

THE UNIVERSITY OF TEXAS AT AUSTIN

EM 388F: Fracture Mechanics

Spring 2008

SYLLABUS

UNIQUE NUMBERS: 13550

TIME: MW 3:00 - 4:30 pm

ROOM: WRW 312

INSTRUCTOR: Rui Huang, WRW 117D, 471-7558, ruihuang@mail.utexas.edu

OFFICE HOURS: Open

SYNOPSIS:

Fracture involves processes at multiple time and length scales. Fracture Mechanics is an interdisciplinary field of engineering and science requiring understanding from the viewpoints of solid mechanics, material science, physics, and chemistry. This course covers the basic topics including linear and nonlinear fracture mechanics, energy method, fatigue and environmentally assisted cracking. Applications of fracture mechanics in thin films and layered materials and composites are discussed.

PREREQUISITES: a graduate course in Solid Mechanics (Elasticity) is recommended

TEXTBOOKS: Not required. Lecture notes provided.

Auxiliary notes

- J. W. Hutchinson, [Notes on Nonlinear Fracture Mechanics](#)
- J. W. Hutchinson and Z. Suo, [ES 242r Fracture Mechanics of Thin Films and Composite Materials](#)
- J. W. Hutchinson and Z. Suo, [Mixed-Mode Cracking in Layered Materials](#)
- J. W. Hutchinson, [Fracture Mechanics of Thin Films and Multilayers](#)
- Z. Suo, [Reliability of interconnect structures](#)

Online resources

- Alan Zehnder, [Fracture Mechanics Book](#).
- Piet Schreurs, [Fracture Mechanics](#).
- C.H. Wang, [Introduction to Fracture Mechanics](#)

Offline resources

- B. Lawn, [Fracture of Brittle Solids](#), Cambridge University Press, 2004.
- H. Tada, P.C. Paris and G.R. Irwin, [The Stress Analysis of Cracks Handbook](#), Del Research, St. Louis, MO., 1985.
- J.M. Barsom and S.T. Rolfe, [Fracture & Fatigue Control in Structures](#), 2nd ed. Prentice-Hall, 1987.
- L.B. Freund and S. Suresh, [Thin Film Materials](#), Cambridge University Press, 2003.
- S. Suresh, [Fatigue of Materials](#), Cambridge University Press, 2006
- L.B. Freund, [Dynamic Fracture Mechanics](#), Cambridge University Press, 1990.
- S.P. Timoshenko and J.N. Goodier, [Theory of Elasticity](#), McGraw-Hill, New York.

Brief Outline of Topics

- **Linear Elastic Fracture Mechanics (LEFM).** Energy release rate. Stress intensity factor. Mixed mode fracture. Interface fracture. Small scale yielding.
- **Application I: fracture in thin films and layered materials.** Channel cracks. Interfacial delamination. Buckle-delamination.
- **Fatigue and environmentally assisted cracking**
- **Nonlinear fracture mechanics.** J integrals. Cohesive zone modeling. Large scale yielding
- **Application II: fracture of Composite materials.** Toughening. Matrix cracking. Crack bridging.
- **Introduction to computational fracture mechanics**
- **Introduction to dynamic fracture**

GRADING POLICY: Homework (80%) and a term paper (20%)

EVALUATION:

The Measurement and Evaluation Center forms for the College of Engineering will be used during the last week of class to evaluate the course and the instructor.

SPECIAL NOTES:

The University of Texas at Austin provides upon request appropriate academic adjustments for qualified students with disabilities. For more information, contact the Office of the Dean of Students at 471-6259, 471-4641 TDD or the College of Engineering Director of Students with Disabilities at 471-4321.