Damage Mechanics and Life Analysis

Programme course

6 credits

Skademekanik och livslängdsanalys

TMHL61

Valid from: 2017 Spring semester

Determined by
Board of Studies for Mechanical Engineering and Design

Date determined
2017-01-25

Main field of study
Mechanical Engineering

Course level
Second cycle

Advancement level
A1X

Course offered for
- Industrial Engineering and Management - International, M Sc in Engineering
- Industrial Engineering and Management, M Sc in Engineering
- Mechanical Engineering, M Sc in Engineering
- Mechanical Engineering, Master's programme

Entry requirements
Note: Admission requirements for non-programme students usually also include admission requirements for the programme and threshold requirements for progression within the programme, or corresponding.

Prerequisites
Linear algebra, multi-variable calculus and basic courses in Engineering Mechanics, Solid Mechanics and Engineering Materials

Intended learning outcomes
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

Course content

Basic Fracture Mechanics:

- Stress field-based linear Fracture Mechanics: Stress intensity, fracture tougness.
- Applicability of linear Fracture Mechanics: Crack tip plasticity. Applicability criteria. Experimental determination of fracture toughness
- Thermodynamics: J and G. Stability
- Fatigue crack growth: Paris' law. Cycle counting

Basic classic fatigue theory:

- Stress based fatigue theory (HCF): Wöhler-diagrams/SN-curves. Mean-stress effect. Haigh-diagram. Linear damage acculmulation rules. Strain based fatigue theory (LCF). Basquin's-, Coffin-Manson's and Morrow's equations. Ramberg-Osgood's equation. Cyclic plasticity and Masing-behaviour. Neuber's rule

Teaching and working methods

Lectures, teaching classes and laboratory work.

Examination

LABA	Laboratory Work	1 credits	U, G
TENA	Written examination	5 credits	U, 3, 4, 5

Grades

Four-grade scale, LiU, U, 3, 4, 5

Department

Institutionen för ekonomisk och industriell utveckling

Director of Studies or equivalent

Peter Schmidt

Examiner

Daniel Leidermark

Course website and other links

Education components

Preliminary scheduled hours: 66 h
Recommended self-study hours: 94 h

Course literature

T Dahlberg och A Ekberg: Failure, Fracture, Fatigue - An Introduction.
Studentlitteratur, Lund 2009

Common rules

Regulations (apply to LiU in its entirety)

The university is a government agency whose operations are regulated by legislation and ordinances, which include the Higher Education Act and the Higher Education Ordinance. In addition to legislation and ordinances, operations are subject to several policy documents. The Linköping University rule book collects currently valid decisions of a regulatory nature taken by the university board, the vice-chancellor and faculty/department boards.

LiU's rule book for education at first-cycle and second-cycle levels is available at http://styrdokument.liu.se/Regelsamling/Innehall/Utbildning_pa_grund-_och_avancerad_niva.