

ADVANCED MECHANICS OF MATERIALS II

FAILURE MECHANICS

CVEN 6161-001, Call No 12993

Spring 2006

Instructor: Kaspar Willam

Office: ECOT 456, hrs: TR 10:00 - 12:00 am

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Prerequisites: Interest in Mechanics and Materials

Course Work:

- Lectures: MW 3:00-4:15 pm, ECCR 118
- Assignments (20 %): Homework and Reading Assignments.
- Term-Project (30 %): One Term-Project.
- One Take-Home Midterm Examination (30 %)
- Final Examination (20 %): Wed., May 10, 2006, 7:30-10:00 am

Reference Texts:

- Marc André Meyers and Krishan Kumar Chawla, "Mechanical Behavior of Materials", Prentice-Hall, Inc. 1999.
- 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/mat101.pdf>

Software:

- MATLAB, MATHEMATICA, ABAQUS FE-Software

Course Outline

1. Preliminaries

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

2. Materials

- Classification
- Structure of Materials
- Schematic Representation of Input-Output
- Theoretical Strength of a Crystal

3. Elasticity and Viscoelasticity

- Invariant Aspects of Stress and Strain
- Isotropic and Anisotropic Elasticity
- Elastic Properties
- Viscoelasticity

4. Plasticity

- Phenomenological Aspects of Strength
- Plastic Flow and Failure Criteria
- Indentation and Hardness
- Elastoplastic Models for Solids and Interfaces
- Limit Load and Localization Analysis

5. Damage Mechanics

- Phenomenological Aspects of Defects
- Interfacial and Volumetric Defects
- Elastic Scalar Damage Models
- Damage Models for Solids and Interfaces
- Limit Load and Localization Analysis

6. Fracture Mechanics

- Phenomenological Aspects of Griffith Criterion
- LEFM of Fracture and Toughness
- Microscopic Aspects of Fracture
- Fracture Testing
- Fatigue

7. Composite Materials

- Fundamental Aspects of Composites
- Reinforcements and Matrix Materials
- Homogenization and Effective Material Properties
- Interfaces in Composites