

Design Optimization

ME 5390-006

Fall 2009

1. Instructor: Bo Ping Wang

Room No: 304C Woolf Hall

Course website: <http://www-woolf.uta.edu>

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2. Course Description:

Unconstrained and constrained minimization problem. Necessary and sufficient conditions. Numerical solutions. Application to mechanical design problems.

3. Course Learning Goals/Objectives:

Formulation of optimal design problem. Identification of design variables, objective function and constraint functions. Numerical solution algorithms. Solution of optimal design problem using Matlab optimization tool box. Sensitivity analysis for engineering analysis. Introduction to global search methods.

4. Attendance and Drop Policy:

Attendance required. The last drop date: see UTA calendar.

5. Tentative Lecture/Topic Schedule (course content):

Introduction : definition of optimization problem, classification of problems, mathematical fundamentals, necessary and sufficient conditions, graphical solution and visualization

Unconstrained minimization of a single variable : Golden section search and polynomial approximation

Unconstrained minimization of many variables : search direction, step size determination

Linear and quadratic programming problem : Problem definitions and Matlab solutions

Constrained minimization of many variables : sequential linear programming, sequential quadratic programming

Design sensitivity analysis: Definition, analytical methods, semi-analytical methods and complex variable methods.

Structural Optimization: Problem types, optimal design of beam and truss, topology optimization of 2D continuum.

Design Optimization of surrogate models: Sampling methods and response surface models. Application to engineering design.

Introduction to stochastic search methods for design optimization: Genetic algorithm(GA), particle swarm optimization(PSO), differential evolution(DE), ant colony optimization (ACO) and simulated annealing(SA).

Matlab will be used extensively.

6. Graded Assignments (Homework / Projects) :

Homework – assigned in each week and due at the beginning of next week's first class. Must be neat; staple pages.

Projects – will be assigned during the semester

Grading Format Weighting / Point Value of Assignments and Examinations:

Grading: Homework: 30%; Mid-term Exam 30%, Final Exam (or Project) :40%

A=85+ ; B=75+ ; C=60+; F =59-