

Optimization

Hoonyoung Jeong

Department of Energy Resources Engineering

Seoul National University

What is Optimization?

- General prospect
 - ✓ Action of making the best or most effective use of a situation or resources.
- Mathematical prospect
 - ✓ Minimize $f(\mathbf{x})$
 - Objective function represents optimality of \mathbf{x}
 - \mathbf{x} consists of design variables (or decision variables)
 - ✓ Subject to constraints
 - $g_j(\mathbf{x}) \leq 0$
 - ❖ Inequality constraints
 - $h_k(\mathbf{x}) = 0$
 - ❖ Equality constraints
 - $\mathbf{x}_l \leq \mathbf{x} \leq \mathbf{x}_u$

Classification of Optimization Problems

- Linear / Non-linear objective function
 - ✓ Linear function: $L(ax+b) = aL(x) + b$
- Unconstrained / Constrained
- Single-objective / Multi-objective
- Continuous / Discrete design variables

Classification of Optimization Methods

- Global / Local
- Gradient-based / Non-gradient-based
- Stochastic gradient methods

Course Outline

- Gradient-based methods

- ✓ Unconstrained optimization methods

- Gradient descent method

- Conjugate gradient method

- Newton methods

- Quasi-Newton methods

- ❖ Davidon-Fletcher-Powell (DFP) method

- ❖ Broyden-Fletcher-Goldfarb-Shanno (BFGS) method

- Stochastic gradient methods

- ✓ Constrained optimization methods