

## ME 335

### *Optimum Design*

This course is intended as a first comprehensive course on engineering Design Optimization for graduate students in all areas of engineering. The basic idea of the course is to introduce the design of engineering systems as a systematic and well-organized activity. Emphasis is on establishing a firm understanding of modern optimization. Many of the assignments are open-ended and subject to individual interpretation and creativity.

The following subjects will be covered in the class. Depending on the class interest, some subjects may be altered.

#### **Part I: Fundamentals of optimization**

1. Design formulation,
2. Graphical optimization
3. Mathematical foundation of formal optimization
4. Explicit optimization of functions without and with constraints
5. Model preparation: variable selection, monotonicity, boundedness, criticality, consistency

#### **Part II: Numerical methods in optimization**

1. Linear Programming
2. Non-linear programming methods
  - One directional search techniques
  - First order methods: Steepest Decent method, Conjugate Gradient
  - Second order methods: family of Newton methods
  - Penalty functions
3. Introduction to geometric programming

#### **Part III: Modern methods and applications**

1. Genetics Algorithms
2. Simulated Annealing
3. Finite Element based optimization

This course is followed by an advanced course in optimization which will cover functional optimization, shape optimization, Pareto optimality, optimization of very large scale systems, optimal control.