

MA 5037: Optimization Methods and Applications

Syllabus and Introduction



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First version: April 12, 2018/Last updated: August 31, 2026

Syllabus

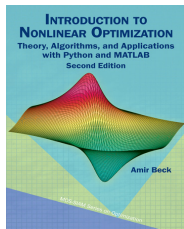
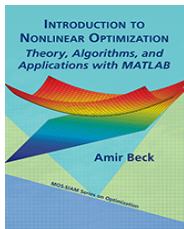
- **Instructor:** Prof. Suh-Yuh Yang (楊肅煜)
 - Office: M315, Hong-Jing Hall
 - Phone: 03-4227151 extension 65130
- **Office hours:** Tuesday 10:00 ~ 12:00 am or by appointment.
- **Prerequisites:** (Advanced) Calculus, Linear Algebra, Numerical Analysis, and some knowledge of software MATLAB.
- **Assignments:** Approximately every two or three weeks, will consist of theoretical problems or computer projects. The students are encouraged to discuss homework with other classmates. *Direct copying is absolutely not allowed.*
- **Examinations:** there will be *a midterm and a final exam.*
- **Grading policy:** *assignments 30%, midterm 30%, final 30%, and others 10%.*

Course objective

- This course will provide the foundations of the theory of nonlinear optimization as well as some related algorithms (and will present a variety of applications from diverse areas of applied sciences).
- This course combines three pillars of optimization: *theoretical and algorithmic foundation, (familiarity with various applications, and the ability to apply the theory and algorithms on actual problems).*

Textbook

Amir Beck, *Introduction to Nonlinear Optimization - Theory, Algorithms, and Applications with Matlab*, MOS-SIAM Series on Optimization, SIAM, 2014. (Second Edition, 2023)



<https://epubs.siam.org/action/doSearch?field1=Title&text1=Nonlinear+Optimization&publication=&Ppub=&pubType=book&target=browse>

Errata of 2014 Edition: https://epubs.siam.org/doi/suppl/10.1137/1.9781611973655/suppl_file/mo19_err.pdf

Important dates

- The period for adding and dropping a course: 09/02-09/22, 2026
- The period for withdrawing a course: 10/19-11/27, 2026
- Midterm: 11/03 (Tue), 2026 (9th week)
- Sports games: November 11 (Wed), 2026, *no class!*
- Final: 12/22 (Tue), 2026 (16th week)

This course will cover the following topics

- **Chapter 1:** Mathematical preliminaries
- **Chapter 2:** Unconstrained optimization
- **Chapter 3:** Least squares
- **Chapter 4:** The gradient method
- **Chapter 5:** Newton's method
- **Chapter 6:** Convex sets
- **Chapter 7:** Convex functions
- **Chapter 8:** Convex optimization
- **Chapter 9:** Optimization over a convex set
- **Chapter 10:** Linearly constrained problems
- **Chapter 11:** The Karush-Kuhn-Tucker conditions
- **Chapter 12:** Duality