ISYE 7683 Advanced Nonlinear Programming

Lectures on Modern Convex Optimization

Contents. The course presents the state-of-the-art of (a significant part of) modern convex optimization, with emphasis on

- *theory* of well-structured convex problems, primarily Second Order and Semidefinite Conic programs,
- *application models* reducible to well-structured convex optimization, including those in compressed sensing, synthesis of linear controllers, robust optimization, design of mechanical structures, stability analysis, combinatorics, signal processing, medical imaging, etc.
- *efficient algorithms* for processing well-structured convex problems and related complexity issues.

To get a detailed impression of the contents, see the modules ``Lecture Notes'' with self-contained Lecture Notes and ``Transparencies'' with slides.

Links:

Lecture Notes https://www2.isye.gatech.edu/~nemirovs/LMCOLN2027.pdf

Transparencies https://www2.isye.gatech.edu/~nemirovs/LMCOTR2027.pdf

- The course is composed of 6 ``macro-lectures:''
  - **Lecture 1**: *From Linear to Conic Programming*
  - **Lecture 2**: *Conic Quadratic Programming*
  - **Lecture 3**: *Semidefinite Programming*
  - **Lecture 4**: *Computational Tractability of Convex Programming*
  - **Lecture 5:** *Polynomial Time Interior Point Methods for LP/CQP/SDP*
  - **Lecture 6**: *Simple Methods for Large-Scale Problems - First Order Algorithms for Deterministic and Stochastic Convex Minimization and Convex-Concave Saddle Points*

Grading policy: There are no obligatory homework assignments; that said, Lectures are accompanied by exercises (usually not so easy), and you are strongly advised to work on the exercises you find interesting or challenging. You are also welcome to consult with me if you need clarification or get stuck.

- There is no MidTerm; the grade for the course is fully based on the take-home Final Exam to be posted on Canvas at least 2 weeks prior to the end of classes.