Course information
TMHL 61, Damage mechanics and life analysis, autumn 2012
(modified 2012-10-25)

Examiner
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Aim
The aim of the course is to give the student

- a basic understanding of the effect cracks and cyclic loading may have on the life of a design
- a basic theoretical knowledge in fracture mechanics
- a basic theoretical knowledge in classic fatigue theory (HCF och LCF)
- an insight in Finite Element-based life analysis and its industrial use
- the ability to independently solve not too advanced problems of the above type analytically and by using an FE-program.

At the end of the course, the student shall be able to

- account for the theoretical basis of Fracture Mechanics and basic classic fatigue theory (HCF och LCF)
- solve not too advanced problems of the above type analytically and by using an FE-program
- give an account of how life analysis is used in the modern design process

Lectures
Kjell Simonsson

Teaching classes
Kjell Simonsson

Laboratory work
Kjell Simonsson

Course language
English

Further inform.
Further information can be found from the course home page http://www.solid.iei.liu.se/Education/TMHL61/tmhl61.html
When needed, information will be sent out by the e-mail list tmhl61-ht2012@student.liu.se
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Literature
Dahlberg T. and Ekberg A. (2009), *Failure, fracture and fatigue, an introduction*, Studentlitteratur; can be purchased at Bokakademin, Kårallen.

Additional material will be handed out during the course.

Examination
Written exam. and mandatory laboratory problems.

The written exam consists of two parts. For the first part, focusing on facts and theoretical aspects, no helping facilities are allowed. For the second part, focusing on problem solution, the book, certain handbooks and mathematical tables, dictionaries and pocket calculator are allowed. The grading of the exam will be done according to the following table

<table>
<thead>
<tr>
<th>points</th>
<th>0 to 5</th>
<th>6 to 8</th>
<th>9 to 11</th>
<th>12 to 16</th>
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<tr>
<td>grade (Sw/ECTS)</td>
<td>uk/Fx</td>
<td>3/C</td>
<td>4/B</td>
<td>5/A</td>
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</tbody>
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There are two mandatory lab problems in the course; one that focuses on Linear Elastic Fracture Mechanics (LEFM) and one that focuses on classical total-life approaches in fatigue design. The work is to be done in groups of two persons, and is to be reported in the form of short reports. Further information concerning content and deadlines will be given in the laboratory work descriptions, which will be found on the course home page. Note also that it is not allowed to use material from other groups in your own laboratory work reports. If such behavior is seen, it will be reported as an attempt to cheat.
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Planning

Below you find a preliminary planning for the course. For further details, please see the course home page http://www.solid.iei.liu.se/Education/TMHL61/tmhl61.html. The chapters refer to the course book.

Lectures 1-3 & Teaching Classes 1-2 (Chapters 2 and 7):
Course introduction, The stress based approach of Linear Elastic Fracture Mechanics (LEFM), applicability of LEFM

Lec 4-6 & TC 3-4 (Ch 4):
Thermodynamics

Lec 7-8 & TC 5 (Ch 3):
Other issues; orientation about EPFM, testing, computational procedures etc

Laboratory Classes 1-5:
LEFM

Lec 9-10 and TC 6-7 (Ch 6)
Fatigue crack propagation and cycle counting

Lec 11
Visit to the material testing lab

Lec 12-13 and TC 8-9 (Ch 8)
High Cycle Fatigue (HCF)

Lec 14-15 and TC 10-11 (Ch 9)
Low Cycle Fatigue (LCF) guest lecture

Lec 16
Guest lecture

Laboratory Classes 6-8:
HCF and LCF

Note that the planning is preliminary, and may be changed