



Aalto University

MEC-E8007

Fracture Mechanics

Luc St-Pierre

Contact persons

Teacher in charge:

Luc St-Pierre

luc.st-pierre@aalto.fi

050 4344 162

Teaching assistant:

Iman Elgharamti

iman.elgharamti@aalto.fi


Schedule

Lectures:

- Mondays 10-12
- Wednesdays 10-12

Calculation hours:

- Thursdays 14-16



All in room 216, Otakaari 4

Registration

- Register via **WebOodi**.
- All lecture notes, assignments, solutions and relevant information will be communicated via **MyCourses**.

Evaluation

- **Assignments (40%)**
 - 3 assignments (problems).
 - *Upload your assignment via MyCourses.*
 - *Assignments submitted late will have a penalty (-10% for every 30 mins).*
 - Presentation/teamwork (more details on the next slide).
- **Exam (60%)**
 - Thursday May 24, 9-12.
 - There will be a 2nd exam, but not 3!

Presentation

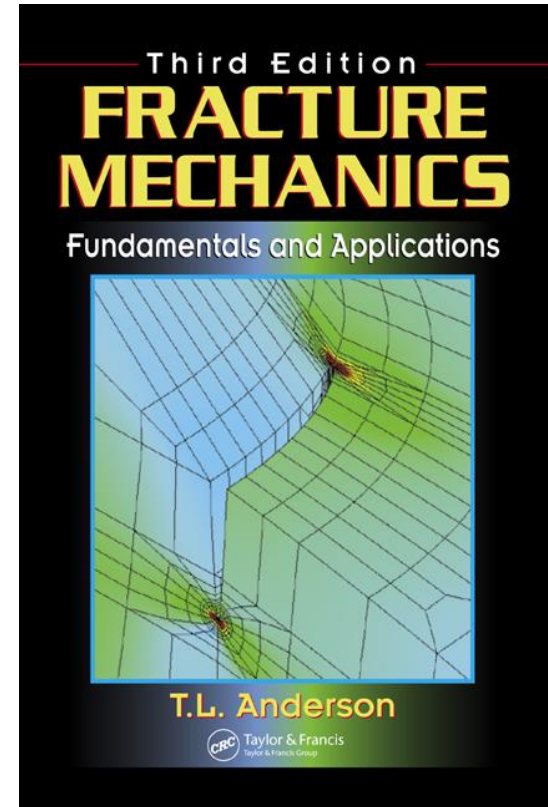
- In teams of 2-3 persons.
- Your team will choose a topic related to Fracture Mechanics and prepare a 10-15 mins presentation about it (a sort of mini-lecture).
- Why?
 - Develop teamwork: all jobs now involve working in a team.
 - Sharpen your presentation skills: you might not become a teacher but you will have to give explanations to others in your career.

Material

Lecture notes will be available on MyCourses. They should be sufficient to pass the course.

Use the textbook if you need additional information:

- T.L. Anderson, Fracture Mechanics: fundamentals and applications, 3rd edition, 2005.



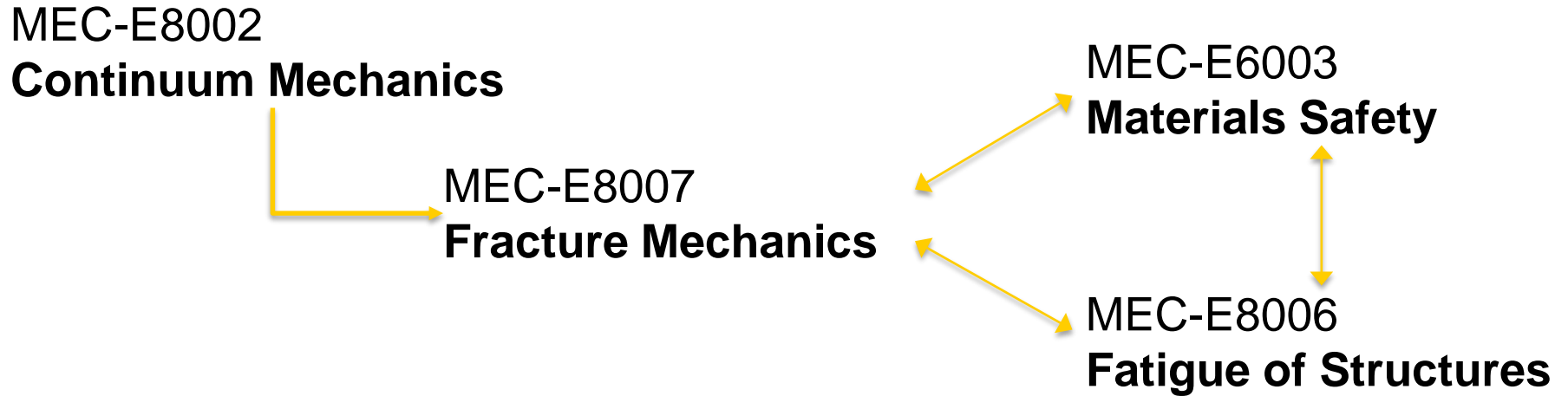
Why study fracture mechanics?

- **To understand how materials break and prevent structures from failing.**
- **Most structures fail because of:**
 1. Negligence during design, fabrication or operation.
 2. The use of new materials or processes leads to unexpected outcomes.
- **Several type-2 failures have lead to the birth of fracture mechanics, which is a relatively new field (1900-).**

Historical perspective

- Old structures (castles, cathedrals & bridges) were made of bricks and mortar, and designed to be loaded in **compression**.
- The industrial revolution brought the mass production of iron and steel.
- This changed the design approach: now structures were able to carry **tensile** stresses.
- This change in design lead to problems. Occasionally, a steel structure would fail at stresses well below the tensile strength.
- Why? That is what we will learn in Fracture Mechanics.

Where does this course fits?



Content

- **Linear Elastic Fracture Mechanics (LEFM)**
 - Week 1: Stress intensity factor.
 - Week 2: Energy release rate.
- **Elastic Plastic Fracture Mechanics**
 - Week 3: Plastic zone size and J-integral.
 - Week 4: Fracture mechanisms and testing methods.
- **Week 5: to be decided.**
- **Week 6: your presentations on different topics**