

MEC-E8007

Fracture Mechanics

Luc St-Pierre

Schedule

Flipped learning approach:

- First, go through the material on your own. Recordings are available via MyCourses.

Seminar: Tue/Wed, 14.15-16.00, Otakaari 4, room 216.

- I will summarise the theory and introduce a few examples.

Calculation hours: Thurs/Fri, 14.15-16.00, Otakaari 4, room 216.

- I will be available to help you with the weekly assignment.

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Evaluation

- **5 Assignments (40%)**
 - Your mark will be based on your 4 best assignments.
 - 4 sets of problems and 1 computer exercise.
 - *Upload your assignment via MyCourses.*
- **Exam (60%)**
 - Friday June 7, 9.00-12.00.
 - Online, open book.
 - You need to pass the exam to pass the course.

Grade	Final mark %
5	≥90
4	80-89
3	70-79
2	60-69
1	50-59
0 – Fail	≤49

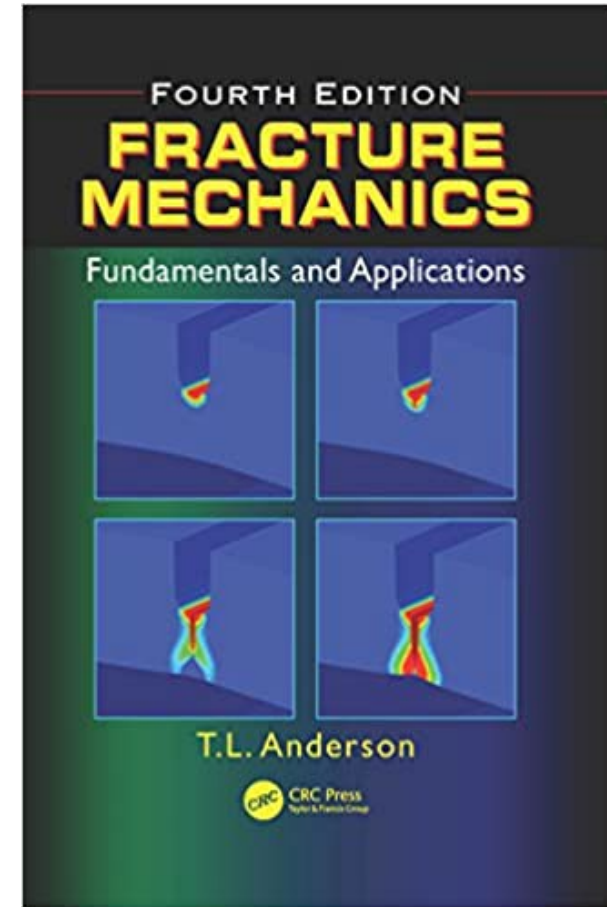
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Material

Lecture notes will be available on MyCourses.

Consult the textbook if you need additional information:

- T.L. Anderson, Fracture Mechanics: fundamentals and applications, 4th edition, 2017.



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E-books available

- M. Janssen; J. Zuidema; R.J.H. Wanhill; *Fracture mechanics*, Spon press, 2004.
- A.T. Zehnder; *Fracture mechanics*, Springer, 2012.
- N. Perez; *Fracture mechanics*, Springer, 2017.
- E.E. Gdoutos; *Fracture mechanics: an introduction*, Springer, 2020.

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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 led to the development of fracture mechanics, which is a relatively new field (1900-).**

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Historical perspective

Old bricks and mortar structures carry **compressive** stresses.



New steel 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.

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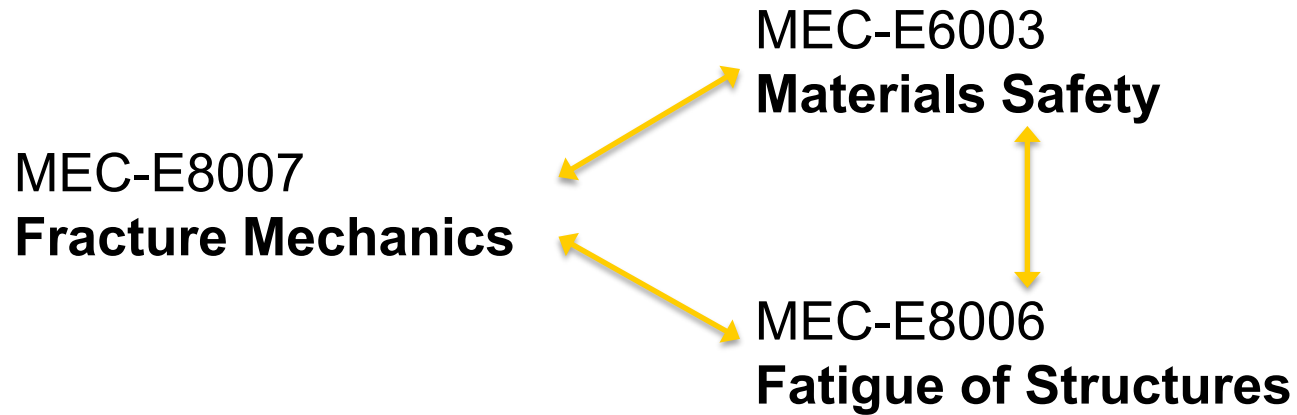
Content

- **Linear Elastic Fracture Mechanics (LEFM)**
 - Week 1: Stress intensity factor.
 - Week 2: Energy release rate.
 - Week 3: Mixed-mode fracture.
- **Elastic Plastic Fracture Mechanics**
 - Week 4: Plastic zone size and J-integral.
 - Week 5: Numerical approaches, Fracture tests and mechanisms.
 - Week 6: Review.

Workload is a bit lower in weeks 5-6 to help you review for the exam.

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Connections with other courses



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