UNIVERSITY OF MANITOBA | **Electrical and Computer Engineering**

24.767 OPTIMIZATION METHODS FOR COMPUTER-AIDED DESIGN
COURSE OUTLINE - JANUARY 2005

Course Objectives

The object of this course is to introduce mathematical optimization techniques for the solution of engineering analysis and design problems. The student will learn to formulate multi-variable engineering problems as a mathematical statement amenable to computer solution. The details of the specific techniques required to solve the mathematical problem will be covered during lecture time using pseudo-code. Each assignment will consist of several questions which reinforce and build upon the material covered in the lectures as well as some programming problems which will allow the student to implement and use the relevant algorithms to solve realistic problems typical of those encountered in the engineering profession. An ability to program in a mathematical programming language such as Matlab, C or Fortran is a pre-requisite; language specific implementation issues will not be covered during class time.

Contact hours

3 lecture hours/week, 13 weeks (three credit hour course)

Time: Tusdays and Thursdays, 4:00-5:30 p.m., **Place**: Room: 566 Engineering 1 Bldg.

Prerequisites

The only prerequisite is a firm grasp of the mathematical concepts which are normally contained in an undergraduate electrical engineering curriculum, including: multivariable calculus, linear analysis, algorithm development, and computer programming.

Course content

Most of the following topics will be covered:

1. Mathematical concepts of single and multivariable optimization.
2. Formulation of engineering problems as constrained optimization problems.
3. Classical methods of unconstrained optimization.
4. Zero, first and second order direct search techniques and algorithms for unconstrained optimization.
5. Linear programming.
6. Constraints - equality and inequality.
7. Constrained optimality criteria.
8. Numerical and classical techniques for constrained optimization.
9. Neural Networks as an optimization problem.
10. Strategies for global optimization.

Textbook

E.K.P. Chong, S.H. Zak, "An Introduction to Optimization", 2nd Edition, John Wiley and Sons, Inc., 2001. (Sci/Technology Fifth Floor: QA 402.5 C476 2001)

Recommended Reference Books

1. G.S.G. Beveridge, R.S. Schechter, "Optimization: Theory and Practice", McGraw-Hill Book Company, 1970. (Sci/Technology Fifth Floor: QA 402.5 B48 1970)
2. G.V. Reklaitis, A. Ravindran, K.M. Gagsdell, "Engineering Optimization: Methods and Applications", John Wiley and Sons, 1983. (Sci/Technology Fifth Floor: TA342.R44 1983)
3. W.H. Press, B.P. Flannery, S.A. Teukolsky, W.T. Vetterling, "Numerical Recipes in C: The Art of Scientific Computing", Cambridge University Press, 1988. (Engineering Reserve: QA76.73 C15 N865 1988). (1992 copy may also be available.)
4. L.E. Scales, "Introduction to Non-Linear Optimization", Springer-Verlag, 1985. (Sci/Technology Fifth Floor: QA 402.5 S33 1985).
5. L. Cooper, D. Steinberg, "Introduction to Methods of Optimization", W.B. Saunders Co., 1970, (Management Main Floor: QA 402.5 C66 1970).

Evaluation

The final course grade will be determined from a student's performance in several assignments, a project, and a final examination. The project will be chosen by the student, with the approval of the instructor, in an area of his/her interest and will demonstrate the application of an optimization algorithm discussed in the course. The weighting of each of these components will be as follows:

Component	Weight
Assignments	40%
Project	20%
Final Exam	40%

Academic Integrity

Students are expected to conduct themselves in accordance with the highest ethical standards of the Profession of Engineering and evince academic integrity in all their pursuits and activities at the university. As such, in accordance with the General Academic Regulations and Requirements of the University of Manitoba, Section 7.1, students are reminded that "plagiarism or any other form of cheating in examinations or term tests (e.g. crib notes) is subject to serious academic penalty (e.g. suspension or expulsion from the faculty or university). A student found guilty of contributing to cheating in examinations or term assignments is also subject to serious academic penalty."

Instructor

Joe LoVetri, Ph.D., P.Eng.
Room350C, Engineering Building
Telephone: 474-6295
Email: lovetri@ee.umanitoba.ca