SE2129 Fracture Mechanics and Fatigue 9.0 credits

Brottmekanik och utmattning

This is a translation of the Swedish, legally binding, course syllabus.

Establishment

Course syllabus for SE2129 valid from Spring 2018

Grading scale

A, B, C, D, E, FX, F

Education cycle

Second cycle

Main field of study

Mechanical Engineering

Specific prerequisites

The course requires the knowedge from a basic course such as SE1010, SE1020 or SE1055. The content corresponding to the course SE1025 FEM for engineering aplications is expected as known.

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

The loss of functionality of engineering structures typically occurs by failure due to instabilities or to cracking. The latter case is controlled by growth of cracks that nucleate or by growth of existing cracks to a critical size. The critical size is governed by the toughness of the material and the type of loading, which may vary or just increase in time. The strong development of both analytical and numerical methods now makes it possible for engineers to analyse structures with defects such as cracks and to predict critical loads or life span. The course aims at giving a fundamental understanding of material failure by cracking and operational skills in to assess defect structures.

After the course, the participants should be able to

- Identify and describe different failure mechanisms in materials and engineering structures.
- Explain how a crack affects an engineering structure and describe the state of stress and strain that may arise in the vicinity of a crack front in different materials.
- Apply different methods to calculate the crack driving force in linear and nonlinear materials and formulate appropriate fracture criteria for stationary and growing cracks in such materials.
- Evaluate fracture toughness data for stationary and growing cracks from linear and nonlinear fracture tests.
- Evaluate crack growth data for materials subjected to cyclic loading in a fatigue test.
- Examine whether a crack will grow in a stable or unstable manner.
- Describe and explain the theoretical background of linear and nonlinear fracture mechanics.
- Analyse well defined fracture mechanics problems for both linear and nonlinear materials subjected to both monotonic and cyclic loading.

Course contents

The course covers phenomenological theories for fracture in solids containing sharp cracks and conventional fatigue theory for life span predictions, and how to apply this knowledge in the design of engineering structures.

Course literature

Nilsson, F. Fracture Mechanics from theory to applications, Hållfasthetslära, KTH, 1999.

Faleskog, J. and Nilsson, F., Examples in fracture mechanics, Hållfasthetslära, KTH, 2014.

Formelsamling i Hållfasthetslära, 11:e upplagan, Hållfasthetslära, KTH, 2014 (Svensk utgåva) eller Handbook of Solid Mechanics, Hållfasthetslära, 2010 (English Edition).

Referensliteratur:

Ted L. Anderson, Fracture mechanics: Fundamentals and applications, 4th Ed., 2017, CRC Press.

Examination

- HEM1 - Home Assignment, 3.0 credits, grading scale: P, F
- TEN3 - Examination, 5.0 credits, grading scale: A, B, C, D, E, FX, F
- LAB3 - Labotary Work, 1.0 credits, grading scale: P, F

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

If the course is discontinued, students may request to be examined during the following two academic years.

Other requirements for final grade

Passed homework (HEM1; 3 credits)
Passed laboratory (LAB3; 1 credits)
Passed written exam (TEN3; 5 credits)

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.