Math 601 (39787R)

Optimization Theory and Techniques

Description

For many scientific and engineering problems, the solution of the problem is characterized by the minimum or maximum of a linear or nonlinear cost functional. In order to choose the appropriate techniques for solving these optimization problems, it is important to understand the relevant mathematical properties of the cost functional and the characteristics of its extremum. For example, the existence, the uniqueness, and the characterization of the extrema are critical information in the selection of the solution techniques. In this course, we present the mathematical theories for optimization problems. A rigorous treatment of optimization theory requires theory of functional analysis such as the theory for Banach spaces and Hilbert spaces, duality theory and theory of operators. Most of these functional analysis tools are introduced in this class, however, a solid knowledge of multi-variable calculus and some knowledge of integration theory will be useful for this class. The course can be outlined as follows:

- Introduction
- Linear spaces
- Convex set, convex functional and duality
- Examples of optimization problems
- Nonlinear programming
- Numerical methods for constrained optimization

Useful Information

Class Time & Location: Lecture, MWF 10:00-10:50AM

Instructor:

Chunming Wang
Office: KAP 244C
Telephone: (213) 740-6097
Fax: (213) 740-2424
E-mail: cwang@usc.edu
Office Hours: MWF 11:30-12:30

Grading Scheme

Description	Percentage in course grade
Midterm	30
Final Exam	30
Homework	20
Projects	20

Textbook

S. Boyd and L. Vandenberghe, *Convex Optimization*, Cambridge University Press, 2004.

References:

E.P.K. Chong and S.H. Zak, *An Introduction to Optimization*, Wiley & Sons Inc., 2008
D. G. Luenberger, *Optimization by Vector Space Methods*, John Wiley & Sons, Inc, 1969.
M.R. Hestenes, *Optimization Theory The Finite Dimensional Case*, John Wiley & Sons, Inc, 1975.
G. Leitmann, *The Calculus of Variations and Optimal Control*, Plenum Press 1981.

Tentative Schedule for Spring 2015*

Monday	**Wednesday**	**Friday**
August 22 Linear spaces and differential calculus	August 24 Linear spaces and differential calculus	August 26 Linear spaces and differential calculus
August 29 Convex sets	August. 31 Convex sets	September 2 Convex sets
September 5 Labor Day	September 7 Convex sets	September 9 Convex sets
September 12 Convex functional	September 14 Convex functional	September 16 Convex functional
September 19 Convex functional	September 21 Duality	September 23 Duality
September 26 Duality	September 28 Duality	September 30 Duality
October 3 Unconstrained nonlinear programming	October 5 Unconstrained nonlinear programming	October 7 Midterm Exam
October 10 Unconstrained nonlinear programming	October 12 Unconstrained nonlinear programming	October 14 Fall Recess
October 17 Interior-point methods	October 19 Interior-point methods	October 21 Interior-point methods
October 24 Interior-point methods	October 26 Interior-point methods	October 28 Interior-point methods
October 31 Interior-point methods	November 2 Interior-point methods	November 4 Interior-point methods
November 7 Least square problems	November 9 Least square problems	November 11 Least square problems
November 14 Least square problems	November 16 Least square problems	November 18 Least square problems
November 21 Statistical estimation	November 23 Thanksgiving Recess	November 25 Thanksgiving Recess
November 28 Statistical estimation	November 30 Statistical estimation	December 2 Statistical estimation

*Schedule as well as other information in this syllabus are subject to change during the semester. Possible changes will be announced during class meetings.