

MTH 474/574 Numerical Optimization

Spring Semester 2012

Tues, Thurs 11:00 - 12:15 in Room 218, Liberal Arts Building

Instructor: Steven Leon
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Office hours: Tues, Thurs 2:00 -3:00, Mon, Wed 1:30 - 2:30, or by
appointment.
These office hours may be revised during the semester.

Textbook: *Linear and Nonlinear Optimization, 2nd ed.*,
by Griva, Nash, and Sofer, SIAM 2009
If you are a member of the Society for Industrial and Applied
Mathematics (SIAM), you can order the book from them at their
member discount rate which is considerably less the price it is selling
in the bookstore. You can join SIAM for free by joining the student
Chapter of SIAM here at UMass Dartmouth. To join the chapter,
contact the current chapter president, Sidafa Conde,
sconde@umassd.edu.
Information about ordering the book from SIAM is available at
<http://www.ec-securehost.com/SIAM/OT108.html#buy>

**Homework
and grading** You will be assigned homework on the various topics covered in the
course and you may also be assigned one or two class projects. Your
grade for the course will depend on how well you do on the
assignments.

**Useful
references:** Highly recommended references:
Numerical Optimization by Jorge Nocedal and Stephen Wright,
Springer-Verlag 1999
Scientific Computing with Case Studies by Dianne P. O'Leary,
SIAM 2009
Older references (oldies but goodies):
Practical Optimization by Philip Gill, Walter Murray, and Margaret
Wright, Academic Press, 1981
Numerical Methods for Unconstrained Optimization by John Dennis
and R. B. Schnabel, SIAM, 1996 (Reprint of 1983 textbook)
For background in linear algebra I am partial to the following book:
Linear Algebra with Applications, 8th ed., by Steven Leon, published
by Pearson, 2010

MTH 474/574 Numerical Optimization - Syllabus

I. Introduction to Optimization

Fundamentals and terminology

Background Material

Topics from linear algebra and numerical analysis

IEEE floating point numbers and finite precision arithmetic

Conditioning and condition numbers

Quadratic forms

Positive definite matrices

Hessian matrices

Newton's root finding algorithm

Convexity: convex sets and convex functions

Lagrange Multipliers

Numerical methods for least squares data fitting

II. Unconstrained Optimization

Line search methods

Steepest descent

Newton's method

Quasi-Newton methods

Trust region methods

III. Constrained Optimization

Linear and nonlinear constraints

Linear programming

Simplex Method

Interior point methods

Finding best infinity-norm and 1-norm approximations to data

Feasible Point Methods

Linear equality constraints

Linear inequality constraints

Sequential quadratic programming

Barrier and penalty methods

IV. The MATLAB Optimization Toolbox (We will use the toolbox throughout the semester.)