

# ADVANCED MECHANICS OF MATERIALS I

CVEN 5161-001

Fall 2003

Instructor: Kaspar Willam

Office: ECOT 456, hrs: MWF 10:00 - 11:00 a.m.

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Prerequisites: Interest in Mechanics and Materials

## Course Organization:

- Lectures : TR 11:00-12:15 p.m., ECCR 137
- Assignments : Reading and Homework (20 %).
- Midterm # 1 : In-Class Examination (20 %).
- Midterm # 2 : Take-Home Examination (30 %).
- Project Report : Term-Project (20 %).
- Final Presentation : Tuesday, December 16, 2002, 7:30 - 10:00 am (10 %)
- Homepage: <http://bechtel.colorado.edu/~willam/CVEN5161.html>

## References:

- Arthur P. Boresi and Richard J. Schmidt, "Advanced Mechanics of Materials" Sixth Edition, John Wiley & Sons, Inc., New York, 2003.
- Irving H. Shames and Francis A. Cozzarelli, "Elastic and Inelastic Stress Analysis" Taylor & Francis Ltd, London, revised printing, 1997.
- Ansel C. Ugural and Saul K. Fenster, "Advanced Strength and Applied Elasticity", Prentice Hall, Fourth Edition, Upper Saddle River, New Jersey, 2003.
- Kaspar J. Willam, "Constitutive Models for Materials", Encyclopedia of Physical Science & Technology, 3rd Edition, Volume 3, Academic Press, pp. 603-633, 2002.  
<http://bechtel.colorado.edu/~willam/mat101.pdf>

## Software:

- MATLAB, MATHEMATICA, ABAQUS, FEAP

# Course Outline

## 1. Preliminaries

- Principles of Mechanics of Materials
- Elements of Stress and Strain
- Linear Elastic Materials
- Failure Criteria of Materials

## 2. Linear Elasticity

- Equilibrium of Elastic Bodies
- Kinematics of Deformable Bodies
- Boundary Value Problem of Linear Elasticity
- Exact and Approximate Solution Methods
- Airy Stress Functions in 2-dim Elasticity

## 3. Torsion of Elastic Bars

- Torsion of Cylindrical Bars
- St Venant Theory of Elastic Torsion
- Prandtl Soap Film Analogy
- Torsion of Thin-Walled Sections

## 4. Bending of Elastic Beams

- Euler-Bernoulli Beam Theory
- Timoshenko Beam Theory
- Linear Elasticity Solution of Bending
- Bending of Symmetric Sections
- Bending of Nonsymmetric Sections

## 5. Stability of Columns

- Concepts of Stability
- Elastic Buckling: Euler Formula
- Column under Eccentric Loading
- Beam-Column Analysis
- Inelastic Buckling: Engesser vs Shanley

## 6. Thermal Stress Analysis

- Thermoelasticity
- Eigenstrains
- Heat Transfer
- Kelvin Effect