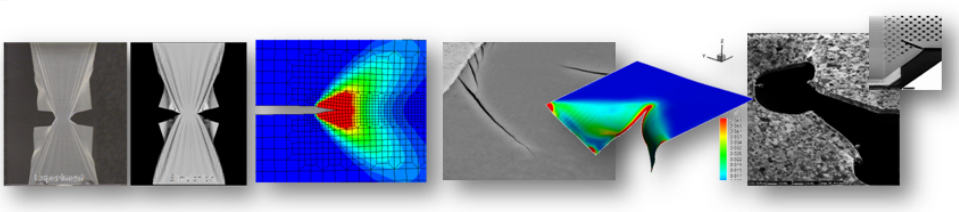
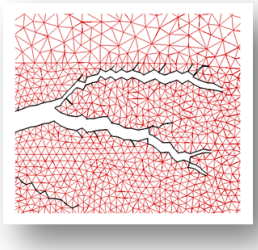
Nonlinear Fracture Mechanics

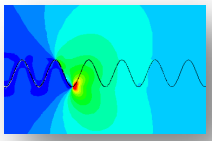
Fall 2021

CE 597-176: Nonlinear Fracture Mechanics, http://engineering.purdue.edu/~zavattie/Fracture

When: Tuesdays and Thursdays 9:00am-10:15am

Where: **HAMP 2113**

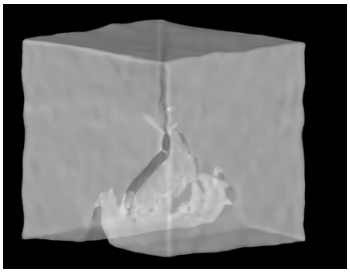


Instructor:

Prof. Pablo Zavattieri, Office: HAMP G217, 496-9644, E-mail: zavattie@purdue.edu

Office hours: TBD (in person and/or zoom)

Description: This is a graduate course in Fracture Mechanics for those students who are interested in learning more about the concepts of material inelastic deformation and failure in the context of solid mechanics when cracks are present. The class will be introductory in nature as we will start with the fundamental concepts of elastic fracture mechanics before we look at nonlinear and complex behavior. The final part of the course will be based on projects where the student will be able to solve some open-ended problems using computational, analytical or experimental tools.



Course Main Topics:

- Overview: Elasticity, Atomic scale concepts
- Linear elastic fracture mechanics, stress intensity factor, fracture toughness, energy release rate, work of fracture, J-integral
- Small-scale yielding/plastic fracture mechanics, resistance curves
- Fracture in engineering materials (e.g., ceramics, polymers, metals, composites, 3D printed, biological materials)
- Cohesive zone models
- Size effects, Multiscale fracture
- Strain rate and instabilities
- Testing methods, Numerical methods. Combined experimental/computational approaches

Homework: Every few lectures

Projects: Depending on number of students and interest, there will be theoretical, computational and (if available) experimental projects.

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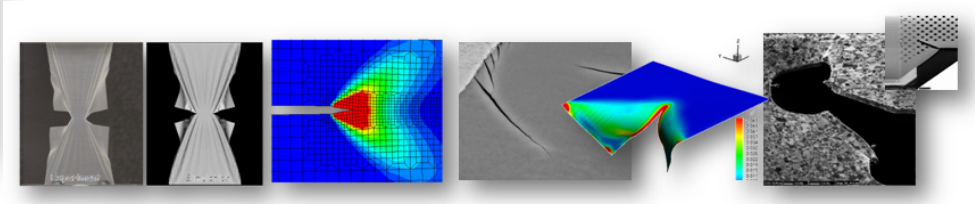
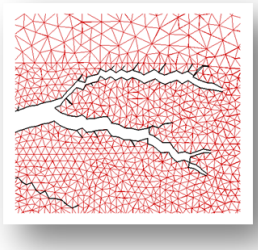

Web site: Homework, projects, exams, handouts, and grades, will be posted in the course web page: http://engineering.purdue.edu/~zavattie/Fracture

Lectures: You are responsible for taking notes during class. I will occasionally post some notes and handouts on the course web.

Books: No book is required. I will personally follow ideas from the following books and resources:

- T.L. Anderson, "Fracture Mechanics: Fundamental and Applications", 3rd Edition, 2005.
- Z.P. Bazant, J. Planas, "Fracture and size effect in concrete and other quasibrittle materials", 1998.
- A. F. Bower, Applied Mechanics of Solids, CRC Press, 2009.
- Mechanical Behavior of Materials, M. Meyers, K. Chawla, Cambridge, 2009.
- J.W. Hutchinson, Notes on Nonlinear Fracture Mechanics http://imechanica.org/files/NonlinearFractureNotes.PDF

Emergency Procedures:

In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances. Information will be provided via email and/or Blackboard. If a student suspects he or she may have symptoms associated with the swine flu, you are encouraged to seek medical help and not come to class. Please see Purdue's Emergency Preparedness website at
http://www.purdue.edu/emergency_preparedness/index.html

Here are ways to get information about changes in this course.

- Instructor's contact information: Prof. Pablo Zavattieri, (765) 496-9644, zavattie@purdue.edu
- Course web page: http://engineering.purdue.edu/~zavattie/Fracture

Academic Integrity:

Academic integrity is expected of all students at all times. Information on what constitutes academic integrity may be found in the handbook University Regulations.

Note: Check any update of this syllabus on the course web page.