



KURSPLAN

Multidisciplinär optimering, 7,5 högskolepoäng

Multidisciplinary Optimization, 7.5 credits

Kurskod:	TMOR25	Utbildningsnivå:	Avancerad nivå
Fastställd av:	VD 2024-10-15	Utbildningsområde:	Naturvetenskapliga området
Gäller fr.o.m.:	2025-08-01	Ämnesgrupp:	MA1
Version:	1	Fördjupning:	A1N

Lärandemål

On completion of the course the student shall:

Kunskap och förståelse

- display knowledge of different types of continuous optimization algorithms and their use
- display knowledge in different types of optimization techniques during the design process
- show understanding about how optimization driven design is used in the development of sustainable products

Färdighet och förmåga

- demonstrate the ability to implement different optimization algorithms
- demonstrate the ability to develop methods to solve real-world optimization problems
- demonstrate skills in parameter optimization in product design
- demonstrate the ability to utilize optimization driven product development

Värderingsförmåga och förhållningssätt

- demonstrate the ability to critically evaluate suitable optimization methods for a given problem
- demonstrate the ability to critically assess the validity of optimization results.

Innehåll

The course enables engineering students to apply optimization techniques in the engineering process to optimize product realization aspects. The applications can be broad and multidisciplinary. This is achieved by utilizing both classical optimization algorithms and software for modelling objective functions by using one software as input to another.

The course includes the following elements:

- Introduction to optimization driven design using parameter optimization and structural optimization
- Univariate optimization, direct methods, local descent, line search
- The steepest descent method, Newton's method, Karush-Kuhn-Tucker conditions (KKT),
- Direct methods: Nelder-Mead Simplex method

- Heuristic methods: Population methods (genetic algorithms, differential evolution), simulated annealing
- Multi-objective non-linear optimization and their industrial applications: Pareto optimality, dominance, NSGA2
- Surrogate modeling using neural networks
- Implementation of optimization algorithms using Julia programming

Undervisningsformer

Lectures, labs and project work.

Undervisningen bedrivs på engelska.

Förkunskapskrav

Passed courses of at least 150 credits in the program Industrial Product Realisation, or a bachelor's degree (i.e the equivalent of 180 ECTS credits at an accredited university) with at least 90 credits in Mechanical Engineering, Product Development, Materials Engineering, Manufacturing Engineering, Industrial Engineering, Civil or Construction Engineering, or the equivalent. The bachelor's degree should comprise a minimum of 15 credits in Mathematics. Proof of English proficiency is required.

Examination och betyg

Kursen bedöms med betygen 5, 4, 3 eller Underkänd.

The final grade of the course is a weighted grade based on the results from the assignments and written examination and is issued only when all course units have been passed.

Poängregistrering av examinationen för kursen sker enligt följande system:

Examinationsmoment	Omfattning	Betyg
Inlämningsuppgift	4,5 hp	5/4/3/U
Projekt	3 hp	5/4/3/U

Kurslitteratur

The literature list for the course will be provided 8 weeks before the course starts.

Compendium at multidisciplinaryoptimization.ju.se

Reference literature:

Title: Algorithms for Optimization

Author: Kochenderfer M.J., Wheeler T.A

Publisher: MIT Press, 2019

ISBN: 9780262039420