Engineering Design Optimization, 7.5 credits

Engineering Design Optimization, 7.5 hp

Third-cycle education course

6FIEI38

Department of Management and Engineering

Valid from: Second half-year 2023

Approved by
Head of Department

Approved
2021-06-03

Revised by
Head of Department

Revised
2023-11-13

Registration number
IEI-2023-00593

Specific information

The English version has not yet been determined. The Swedish curriculum applies.

Learning outcomes

The participant should after the course:

- Be able to formulate design problems as optimization problems.
- Be able to handle optimization problems with several conflicting objectives
- Understand the function and explain the difference between different optimization methods, e.g. Gradient Based search, the Complex method and Genetic Algorithms
- Use optimization methods to solve real life engineering problems
- Use optimization methods together with different types of simulation models

Contents

- Engineering Design and Optimization- How can optimization support the design process?
- Optimization methods – from traditional gradient based methods to non-gradient methods such as the Complex method, Genetic Algorithms and Particle Swarm Optimization.
- Multi-objective optimization – How to handle problems with several conflicting objectives.
- Handling of constraints via penalty functions.
- Surrogate Models – How to use Design of Experiments and Surrogate Models to reduce the optimization time.
- Post optimal analysis – How to choose a solution from a large pool of optimal solutions
- Application examples where modeling, simulation and optimization are used to solve real world industrial problems.

Educational methods

The course consists of lectures and computer exercises during three workshops in Linköping, as well as individual project work. The scheduled time is approximately 40 hours.

Examination

Presenting an optimization project with an application of your choice, including an oral presentation and a written report.

Grading

Two-grade scale

Course literature

Examples of relevant literature. A complete list will be distributed before the course start.

- Box M. J., A new method of constraint optimization and a comparison with other methods, Computer Journal, vol. 8, pp. 42-52, 1965.
- Goldberg D., Genetic Algorithms in Search and Machine Learning. Reading, Addison Wesley, 1989.
- Onwubiko C., Introduction to Engineering Design Optimization, Prentice Hall, 2000.
- Deb K., Multi-Objective Optimization using Evolutionary Algorithms, Wiley, 2001.
- Persson J., & Ölvander J., Design Optimization – Optimization methods with Application to Engineering Design Problems, compendium, Department of Management and Engineering, Linköping University, 2025.

General information

The course takes into account equal conditions and aims to make use of the resources that students with different backgrounds, life situations and skills add to the education
Bibliography and schedule are determined in a different order
Course evaluation must be done by the course coordinator after each course opportunity. The results of the course evaluation must be communicated to the participants and the postgraduate education council at IEI.