UNIVERSITY OF Cincinnati

Mathematical Sciences
P.O. Box 210025
Cincinnati, OH 45221-0025

Nonlinear Optimization – Spring 2006-7 (15-MATH-526-001)

Time and Place: MWF 9:00-9:50 PM, ???
Instructor: Donald A. French (820D Old Chemistry)
Phone & Email: 556-4039 (Messages 556-4050), french@math.uc.edu
Office Hours: MW 1:30-3:00 PM and by appointment.

Prerequisites: Calculus I-IV (especially Multivariable Calculus), Linear Algebra and experience with programming – preferably MATLAB. It will help to have taken Differential Equations and have some maturity in Mathematics gained thru higher level mathematics courses.

Description: Nonlinear optimization problems arise in virtually all areas of Science and Engineering. The typical optimization problem involves minimizing (or maximizing) a real-valued function $f = f(x_1, ..., x_n)$ where n could be very large. Except in very special cases numerical or computer methods are needed to approximate the point of optimization. Both local (Newton, Quasi-Newton, and Broyden) and global schemes (steepest descent, trust region, and conjugate gradients) will be examined. Applications such as data fitting or optimal control may also be included. The focus of the course will be on the numerical methods and a detailed examination of how they work from the mathematical point of view. Some analysis of convergence rates, robustness and accuracy will be provided.

This course is primarily for students in engineering, mathematics and physics. Since functions of many variables will be a significant part of the course concepts from Multivariable Calculus and Linear Algebra are very important. We will review these concepts as needed.

Grading: Grades will be based on homework and two tests given on the following dates:

Midterm: Friday, May 3 (In Class)
Final: Monday, June 4, 7:30-9:30 am.

For the homework you may (and are encouraged) to discuss the problems with other students as long as the write-up is your own work ("in your own words"). The tests will count for 60% of the grade (Midterm is 25% and Final is 35%) and the homeworks will count for the other 40%.

Lectures: Class notes are the primary study source.

References: There is no required text for this course. The following books are being placed on reserve in the GeoMathPhys Library:

1. Matrix Computations (2nd Ed.), G.H. Golub and C.F. Van Loan, Johns Hopkins 1989 (ISBN 0-8018-3772).

2. Numerical Methods and Analysis, J.L. Buchanan and P.R. Turner, McGraw-Hill Inc. 1992 (ISBN 0-07-008717-2).

3. Optimization, G.L. Nemhauser, A.H.G. Rinnooy Kan, and M.J. Todd, (Handbooks in Operations Research and Management Science Vol. 1), Elsevier Science Publishers B.V. (North-Holland) 1989 (ISBN 0-444-87284-1).

The information given here is subject to change. Any major changes will be announced in lecture.