University of Victoria Engineering

Faculty of Engineering

COURSE OUTLINE

ELEC 403-503 Engineering Design by Optimization

Term – SUMMER 2015 (201505)

Instructor

Dr. Wu-Sheng Lu
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Office Hours

Days: Wednesdays
Time: 14:00 – 16:00
Location: EOW 427

Course Objectives

- To understand fundamental principles and basic algorithms for unconstrained optimization problems encountered in engineering analysis and designs.

Learning Outcomes

- Ability to analyze and formulate a typical engineering analysis/design problem as an optimization problem; and apply appropriate algorithm(s) to obtain and evaluate an optimal solution to the problem at hand.

Syllabus

- **Basic Principles** 9
  Introduction. Gradient. Taylor Series. Necessary and sufficient conditions for local minima. Convex and concave functions. Optimization of convex functions

One-Dimensional Optimization (**Line Search**) 7
Dichotomous Search. Fibonacci Search. Golden-Section Search. Quadratic interpolation. Cubic interpolation. Working examples.

Basic Multi-Dimensional Gradient Methods 7
Steepest-Descent method. Newton's method. Gauss-Newton method. Examples.

Conjugate Direction Methods 3
Conjugate directions. Conjugate gradient method. Minimization of non-quadratic functions. Fletcher-Reeves method. Powell's method. Partan method. Examples.

Quasi-Newton Methods 6
Basic quasi-Newton approach. Rank-one method. Davidon-Fletcher-Powell method. Broyden-Fletcher-Goldfarb-Shanno method. The Broyden family. Inexact line searches. Examples.

Case Studies.....6
Point pattern matching. Inverse kinematics of robotic manipulators. Optimal design of finite-impulse-response digital filters.

A-Section(s): A01(A02)/ CRN30313(30314) B01(30315) Monday 4:00-6:50pm ELW B326
Days: TWF TA: Darya Ismailova E-mail: ismailova.ds@gmail.com
Time: 12:30 – 13:20 B02(30316) Monday 4:00-6:50pm ELW B326
Location: ECS 124 TA: Lan Xu E-mail: lanxu@uvic.ca

Required Text

Title: Practical Optimization: Algorithms and Engineering Applications
Author: A. Antoniou and W.-S. Lu
Publisher: Springer
Year: 2007

Assessment:

Assignments:	10%	Due Dates: May 15, 22, 29, June 12, 24, July 7, 17.
Labs (ELEC403)	15%	
Labs and Project (ELEC503)	15%	
Mid-term	20%	Date: June 26, Friday.
Final Exam	55%	

Note:

Failure to complete all laboratory requirements will result in a grade of N being awarded for the course.
Failure to pass the final exam will result in a failing grade for the course.

The final grade obtained from the above marking scheme for the purpose of GPA calculation will be based on the percentage-to-grade point conversion table as listed in the current Undergraduate Calendar.

Assignment of E grade and supplemental examination for this course will be at the discretion of the Course Instructor. The rules for supplemental examinations can be found in the current Undergraduate Calendar.

http://web.uvic.ca/calendar/FACS/UnIn/UARe/Grad.html

Note to Students:

Students who have issues with the conduct of the course should discuss them with the instructor first. If these discussions do not resolve the issue, then students should feel free to contact the Chair of the Department by email or the Chair's Secretary to set up an appointment.

Accommodation of Religious Observance
http://web.uvic.ca/calendar/GI/GUPo.html

Policy on Inclusivity and Diversity
http://web.uvic.ca/calendar/GI/GUPo.html

Standards of Professional Behaviour

You are advised to read the Faculty of Engineering document Standards for Professional Behaviour in current Undergraduate Calendar, which contains important information regarding conduct in courses, labs, and in the general use of facilities.

Cheating, plagiarism and other forms of academic fraud are taken very seriously by both the University and the Department. You should consult entry in current Undergraduate Calendar for the UVic policy on academic integrity.

http://www.uvic.ca/engineering/assets/docs/professional-behaviour.pdf

Course Lecture Notes

Unless otherwise noted, all course materials supplied to students in this course have been prepared by the instructor and are intended for use in this course only. These materials are NOT to be re-circulated digitally, whether by email or by uploading or copying to websites, or to others not enrolled in this course. Violation of this policy may in some cases constitute a breach of academic integrity as defined in the UVic Calendar.