# Special Topics in MECHANICS OF MATERIALS

# CVEN 6831-002, Call No 23839 Spring 2001

Instructor: Kaspar Willam Office: ECOT 456, hrs: MWF 10:00 - 11:00 a.m., Tel.:(303) 492-7011, e-mail: willam@colorado.edu Prerequisites: Interest in Mechanics of Materials

## Course Work:

- Lectures: MWF 11:00-11:50 p.m., ECCR 108
- Assignments (20 %): Homework and Reading Assignments.
- Term-Project (30 %): One Term-Project.
- One Take-Home Midterm Examination (20 %)
- Final Examination (30 %): Tuesday, May 8, 2001, 7:30 10:00 p.m.

# Reference Texts:

- Jean Lemaitre and Jean-Louis Chaboche, "Mechanics of Solid Materials", Cambridge University Press, 1990.
- Irving H. Shames and Francis A. Cozzarelli, "Elastic and Inelastic Stress Analysis", Taylor & Francis Ltd, London, revised printing, 1997.
- W.-F. Chen and D.J. Han, "Plasticity for Structural Engineers", Springer-Verlag, New York, 1988.
- Kaspar J. Willam, "Constitutive Models for Materials", Encyclopedia of Physical Science & Technology, 3rd Edition, Academic Press, 2002. http://civil.colorado.edu/ willam/matl01.pdf

#### Software:

- Constitutive Driver for Plasticity and Elastic Degradation, by E. Hansen, PhD 2000 Visual  $C^{++}$ , Digital Fortran
- MATLAB, MATHEMATICA, Indigenous FE-Software

# Course Outline

# 1. Preliminaries

- Principles of Mechanics and Materials
- Physical Mechanisms at Different Levels of Observation
- Elements of Continuum Mechanics

# 2. Classification of Material Behavior

- Experimental Techniques
- Schematic Representation of Input-Output
- Rheological Elements of Elastic and Inelastic Material Behavior

## 3. Linear Elasticity

- Phenomenological Aspects of Stiffness
- Isotropic and Anisotropic Elasticity
- Thermoelasticity, Poroelasticity
- Computational Elements of Coupled Elasticity

## 4. Plasticity

- Phenomenological Aspects of Strength
- Elastoplastic Material Models
- Limit Load Theorems and Shake-Down Analysis
- Computational Elements of Plasticity
- 5. Damage Mechanics
  - Phenomenological Aspects of Stiffness Degradation
  - Elastic Scalar Damage Models
  - Thermodynamic Background
  - Computational Elements of Elastic Degradation

## 6. Fracture Mechanics

- Phenomenological Aspects of Fracture
- Crack Initiation and Crack Propagation
- Fatigue and Fracture
- Computational Elements of Fracture Mechanics