MAE 258: Mechanical Behavior of Solids: Continuum Theories
Winter Quarter 2016

Syllabus

Instructor: *Lorenzo Valdevit*
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Office hours: By appointment.

Class schedule: T Th 8.00 – 9.20pm, DBH 1427

Textbook: Allan F. Bower, "Applied Mechanics of Solids", CRC Press, 2009 (also available online free of charge at http://solidmechanics.org)

James R. Rice, "Solid Mechanics", downloadable at: http://esag.harvard.edu/rice/e0_Solid_Mechanics_94_10.pdf

References: Most of the following references will be available at the Science Library Reserve Desk).

Fung and Tong, *Classical and Computational Solid Mechanics,* World Scientific Publishing, 2001.
Mase and Mase, *Continuum Mechanics for Engineers*, CRC.
W. Slaughter, *The Linearized Theory of Elasticity*, Birkhauser, 2001.
J. Lubliner, *Plasticity Theory*, Dover Publications.
R. Hill, *The Mathematical Theory of Plasticity*, Oxford Univ. Press, 1998.
R. Lakes, *Viscoelastic Materials*, Cambridge University Press, 2009.
R.M. Christensen, *Theory of Viscoelasticity*, Dover Publications, 2010.
T.L. Anderson, *Fracture Mechanics*, 2nd Ed., CRC.
S. Suresh, *Fatigue of Materials*, 2nd Ed., Cambridge University Press.

Course website: https://eee.uci.edu/16w/19580

Course description: This course presents a continuum, macroscopic view of deformation and failure of solids. Elasticity, plasticity, visco-elasticity, visco-plasticity, fracture and fatigue will be covered. Each topic includes a discussion of physical behavior, mathematical formalism and measurement techniques.

Course Learning Outcomes. Students will: (1) appreciate the fundamental physical features of time-independent and time-dependent elastic and plastic behavior of materials; (2) understand the mathematical formulation of these constitutive behaviors using the language of tensor analysis; (3) learn the fundamental aspects of failure of engineering materials by fracture and fatigue; (4) develop an appreciation for the

theoretical and practical challenges underlying the experimental measurement of mechanical properties of materials.

Prerequisites: MAE254 – Mechanics of Solids, or an equivalent graduate-level course in Continuum Mechanics.

Lecture topics: See attached document

Grading Criteria:
Homework: 30%
Final paper/presentation: 30%
Final oral exam: 40%

Homework Policy:
There will be a number of homework assignments (~4) throughout the course, covering analytical derivations, problem solving and synthesis of reading assignments. Assignments will be posted on the website, and are typically due 1-2 weeks after posting.

Working together is strongly encouraged (but NOT copying each other). Identical homework assignments from two students will be considered cheating and not tolerated.

Some homework assignments might require the use of computational resources (e.g., ABAQUS and/or MATLAB), available in the computer labs.

These factors ALL contribute to the grade:
- Conceptually sound problem-solving approach.
- Numerical accuracy of results.
- Neatness of the presentation and description of the procedure.

Please, format your homework in a clear way. All the fundamental steps of your derivations need to be clearly stated.
A correct solution obtained with a wrong or unclear methodology will be given no credit. Conversely, numerical mistakes associated with sound and reasonable approaches will result in partial credit.

Final examination
There will be one final oral examination, approximately 30-45 minutes in length. Each student should contact the instructor to schedule her/his oral exam at a mutually convenient time (ideally during finals week, Mar 12-18, 2016).