OPTIMUM STRUCTURAL DESIGN

Instructor: Fazıl Önder Sönmez

Class hours: Wednesdays 10.00–11.00 (M 2152), 11.00–12.00 (M 1200), 16.00–17.00 (M 2171)

Office hours: Mondays 10.00–12.00, Wednesdays 13.00–15.00, or drop by

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Prerequisite: CmpE 150: Introduction to Computing, ME 345: Mechanics of Materials

Course Objectives: Applying optimization algorithms to obtain optimum design of structures (to minimize the weight (or cost) or to maximize performance); improving understanding of the mathematical basics, the ability to make a mathematical formulation to solve optimization problems, to make the choice of an appropriate optimization tool, and estimate the numerical effort.

Textbook: Hand-outs and hand-notes, as supplementary "Elements of Structural Optimization," by Raphael T. Haftka and Zafer Gürdal.

Grading:		
	Projects	26 %
	Quizzes	18 %
	Midterms	30 %
	Final	26 %
	Attendance	±2 %

No make-up exam unless in emergency with written excuse.
Midterms and final are closed book and notes. Only one A4 paper is permitted containing formulas.

Week	**Topics**
1	Introduction: Comparison of analysis and design formulations; basic concepts of design optimization (design variable, objective function, constraint, design domain, feasible region); types of design optimization: Size, shape, and topology optimization
2-4	Classical tools in structural optimization Differential Calculus, Variational Calculus, Lagrange Multipliers, Karush-Kuhn-Tucker conditions ***Quiz 1*** ***Quiz 2*** ***Midterm 1***
5-6	Linear programming: Simplex method ***Quiz 3*** Nonlinear Programming I: Unconstrained optimization
7-8	Minimization of functions with one variable Zero order methods: Bracketing, golden section search, First order methods: Bisection, Second order methods: Newton's method
9-10	Minimization of functions with several variables Sequential simplex (Nelder-Mead) method Steepest descent method Quadratic convergence and conjugate directions Fletcher & Reeves conjugate gradients method ***Project 1*** ***Midterm 2***
11-12	Nonlinear programming II: Constrained optimization Method of feasible directions Penalty function methods ***Project 2***
13	Optimization with surrogate models: Response surface method, artificial neural networks
14	Global optimization methods: Simulated annealing, genetic algorithms