models
   - Problem statement
   - Continuum versus consistent operators
   - Euler methods of integration
   - Mises constitutive model
   - Elastic predictor-plastic corrector methods
   - Methods of integration
     - Two-step Euler method
     - Cutting-plane method
     - Closest point projection method (CPPM)

Grading: Projects and presentations: 50%, Final Exam: 30%, Homework: 20%