53:243/58:251 Computational Inelasticity

College of Engineering
The University of Iowa
Fall Semester, 2005

Instructor:

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Text:

Computational Inelasticity
J.C. Simo and T.J.R. Hughes
Springer, 1998.
ISBN: 0387975209

Course Objective:

- To facilitate a detailed knowledge of implementing and testing sound inelastic material constitutive models.

Attendance policy:

- For those taking the course for credit, please check in with the instructor whenever a class period will be missed.

Grading policy:

- 70% of course grade will be determined based on work submitted in fulfillment of course assignments;
- 10% will be determined based on in-class participation in discussion and questions.
- 20% will be determined by an oral examination given during finals week.

Tentative Course Schedule:

Week of:	Topic	Reading Materials
08/22 – 08/26	Overview of computational inelasticity; preliminary concepts; notations of continuum mechanics.	Malvern, Ch. 2. or equivalent
08/29 – 09/02	Basic elements of continuum mechanics; stress and strain invariants and decompositions.	Malvern, Ch. 3,4 or equivalent
09/05 – 09/09	Thermodynamics of continuous media; first and second laws; thermodynamically admissible constitutive models.	Malvern, Ch. 5 or equivalent.
09/12 – 09/16	Classical elastoplasticity; incremental form of constitutive equations; Flow rules and hardening laws; Kuhn-Tucker conditions; Softening and Hardening material behaviors.	Text, Ch. 1 and 2.
09/19 – 09/23	Principle of Maximum Plastic Dissipation; relations between classical elastoplasticity and two forms of elasto-viscoplasticity.	Text, Ch. 2.

09/26 – 09/30	Integration algorithms for incremental constitutive equations; The generalized closest point projection return mapping algorithm.	Text, Ch. 3.
10/03 – 10/07	Cutting plane integration algorithm; consistent tangent operators based on linearization of the integration algorithm.	Text, Ch. 3.
10/10 – 10/14	Integration algorithms for classical forms of elasto-viscoplasticity.	Text, Ch. 3.
10/17 – 10/21	Issues related to solution of elliptic BVPs with inelastic material behaviors; implementation issues; Newton iterations; stress, strain, and internal variable updating.	Text, Ch. 4.
10/24 – 10/28 10/31 –11/04	Nonsmooth multisurface plasticity and viscoplasticity	Ch. 5.
11/07 – 11/11	Finite deformation continuum mechanics; objective increments; Lie derivatives; Hyperelasticity.	Ch. 7.
11/14 – 11/18	Objective integration algorithms for incremental elastoplasticity at finite deformations	Ch. 8.
11/21 – 11/25	Thanksgiving Holiday Break (no classes)	
11/28 – 12/02	Plasticity modeling at finite deformations based on multiplicative decomposition of **F.** Notion of intermediate stress-free configuration.	Ch. 9.
12/05 – 12/09	Issues in viscoelasticity.	Ch. 10.