COM 5245 Optimization for Communications (通訊之最佳化方法)

Lecture hours: **T2,T3,T4** Classroom: **Room 216**, 台達館

(Spring Semester 2013)

Instructor: 祁忠勇 (Chong-Yung Chi), Office: Room 966, 台達館

Office hours: 9:00 am-11:00 am, Thursday

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Convex analysis and optimization *along with available software has been recognized as a powerful tool for solving a wide range of science and engineering problems, if the problem of interest can be advisably formulated into a convex optimization problem. Over the last decade, convex optimization has been employed successfully in solving various problems in signal processing and communications engineering, as we recently have applied it to Blind Source Separation (BSS) and biomedical and hyperspectral image analysis in signal processing, as well as coherent/noncoherent detection and channel estimation, space-time coding, distributed signal processing, beamforming, and resource allocation in multiple-input multiple-output (MIMO) Communications and Networking. More successful applications are emerging and rapidly growing, specifically such as analytical chemistry for the former, and physical-layer secrecy and cooperative communications for the latter, and many new interdisciplinary science and engineering applications. This course is to introduce convex optimization concepts and methods, available software and their applications.*

Background: A good background in linear algebra and matrix theory is desirable.

Course Outline:

1. Background materials in linear algebra and matrix theory
2. Convex sets
3. Convex functions
4. Convex optimization problems
5. Duality
6. Unconstrained minimization
7. Interior-point methods
8. Applications to engineering problems
9. Selected topics from recent optimization methods for communications/signal processing

Textbook and Lecture Notes:

Boyd and Vandenberghe, *Convex Optimization*, Cambridge University Press, Cambridge, 2004. E-book can be downloaded from: http://www.stanford.edu/~boyd/cvxbook/

Chong-Yung Chi, ``Convex Optimization for Signal Processing and Communications" (Booklet):

A master hard copy is available for making your own hard copy.

References:

R. Fletcher, *Practical Methods of Optimization*, John Wiley and Sons, 1988.

D. P. Bertsekas, *Convex Analysis and Optimization*, Athena Scientific, 2003.

D. P. Bertsekas, *Convex Optimization Theory*, Athena Scientific, 2009.

Daniel P. Palomar and Yonina C. Eldar (Editors), *Convex Optimization in Signal Processing and Communications,* Cambridge University Press, Cambridge, 2010.

Grading:

Homework: 15%;

Midterm Exam: 30%; (written examination in class)

Final Exam: 30%; (written examination in class)

Term Project: 25% (no more than 2 persons per group)

Teaching Assistants:

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Remarks:

1. The language of instruction is English.
2. We are against plagiarism. Those who are found committing any (even slight) form of plagiarism in assignments, projects, and examinations will be seriously punished; for example, getting no score for the whole course.
3. Homework must be handed in the lecture time by the deadline. The score will be multiplied by **a factor of 0.7 per day passing the deadline**.
4. *Nonlinear adjustment* will be made as needed for the final term grade.
5. Course website: http://www.ee.nthu.edu.tw/cychi/courses-e.html