COMPUTATIONAL MECHANICS OF SOLIDS AND STRUCTURES

CVEN 7511-001

Fall 2001

Instructor: Kaspar Willam
Office: ECOT 456, Hours TR 11:00 - 12:30 a.m.
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Prerequisites: Mechanics of Materials, Finite Element Analysis

Course Work:

- Lectures: TR 11:00-12:30 pm, ECCR 137
- Assignments (20 %): Homework Problems.
- Midterm Examination (20 %): Take-Home Exam.
- Computer Term Project (20 %), Presentation (10 %): .
- Final Examination (30 %): Saturday, Dec. 15, 7:30 - 10:00 pm

Reference Texts:

- Belytschko, Ted, Liu, Wing-Kam, Moran, Brian, "Non-Linear Finite Elements for Continua and Structures",
  John Wiley & Sons, Inc., New York, 2000.
- Doyle, James, "Non-Linear Analysis of Thin-Walled Structures",
  Springer-Verlag Berlin 2001.
- Crisfield, J., "Non-Linear Finite Element Analysis of Solids & Structures",
  John Wiley & Sons, Inc., New York, 1997.
- Simo, Juan C. and Hughes, Thomas J.R., "Computational Inelasticity",
  Springer Verlag New York, 1998.

Software Platforms:

- MATLAB, MATHEMATICA, Structures Programs
- ABAQUS (HKS), DYNA3D (LSTC)
- FEAP (R.L. Taylor UC-Berkeley)
- MFEM-FETI (CU-Boulder)

Course Outline

1. Preliminaries

- Notation
- Continuum Mechanics
- The Finite Element Displacement Method
- Linear vs. Nonlinear Finite Element Analysis

2. Total and Updated Lagrange Formulations in 1-D

- Strong Form of Momentum Balance
- Weak Form of Momentum Balance
- 1-D Finite Element Discretization of Motion: TLF and ULF
- Linearization of Internal Forces
- Tangential Stiffness: Material and Geometric Properties

2. Total and Updated Lagrange Formulations in 2-D

- Strong Form of Momentum Balance
- Weak Form of Momentum Balance
- 2-D Finite Element Discretization of Motion: TLF and ULF
- Linearization of Internal Forces
- Tangential Stiffness: Material and Geometric Properties

3. Nonlinear Material Formulations

- Nonlinear Elasticity and Damage
- Flow Theory of Plasticity
- Computational Plasticity