AE 521/CEE575 – Fracture Mechanics (and Fatigue)

Fall semester 2013

Instructor:

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Time and location: Tuesdays and Thursdays 2:00pm-3:20pm in 403B2 ENGH

Course web site: https://compass2g.illinois.edu/

Textbook: There is no required textbook for this course. The recommended textbook is "Fracture Mechanics: Fundamentals and Applications" by T. L. Anderson, 3rd edition, CRC Press. Copies of the slides presented during the lectures can be found on the course web site. You are encouraged to download and print them prior to the lectures. The slides contain primarily the theoretical part of the course. Many of the illustrative examples will be solved in class.

Course outline:

1) Introduction – Historical perspective

2) Linear elastic fracture mechanics

- Stress concentration and stress singularity
- Asymptotic K fields
- Computation of stress intensity factors
- Energy approach
- Conservation integrals
- Stability of crack propagation
- Cohesive fracture
- Numerical aspects

3) Elasto-plastic fracture mechanics

- Review of plasticity theory
- Estimation of plastic zone, Small-Scale Yielding (SSY), shape of plastic zone
- HRR asymptotic fields, *J*-*Q* theory, mixed mode
- Experimental determination of *J*
- Elastic-plastic crack growth

4) Fatigue failure

5) Interfacial fracture mechanics

- Oscillatory index
- Small scale contact
- Interfacial fracture toughness

6) Dynamic fracture mechanics

- Review of elastodynamics
- Steadily moving dynamic crack
- Dynamic loading of a stationary crack
- Energetics of a dynamically propagating crack

Homework assignments, exam and project:

A series of homework problems will be handed out approximately every second or third week. These will consist of direct applications of topics covered in class. The homework **will not be graded** and is meant as a learning tool to be used throughout the semester. However you are expected to do the homework and hand it in in a timely fashion, and for this reason it will be assigned a small portion of th efinal grade.

A 80-minute (midterm) exam will be handed out sometime between the midpoint and end of the semester, after the completion of topic #3. There is no final exam for this course. Instead there will be a final project which will consist of a programing assignment related to numerical fracture mechanics. More details on the project will be provided in class a few weeks into the semester.

Grading:		
	Homework	10%
	(Midterm) Exam:	50%
	Final project:	40%