

IOE 611 Syllabus

Instructor: Professor Katta G. Murty, 232 IOE Bldg., 763-3513, katta_murty@umich.edu

Prerequisites: A course in linear programming, equivalent to IOE 510

Time & Room: Tu, Th 9 AM to 10:30 AM, 2717 IOE.

Course objectives: To expose the student to nonlinear models, their applications, how to construct them, and to use algorithms for solving them satisfactorily.

Transparencies: The course will be taught using overhead transparencies. Students can access copies of the transparencies on the WWW using the address:

<http://www-personal.engin.umich.edu/~murty/611/index.html>

Books:

1. M.S. Bazaraa, H.D. Sherali, and C.M. Shetty, Nonlinear Programming Theory and Algorithms, Wiley, 1993, 2nd Edition.
2. K.G. Murty, Linear Complementarity, Linear and Nonlinear Programming, Helderman-Verlag, 1988. Can be seen on the web at:
http://ioe.engin.umich.edu/people/fac/books/murty/linear_complementarity_webbook/
3. R. Fletcher, Practical Methods of Optimization, Wiley-Interscience, 1987.

Contents:

1. Formulation of continuous optimization models, curve fitting, parameter estimation, L_1 , L_2 and L_∞ - measures of deviation. Difference between linear and nonlinear model building. Examples.
2. Types of problems. State of the art. What can and cannot be done efficiently? Goals for algorithms.
3. Theorems of alternatives for linear systems.
4. Convex sets, separating hyperplanes, convex and concave functions.
5. Optimality conditions.
6. Quadratic programming and complementary pivot methods.
7. Newton's method and simplicial methods for nonlinear equations.
8. Line Search methods.
9. Unconstrained minimization algorithms.
10. Constrained minimization algorithms. Penalty and barrier methods, SQP and SLP methods.

Work in the course: Homeworks every week. One midterm (in the class on 19 Feb 2004) and final (1:30 PM to 3:30 PM, 23 April 2004). A computer project.

I would like each student to study one nonlinear programming paper from the literature carefully and give a 30 minute lecture on it to the whole class towards the end of the term.

The approximate contribution to the final grade will be: Homeworks (0.2), Midterm (0.25), Final (0.35), Computer project (0.1), lecture (0.1).