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Course PM

SF3847 Convex optimization with engineering applications, 6cr, 2018/2019

General information

This course is a graduate course, given jointly by the Department of Information Science and Engineering, and the Department of Mathematics at KTH. The course is primarily not intended for students with focus on optimization, but rather aimed for students from other areas.

Examiners: Mats Bengtsson (Information Science and Engineering), Anders Forsgren (Mathematics) and Joakim Jaldén (Information Science and Engineering).

The course consists of 24h lectures, given during Period 4, spring 2019.

Course literature: S. Boyd and L. Vandenberghe, *Convex Optimization*, Cambridge University Press, 2004, ISBN: 0521833787

Aim

After completed course, students will be able to

- characterize fundamental aspects of convex optimization (convex functions, convex sets, convex optimization and duality);
- characterize and formulate linear, quadratic, geometric and semidefinite programming problems;
- implement, in a high level language such as Matlab, crude versions of modern methods for solving convex optimization problems, e.g., interior methods;
- solve large-scale structured problems;
- give examples of applications of convex optimization within statistics, communications, signal processing and control.

Syllabus

- Convex sets
- Convex functions
- Convex optimization
- Linear and quadratic programming
- Geometric and semidefinite programming
- Duality
- Smooth unconstrained minimization
- Sequential unconstrained minimization
- Interior-point methods
- Large-scale optimization
- Applications in estimation, data fitting, control and communications

Course registration

PhD students from KTH register through e-ISP and regular course registration procedures.
Clarification: First, make sure the course is included in your e-ISP. This you do together with your main academic advisor. Then, send an e-mail to Anders Forsgren.

PhD students from other universities must fill out this form and send signed and scanned copy by e-mail to Anders Forsgren.

Course requirements

For passing the course, successful completion of homework assignments and presentation of a research paper in a short lecture at the presentation day are required.

There will be a total of four sets of hand-ins distributed during the course. Hand-in dates are March 28, April 9, April 23 and May 2. Late homework solutions are not accepted.

The short lecture should sum up the key ideas, techniques and results of a (course-related) research paper in a clear and understandable way to the other attendees.

Prerequisites

The course requires basic knowledge of calculus and linear algebra. Please contact the lecturers if you are uncertain about your prerequisities.

Schedule

Lectures will be given in Room F11, Lindstedtsvägen 22, KTH.

Lecture notes will be posted in Canvas.

Lecture	Date	Time	Venue	Activity	Lecturer
1	Tue Mar 19	13-15	Room F11	Introduction	MB/AF/JJ
2	Thu Mar 21	13-15	Room F11	Convexity	AF
3	Tue Mar 26	13-15	Room F11	Linear programming and the simplex method	AF
4	Thu Mar 28	13-15	Room F11	Lagrangian relaxation, duality and optimality for linearly constrained problems	AF
5	Tue Apr 2	13-15	Room F11	Sensitivity and multiobjective optimization	MB
6	Thu Apr 4	13-15	Room F11	Convex programming and semidefinite programming	AF
7	Tue Apr 9	8-10	Room F11	Applications of conic programming	MB
8	Thu Apr 11	13-15	Room F11	Smooth convex unconstrained and equality-constrained minimization	AF
9	Tue Apr 23	13-15	Room F11	Interior methods	AF
10	Thu Apr 25	13-15	Room F11	Large-scale optimization	JJ
11	Tue Apr 30	13-15	Room F11	Applications	MB
12	Thu May 2	13-15	Room F11	Applications	JJ

Research paper presentations will be held on Thursday May 9.

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