

## Modern Methods of Optimization

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**Subject area:** Mathematics

**University:** CTU  
**Level:** BA2  
**Teaching mode:** hybrid: some students participate online, other students attend real-life  
**Instructor(s):** Jan Zeman, Matěj Lepš

### Short description

The goal of the course is to obtain an understanding of basic principles and terminology of mathematical optimization as well as approaches to global stochastic methods. The theoretical exposition will be complemented with practical solution of selected optimization problems using publicly available toolboxes in MATLAB environment.

### Full description

The course covers the following topics:

1. Introduction to optimization.
2. Principles of Mathematical Programming with emphasis on the Newton method
3. Direct Search methods, Simulated Annealing, Threshold Acceptance
4. Genetic Algorithms
5. Evolution Strategies, Differential Evolution, PSO and ACO
6. Parallel Evolutionary Algorithms and No free lunch theorem
7. Multi-modal optimization, comparison of optimization algorithms,
8. Multi-objective optimization, constrained optimization
9. Meta-modeling,
10. Introduction to Genetic Programming
11. Examples of engineering applications

### Learning outcomes

- Understand the differences between mathematical and nature-inspired optimization methods
- Obtain an overview of available techniques in both fields
- Obtain basic hands-on experience in solving simple problems with available libraries

## General information

<b>Contact hours per week:</b>	2
<b>Total workload:</b>	50 (in student hours for the whole course)
<b>ECTS credits:</b>	2
<b>Language:</b>	English

**Course start date:** 19 September 2022

**Course end date:** 15 January 2023

**Add. info about start date:** Start course date refers to start of the semester at CTU. Schedules will be available 1-2 weeks before semester starts. Lectures are taken place from 19.9.2022 until 15.1.2023. Examination period from 16.1.2023 until 19.2.2023.

## Weekly teaching day/time:

**Time zone:** CET (Denmark, Germany, France, Netherlands, Switzerland, Czech Republic)

## Further information:

**Prerequisites:** Basic of calculus, linear algebra, and statics are welcome but will be repeated during the course.

**Activities and methods:** Lectures, Seminars

**Presence on campus:** no

## Final examination

**Form:** written, a collaborative project

**Date:**

**Location/format:**

**Re-sit possibility:** yes

**Transcript available:** end of semester

**Add. info/requirements:** The students can complete the course by passing the final test or by working on a project problem.

## Registration

To register for this course, follow the registration requirements of your **home university** as specified here: [www.euroteq.eu/courses-registration](http://www.euroteq.eu/courses-registration).

## Administration

<b>Number of places:</b>	20
<b>Minimum participants:</b>	1
<b>Internal course code:</b>	132MMO
<b>Contact:</b>	matej.leps@fsv.cvut.cz, jan.zeman@cvut.cz

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*This course is part of the EuroTeQ Engineering University joint course catalogue 2022/2023. This is a collaborative activity of the partner universities DTU, L'X, TU/e, TalTech, CTU, TUM as well as Technion. Students from these universities can participate in the offered courses. It is the responsibility of the student to check if you fulfil the requirements to participate in a specific course. Students are also advised to check with their home institution how to get recognition of the ECTS credits gained in courses of the EuroTeQ course catalogue. For further information about EuroTeQ Engineering University, visit [www.euroteq.eu](http://www.euroteq.eu) or get in touch with the above-mentioned point of contact.*