Course syllabus

Datorbaserad konstruktionsanalys 2
Computer Based Engineering, Design Analysis 2

MMKN51, 7,5 credits, A (Second Cycle)

Valid for: 2023/24
Faculty: Faculty of Engineering, LTH
Decided by: PLED M
Date of Decision: 2023-04-11

General Information

Elective for: M4-pu, MD4
Language of instruction: The course will be given in English on demand

Aim

This course aims to provide students with insight into how advanced computer aids through an extensive integration can be utilised to reduce lead times while increasing efficiency and quality in development and design projects. Such aids are introduced in this course for the following activities: modelling, analysis and optimisation of non-linear static and dynamic systems optimization through concrete design tasks and examples from industry and the research world. This course also covers optimization methods suitable for complex combinations of phenomena and meta-modelling. The course provides insight into how computer-based tools can be utilized to use material in a resource-efficient manner, which ties into goal 9 and 12 of Agenda 2030.

Learning outcomes

Knowledge and understanding
For a passing grade the student must

• be able to analyse, as well as motivate the choice of analysis type, meta-model and optimization method for a complex problem exposed to non-linear static or dynamic structural loads, flow and/or thermal loads.
• be able to create an analysis model based on the chosen analysis type

• be able to introduce necessary boundary conditions into the analysis model
• execute the actual analysis program
• be able to evaluate the analysis and optimization results achieved and suggest possible changes in the existing design solution
• be able to communicate the process as well as the results of the analysis/es orally and in writing

Competences and skills
For a passing grade the student must

• based on the assignment description, carry out a complete analysis and optimization of a design solution loaded non-linearly statically or dynamically – structurally, thermally and/or involving any form of flow.
• have acquired the kind of insights into the methods, technics and terminology regarding current computer based analyses so that the student is able to communicate his or her results to an industrial company verbally and in writing based on his or her analyses

Judgement and approach
For a passing grade the student must

• be able to reflect on the results achieved and suggest possible further analyses and/or design changes in the original design solution

Contents

The main emphasis of the course is on non-linear design analysis. Design analysis in this context primarily concerns the utilisation of computer based analysis methods/techniques for quantitative problem solving in the design process. The finite element method (FEM) is primarily dealt with and methods and techniques for the analysis of non-linear static and dynamic mechanical systems. The course also deals with how computationally expensive analyses can be completed by metamodeling in order to enable time-efficient optimization.

The current software programs are ANSYS, WorkBench, Autodesk CFD, modeFRONTIER and PTC. Modelling is a crucial element in the analysis activity, in which the goal is a transfer of the technical solution that has been developed in a usable form for the subsequent operations. Structural analysis, thermal analyses and CFD analyses of non-linear and/or dynamic phenomena are becoming increasing more common in product development in order to optimally simulate the product's actual environment and characteristics. The lectures are focused on modelling and selection of analysis type, as well as showing industrial applications. Guest lecturers with deep insights in specific techniques will be invited. Each student is expected to solve and submit a modelling and analysis assignment.

Examination details

Grading scale: TH - (U,3,4,5) - (Fail, Three, Four, Five)
Assessment: For a final passing grade the student must pass an individual assignment. The assignment can be resubmitted with improvements if the student does not receive a passing grade the first time, but the student will only receive the minimum passing grade (G).

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

Admission

Assumed prior knowledge: MMKN46 Computer Based Engineering Design Analysis 1 or equivalent.
The number of participants is limited to: 60
Selection: Completed university credits within the programme. Priority is given to students enrolled on programmes that include the course in their curriculum
The course overlaps following course/s: MMKN50

Reading list

- Burman, Å. (ed.) Lecture material, Division of Machine Design, LTH, 2007.

Contact and other information

Course coordinator: Axel Nordin, axel.nordin@design.lth.se
Director of studies: Elin Olander, elin.olander@design.lth.se
Course homepage: http://www.product.lth.se/education/