University of Wisconsin-Madison
ME 548: Introduction to Design Optimization
Spring 2021

Instructor: Krishnan Suresh, ksuresh@wisc.edu
Lectures: Tu-Th, 9:30 – 10:45 AM (Canvas, Blackboard Ultra)
Homework: Due typically on Mondays, 8 pm (check Canvas)
Office hours: Fridays, 11 – 12 AM (Canvas, Blackboard Ultra)

TA: Aaditya Chandrasekhar, achandrasek3@wisc.edu, office hours: Mon, 3 - 4 PM
TA: Subodh Subedi, scsubedi@wisc.edu, office hours: Th, 2:30 – 3:30 PM

Objective

The course introduces basic concepts and techniques used in the optimization of engineering design components and systems. Students will learn three complementary topics: (1) basics of optimization theory, (2) numerical methods, and (3) applications of optimization. While the course largely focuses on geometric and structural applications, the underlying concepts can be easily applied to other engineering disciplines. The course will use MATLAB's optimization toolbox and SolidWorks. A background in undergraduate mechanics of solids is assumed. Programming experience is desirable, but not required.

Credits: 3 credits

There are two 75-minute online (recorded) lectures each week. Students are expected to work on course learning activities for an additional 2 hours outside the classroom for every class period.

Pre-requisite

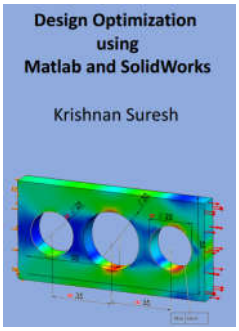
1. ME 306 (Mechanics of Materials)
2. Background in programming (preferably MATLAB) is desirable but not required.
3. Basic knowledge of finite element analysis (FEA) desirable but not required.

Text

1. "**Design Optimization using Matlab and SolidWorks**", Krishnan Suresh, 2019; available at Amazon.

Topics

1. Introduction to design optimization
2. Basics of Matlab programming
3. Unconstrained optimization
4. Matlab optimization toolbox
5. Equality and inequality constraints
6. Truss systems analysis
7. Truss optimization
8. FEA & shape optimization in 2D
9. SolidWorks: FEA and optimization



Software Tools: MATLAB, SolidWorks, SolidLab

Grading Evaluation: Students will be evaluated based on home-works (40%), class participation (5%), midterm exam (20%), a project (15%) and final exam (20%)

Class Participation: Students are highly encouraged to participate in the class. Your participation grade (of 5%) requires that you ask at least (a total of) 3 technical questions during class.

Grade Scale: Students will be graded on a relative basis. Typical grading is as follows (this can change from semester to semester): A (92-100), AB (86- 91.5), B (80 – 85.5), BC (72 – 79.5), C (60 – 71.5), D (50 – 59.5) and F (< 50).

Learning Outcomes: Students will be able to pose engineering optimization problems in a systematic manner, identify optimization tools to solve such problems, and finally, evaluate the numerical solution for correctness.