

Modern Optimization Techniques

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MSc Course
Second Semester
2020-2021

Modern Computer Architecture

MSc Course

Second Semester

CH1

Review and Introduction

“Find The Best, Discard The Rest”

Goals

- Learning classical and modern optimization techniques;
- acquiring an ability to apply to engineering problems;
- acquiring abroad understanding of the importance, scope, and current state of the optimization theory.

Learning Outcomes

- An overall understanding of the importance of optimization in engineering as a **mathematical tool**.
- Skills to implement classical optimization techniques in *real engineering problems*.
- An understanding of modern optimization techniques.
- Ability to use various software platforms involving optimization.
- An understanding of the *limitations and applicability* of optimization techniques.

Introduction

- Optimization is the act of obtaining the best result under given conditions/circumstances (*Best Possible*)
- Optimization can be defined as the process of *finding the conditions that give the maximum or minimum of a function*.
- The optimum seeking methods are also known as *mathematical programming techniques* and are generally studied as a part of *operations research*.
- *Operations research* is a branch of mathematics concerned with the application of scientific methods and techniques to decision making problems and with establishing the best or optimal solutions.

Applications

Some representative applications include:

- **Optimal routing in communication networks.**
- **Neural network training and applications in recent programming techniques.**
- **Pattern recognition and classification.**
- **Optimal resource allocation in manufacturing and communication systems.**
- **Applications of semidefinite programming in combinatorial optimization, control theory, and design of chips.**
- **Estimation and system identification.**
- **Optimal control problems (e.g., rocket launching).**

Course Content

- Introduction to optimization

Classification of Optimization Algorithms

What is an optimum?

Single Objective Functions

Multiple Objective Functions

Constraint Handling

The Structure of Optimization

Problems in Optimization

- Classical Optimization: Constrained Multivariable Optimization

Classical Optimization: Single-Variable Optimization, Unconstrained Multivariable Optimization Linear, quadratic, and geometric programming

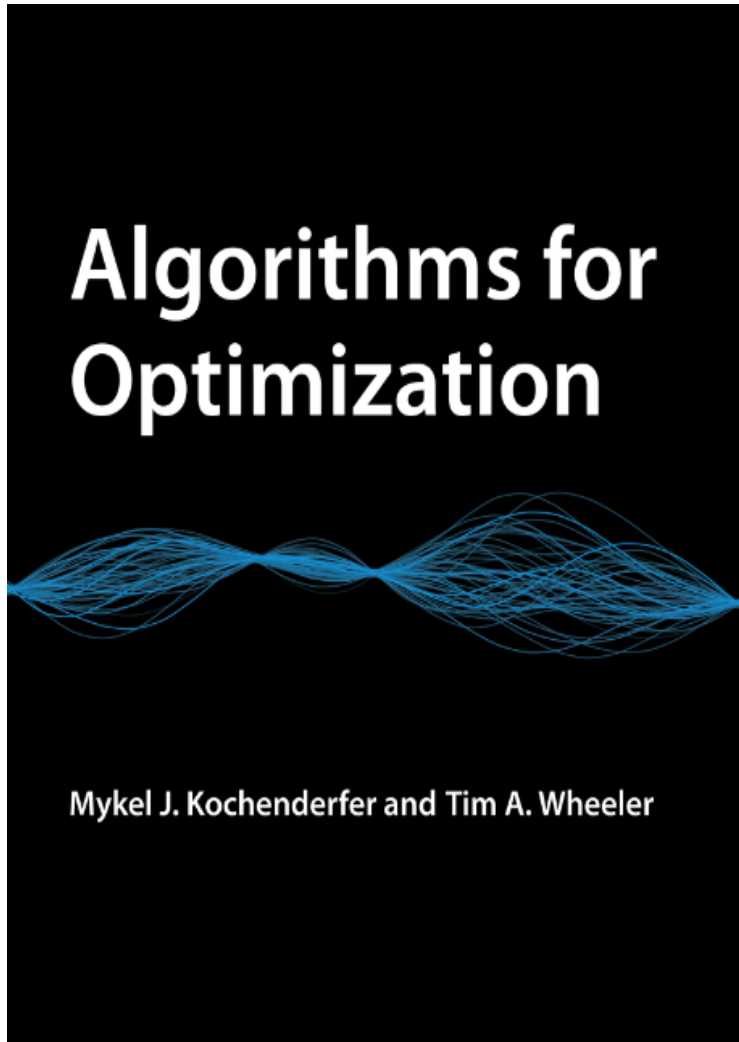
- Theoretical Concepts of Nonlinear Programming
- Introduction to Modern Methods: GA, Swarm Opt., Ant Colony Opt.
- Hill Climbing
-

Text Books

Mykel J. Kochenderfer
Tim An Wheeler

Algorithms for Optimization

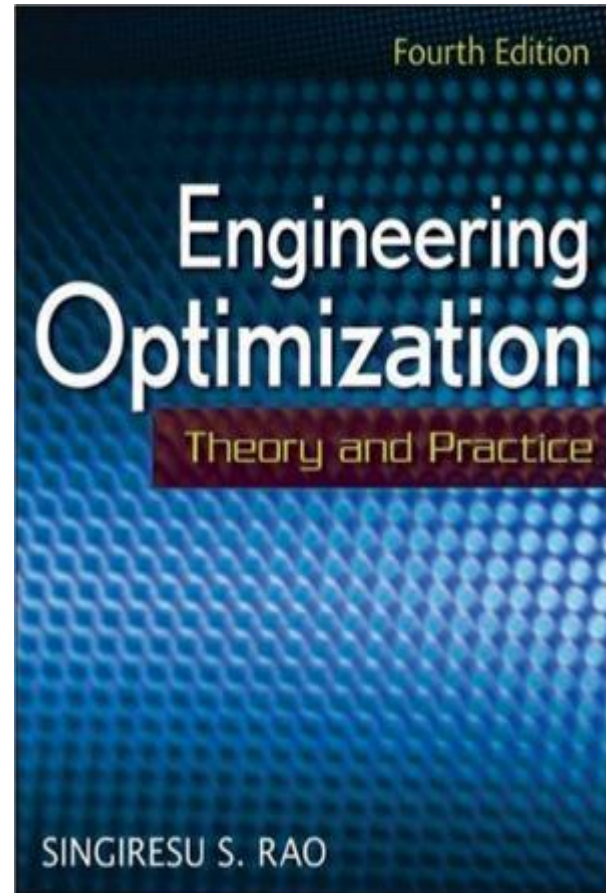
2019



Text Books

Singeresu S. Rao

Engineering Optimization
Theory and Practice

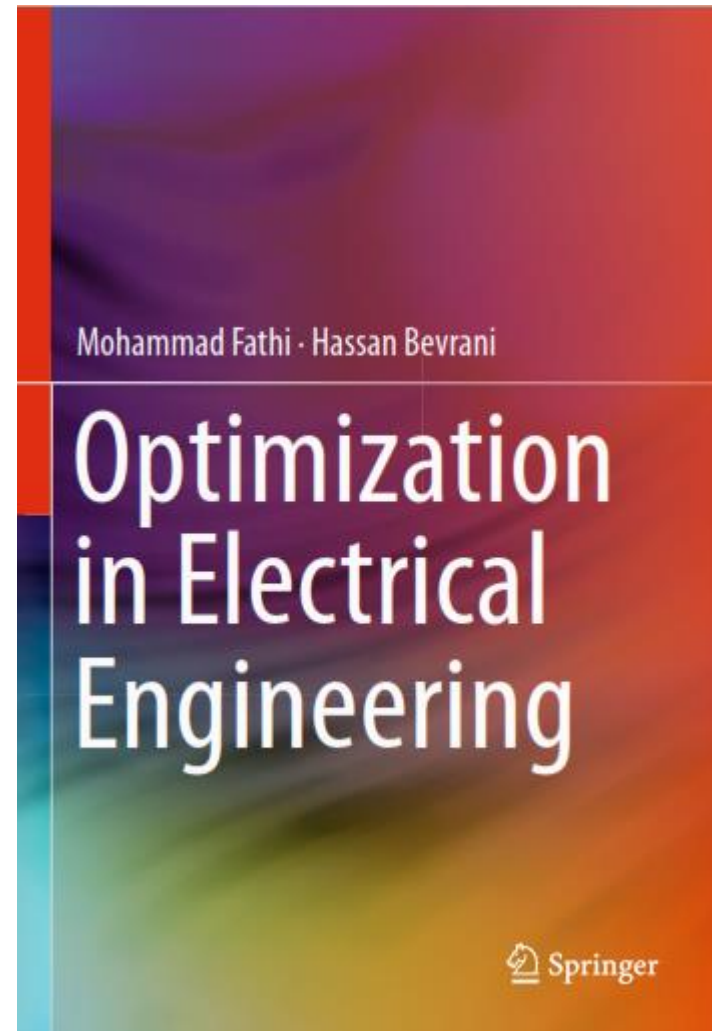


Text Books

Mohammad Fathi

Hasan Bevrani

Optimization in Electrical
Engineering

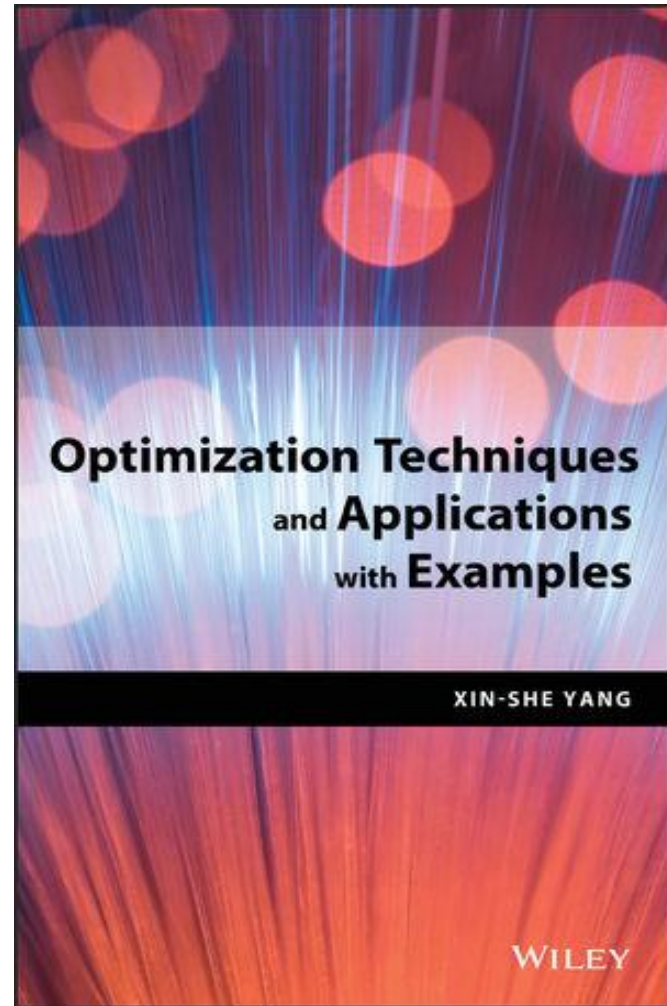


Text Books

Optimization Techniques and
Applications
with Examples

Xin-She Yang

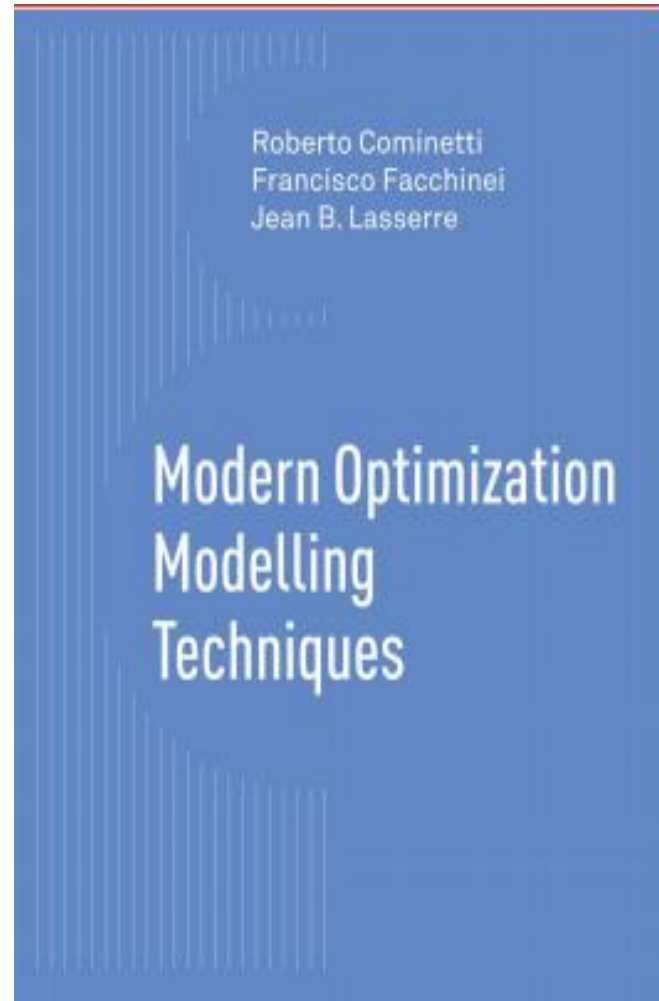
2018



Text Books

Roberto Cominetti
Francisco Facchinei
Jean B. Lasserre

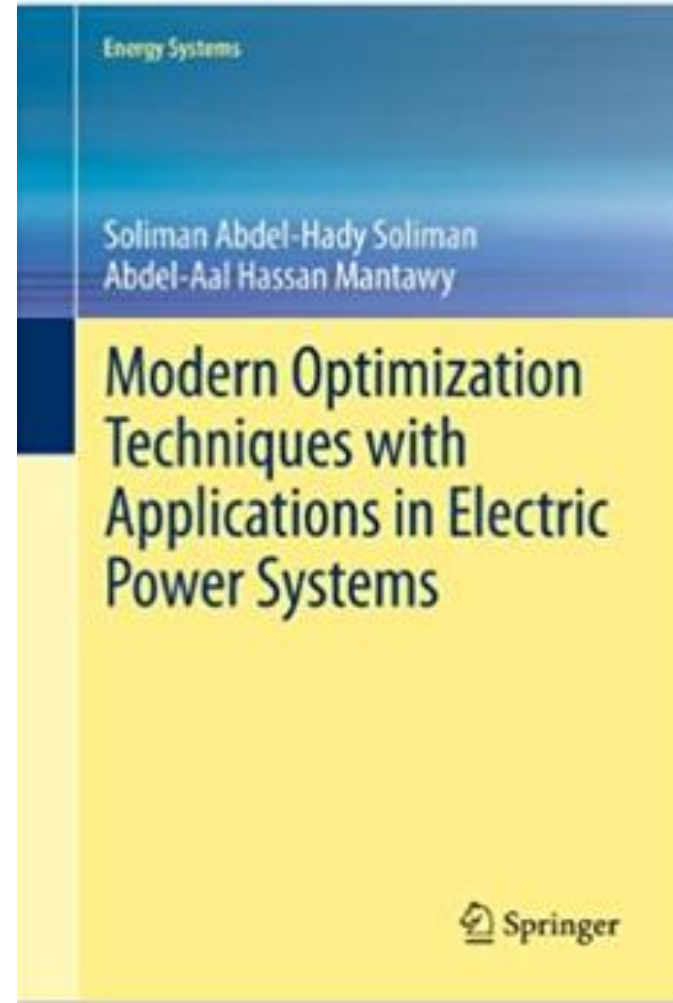
Modern Optimization
Modelling Techniques



Text Books

Soliman Abdel-Hady Soliman
Abdel-Aal Hassan Mantawy

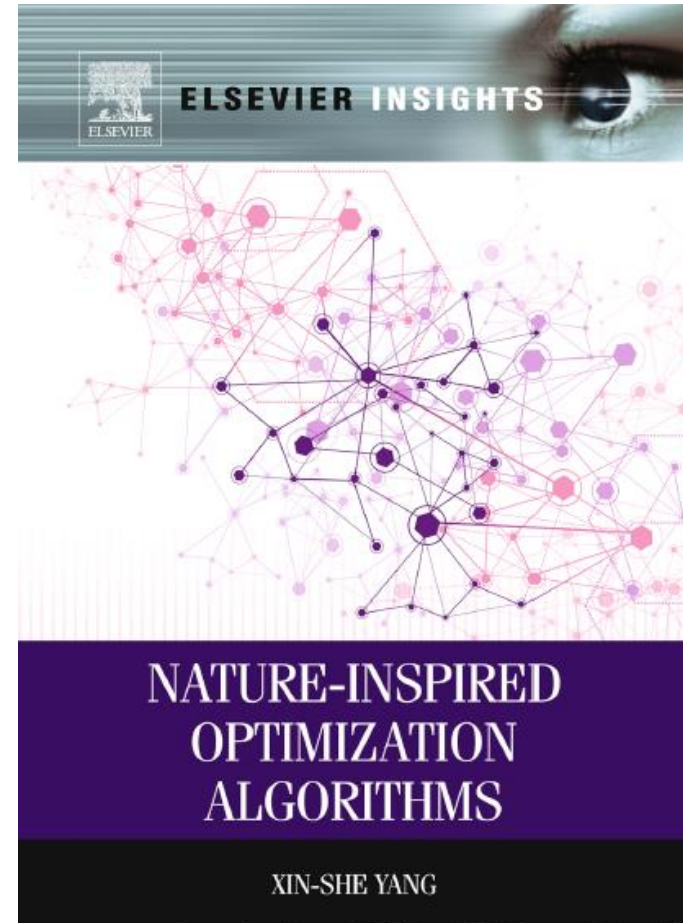
Modern Optimization
Techniques with Applications
in Electric Power Systems



Text Books

Xin-She Yang

Nature-Inspired
Optimization Algorithms



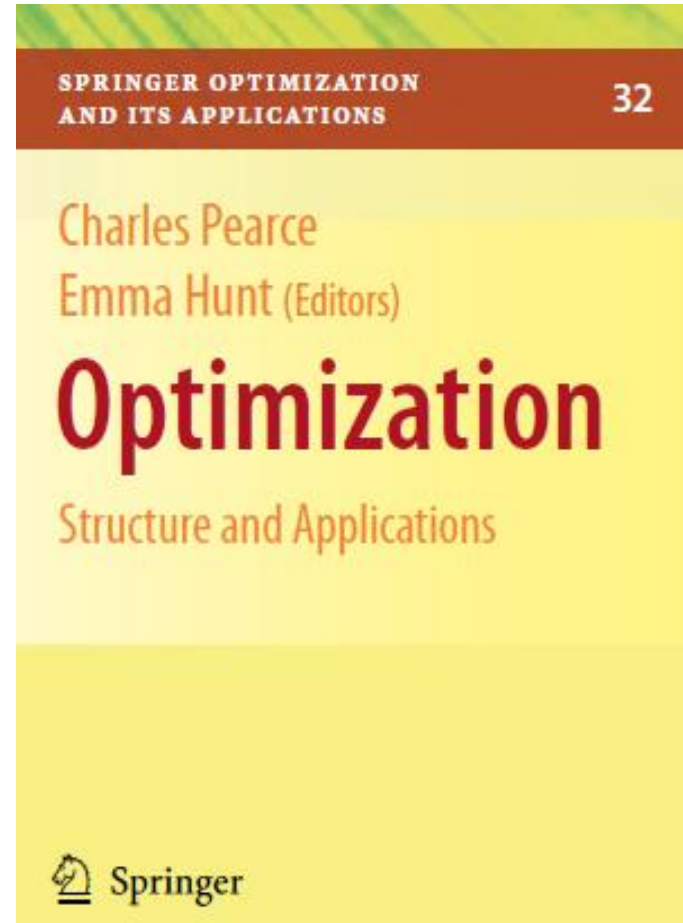
Text Books

Charles Pears

Emma Hunt

Optimization

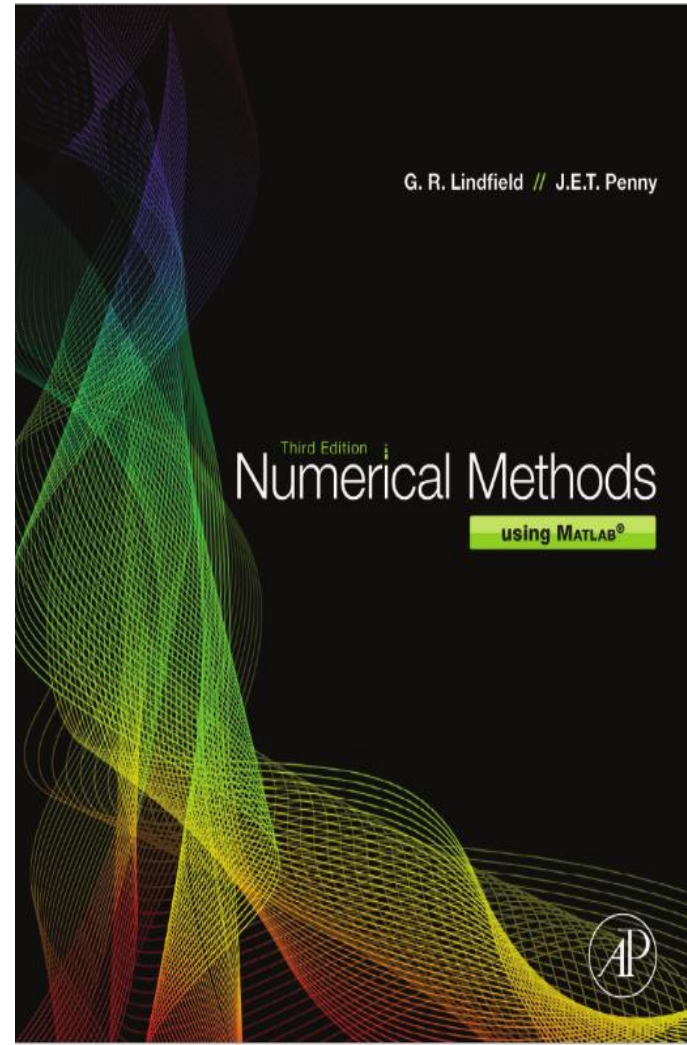
Structure and Applications



Text Books

G.R. Lindfield
J.E.T. Penny

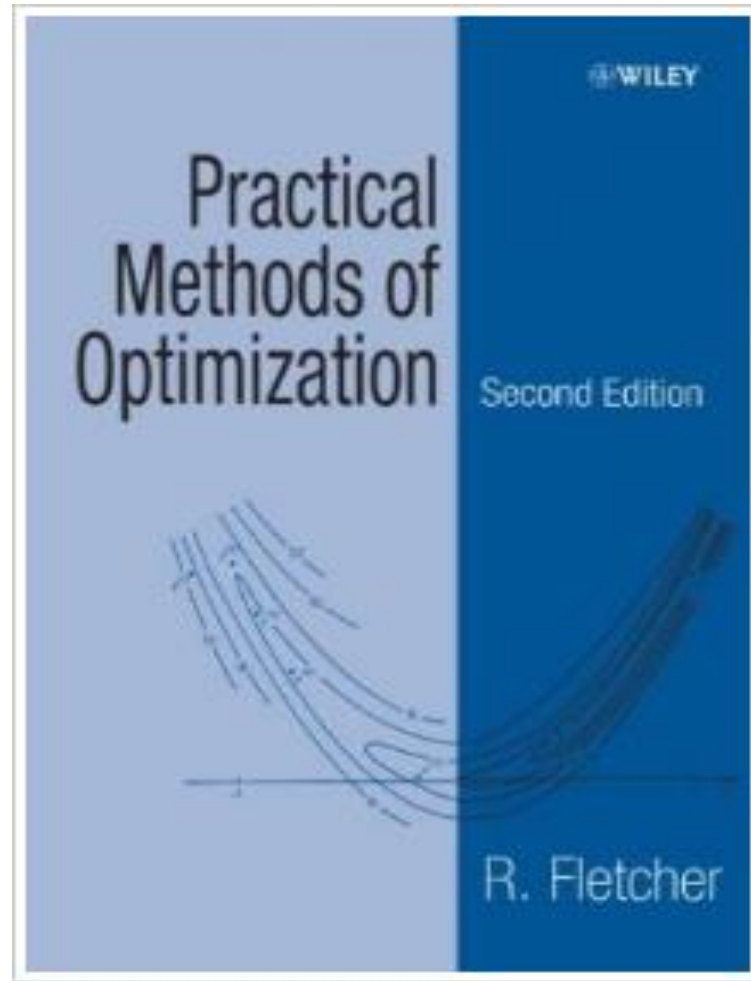
Numerical Methods
Using MATLAB



Text Books

R. Fletcher

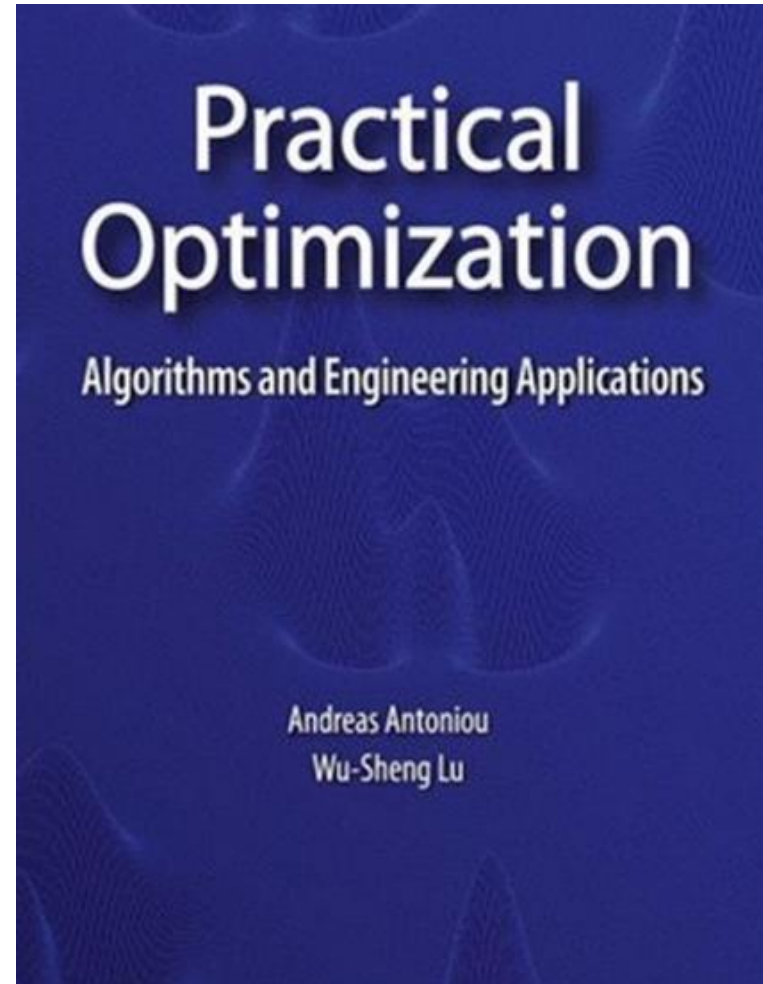
Practical Methods in
Optimization



Text Books

Andreas Antoniou
Wu-Sheng Lu

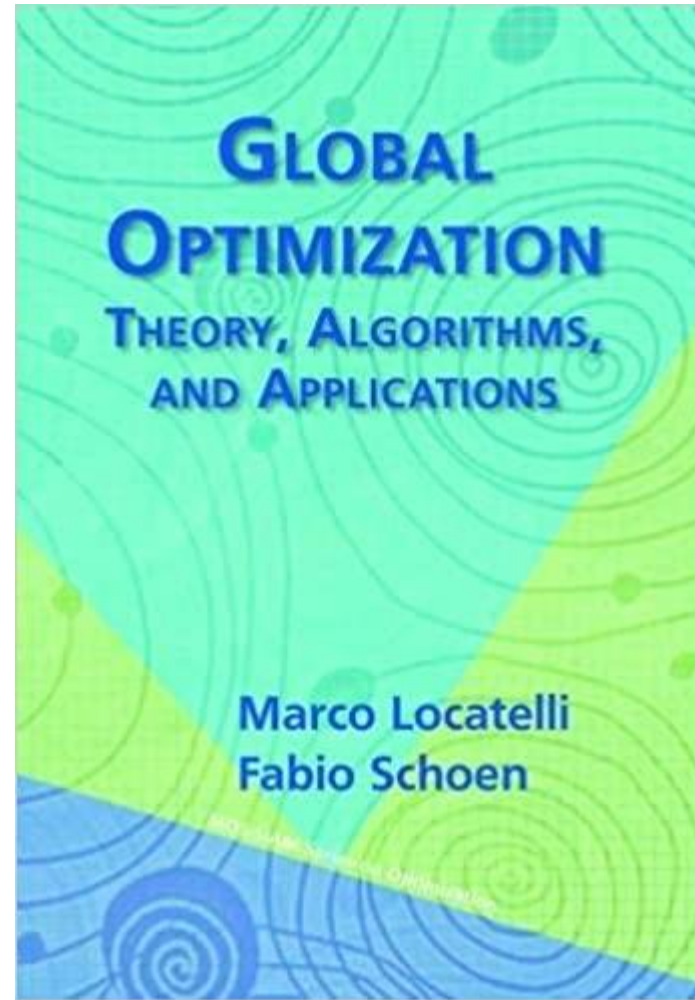
Practical Optimization
Algorithms and Engineering
Applications



Text Books

Marco Locatelli
Fabio Schoen

Global Optimization
Theory Algorithms, and
Applications



Modern Optimization Techniques

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END of CH1

Review and Introduction