Modern Nonlinear Optimization, 8.0 credits

Modern Nonlinear Optimization, 8.0 hp

Third-cycle education course

6FMAI34

Department of Mathematics

Valid from: First half-year 2026

Approved by
Head of Department

Approved
2026-01-30

Registration number
MAI-2026-00010

Entry requirements

Calculus, Linear Algebra, Introduction to Optimization, Matlab/Python.

Learning outcomes

- Learn optimization theory and apply theory to optimization problems in practice.
- Learn advanced optimization algorithms that can be used to improve performance on challenging problems.
- Learn implementation in software and use built-in optimization tools to tackle practical problems.

Contents

Tentative Contents:

- Optimization Models: Theory and Applications
- Optimization Methods: Proximal Gradient Methods, Accelerated Methods, Stochastic Methods, Constrainted Optimization Methods
- Generalized Problem Formulations: Variational Inequality, Monotone Inclusion

Educational methods

Lectures by the instructor, Homework presentation by students.

Examination

Homework Assignment, Course Project.

Grading

Two-grade scale

Course literature

- *First-Order Methods in Optimization*

  Book by Amir Beck
- *Optimization Methods for Large-Scale Machine Learning

  *SIAM Review by Léon Bottou, Frank E. Curtis, and Jorge Nocedal
- *Nonlinear Optimization*

  Book by Andrzej Ruszczynski
- *Frist-Order and Stochastic Optimization Methods for Machine Learning

  *Book by Guanghui Lan