

EE 512: OPTIMIZATION TECHNIQUES (3-0-0: 3)

Introduction

Historical Development; Engineering applications of Optimization; Art of Modeling; Objective function; Constraints and Constraint surface; Formulation of design problems as mathematical programming problems; Classification of optimization problems based on nature of constraints, structure of the problem, deterministic nature of variables, separability of functions and number of objective functions; Optimization techniques – classical and advanced techniques.

Linear Programming

Standard form of linear programming (LP) problem; Canonical form of LP problem; Assumptions in LP Models; Elementary operations; Graphical method for two variable optimization problem; Examples; Motivation of simplex method, Simplex algorithm and construction of simplex tableau; Simplex criterion; Minimization versus maximization problems; simplex method with artificial variables;

Optimization using Calculus

Stationary points - maxima, minima and saddle points; Functions of single and two variables; Global Optimum; Convexity and concavity of functions of one and two variables; Optimization of function of one variable and multiple variables; Gradient vectors; Examples; Optimization of function of multiple variables subject to equality constraints; Lagrangian function; Optimization of function of multiple variables subject to equality constraints; Hessian matrix formulation; Eigen values; Kuhn-Tucker Conditions; Examples.

Non Linear Programming:

Unconstrained optimization techniques, Direct search methods, Descent methods, 2nd order methods, constrained optimization, Direct and indirect methods, Kuhn Tucker conditions.

Dynamic Programming

Sequential optimization; Representation of multistage decision process; Types of multistage decision problems; Concept of sub optimization and the principle of optimality; Recursive equations – Forward and backward recursions; Computational procedure in dynamic programming (DP); Discrete versus continuous dynamic programming; curse of dimensionality in DP, example.

Text Books & References

1. S S Rao, "Engineering Optimization: Theory and Practice", New Age International (P) Ltd.
2. Suresh Chandra, Jaydeva, "Numerical Optimization with Applications", Narosa publisher.
3. Edwin K P Chong, Stanislaw H Zak, "An Introduction to Optimization", John Wiley.
4. Mohan C Joshi, Kannan M Moudgalya, "Optimization Theory and Practice", Narosa publisher.