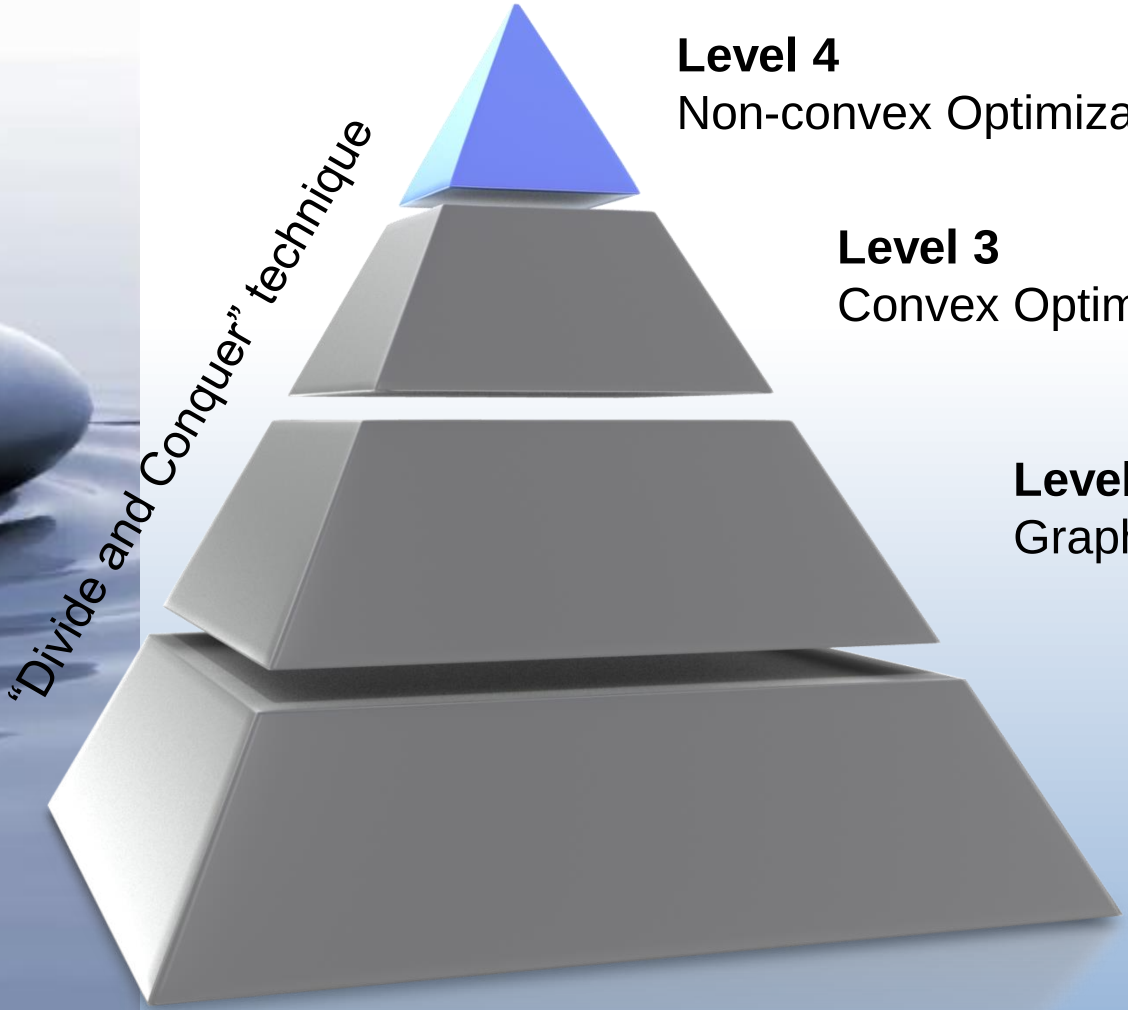
Theoritical Models for Computing: Introduction

Presenter: Dr. Ha Viet Uyen Synh.

How to solve a problem in computer science?



“Divide and Conquer” technique

Level 4
Non-convex Optimization

Level 3
Convex Optimization

Level 2
Graphs

Level 1
“Exhausted check” method

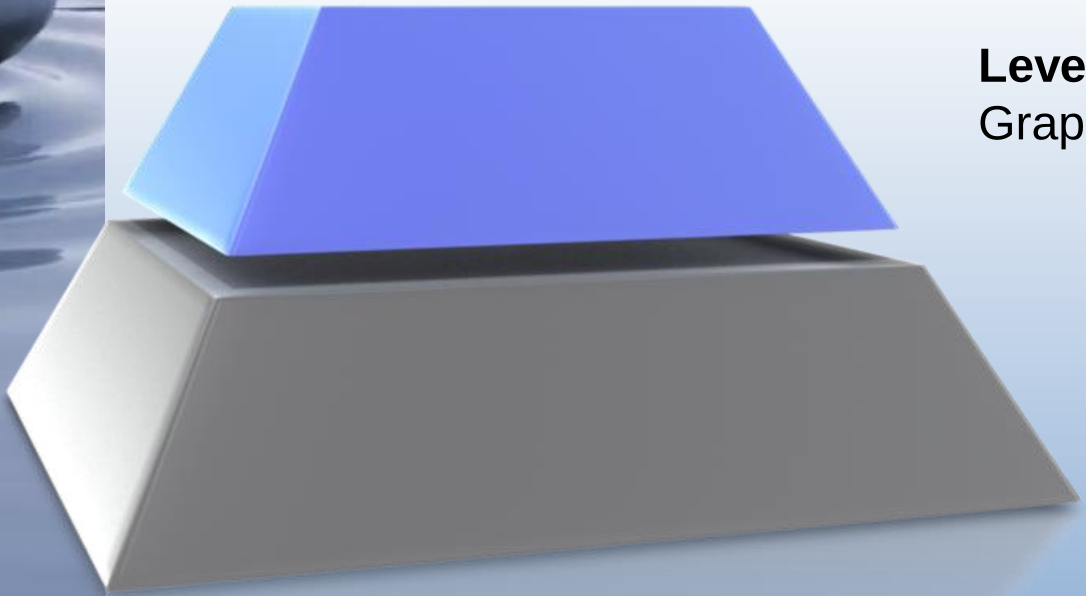
How to solve a problem in computer science?

The number of states is small, we can check all of them fast.

Level 1
“Exhausted check” method

How to solve a problem in computer science?

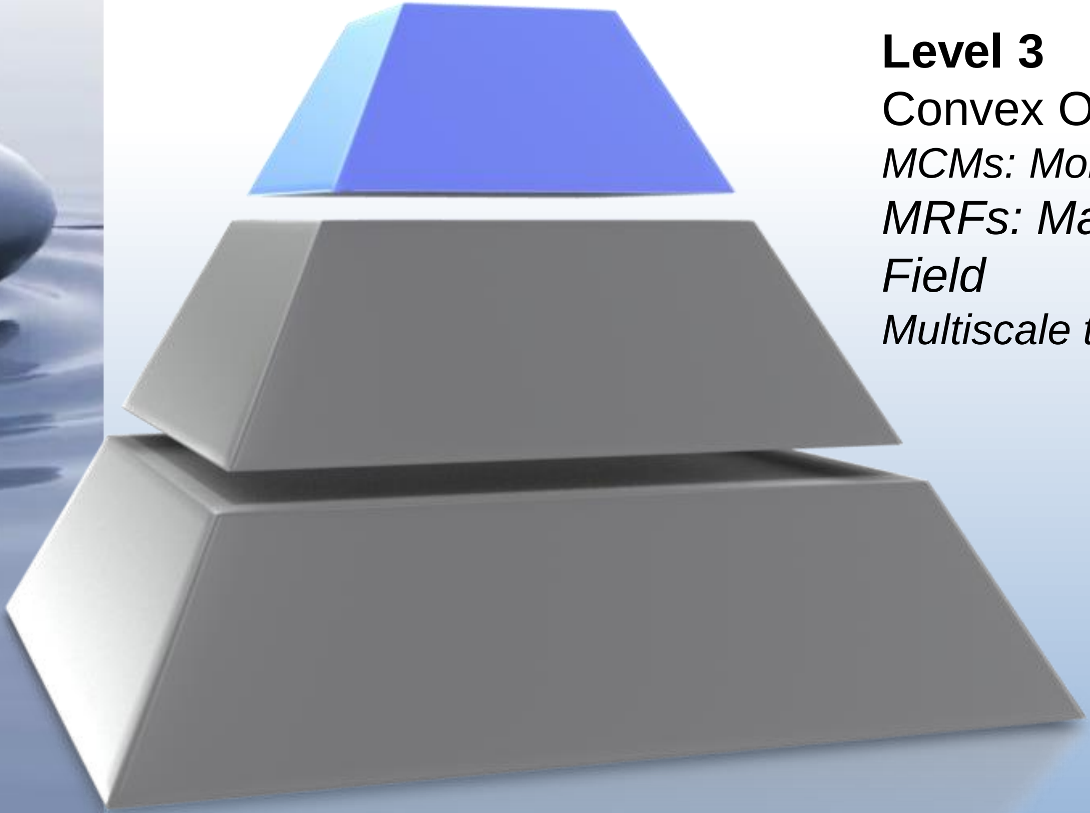
The number of states is large, we spend a lot of time to check all of them.



Level 2
Graphs

How to solve a problem in computer science?

The number of states is huge, we can’t check all of them. But there is a mathematical model for its domain.



Level 3

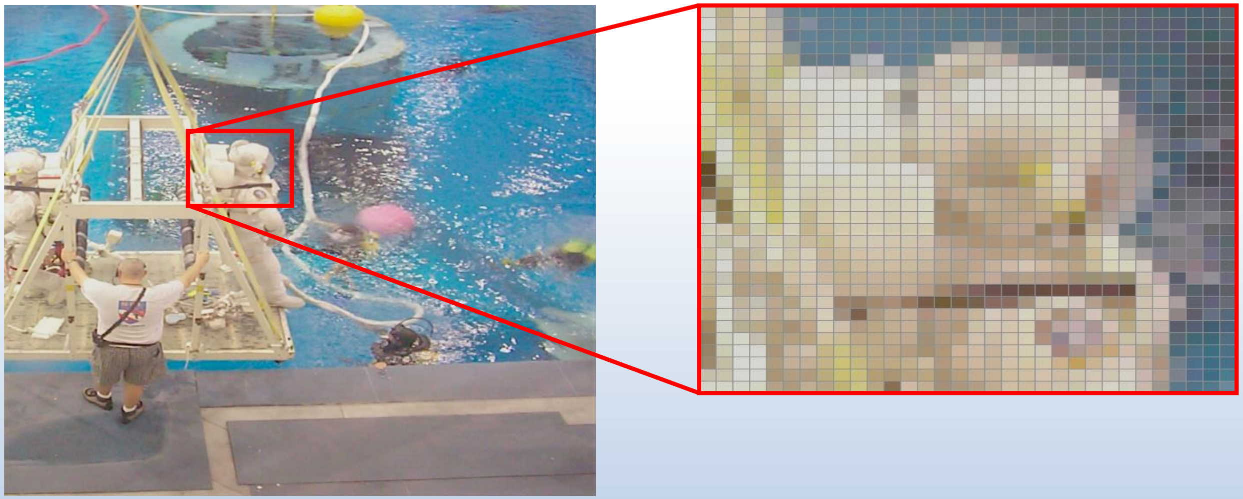
Convex Optimization

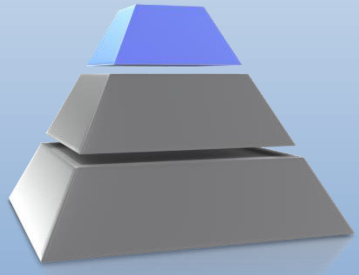
MCMs: Monte Carlo Model

MRFs: Markov Random Field

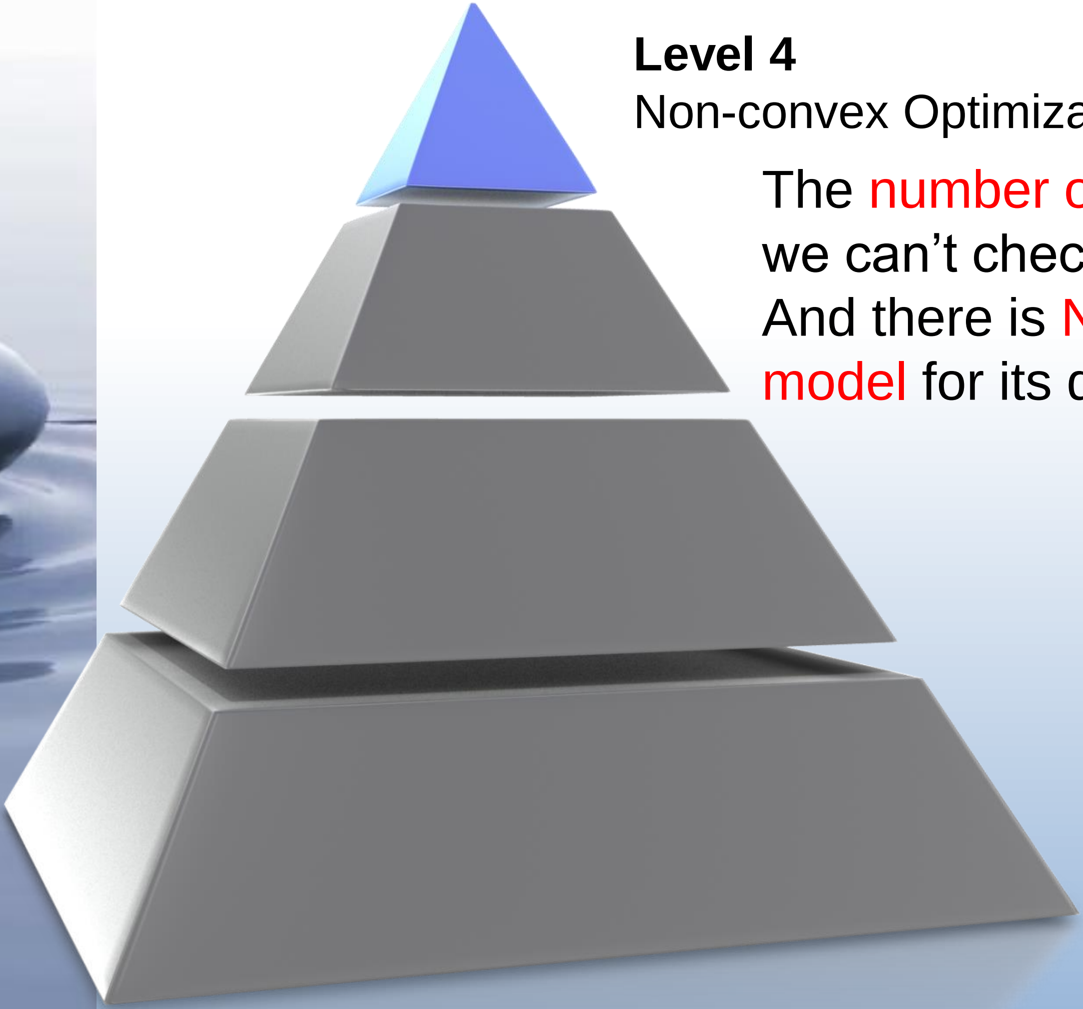
Multiscale technique

Discrete Prob. Vs Relational Prob.





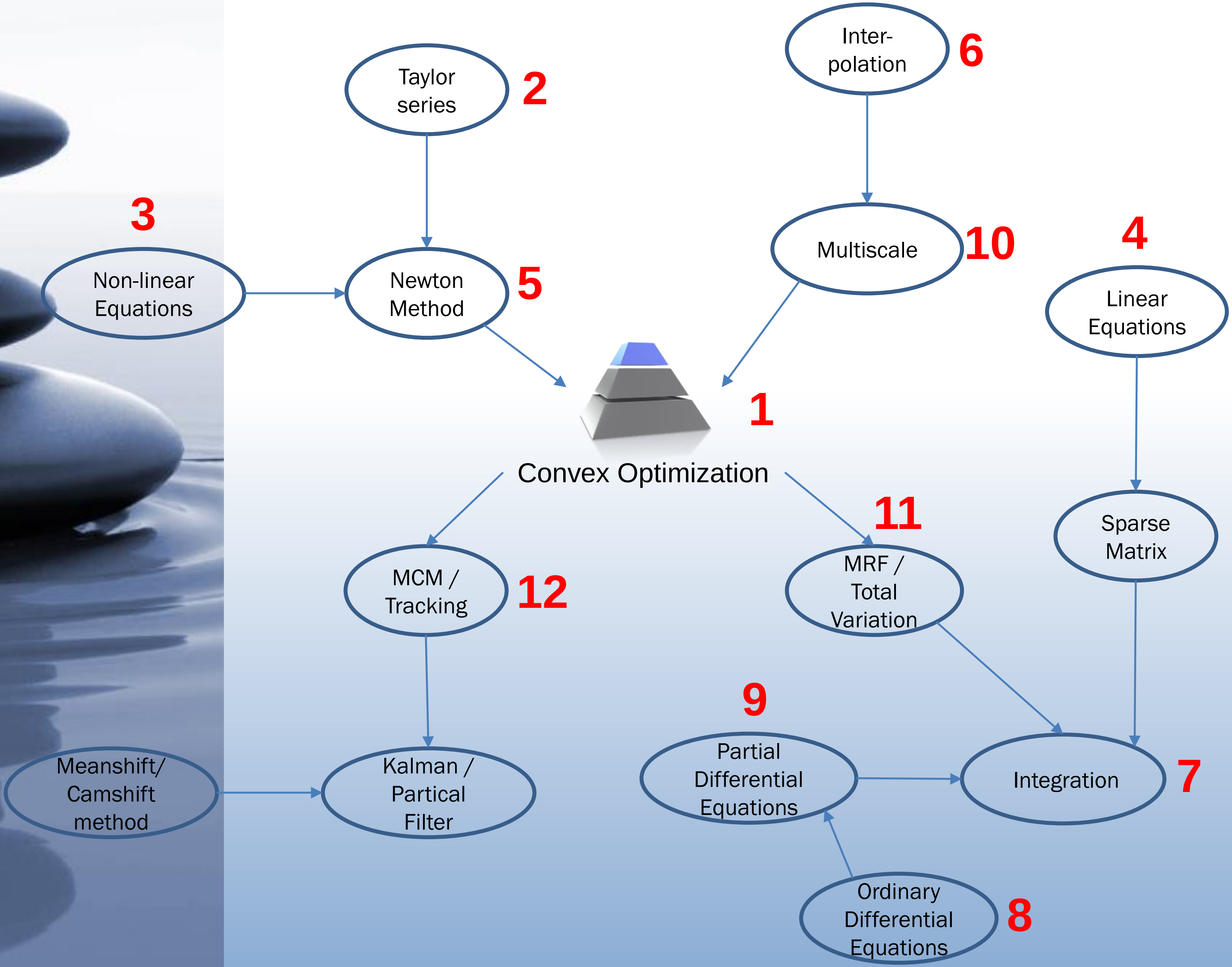
How to solve a problem in computer science?



Level 4
Non-convex Optimization

The number of states is huge, we can't check all of them. And there is NO mathematical model for its domain.

There are some dilemmas in the problem



Inter-polation 6

Taylor series 2

Multiscale 10

3 Non-linear Equations

Newton Method 5

4 Linear Equations

1

Convex Optimization

11 MRF / Total Variation

Sparse Matrix

MCM / Tracking 12

9 Partial Differential Equations

Integration 7

Meanshift/ Camshift method

Kalman / Partical Filter

Ordinary Differential Equations 8

Course Material

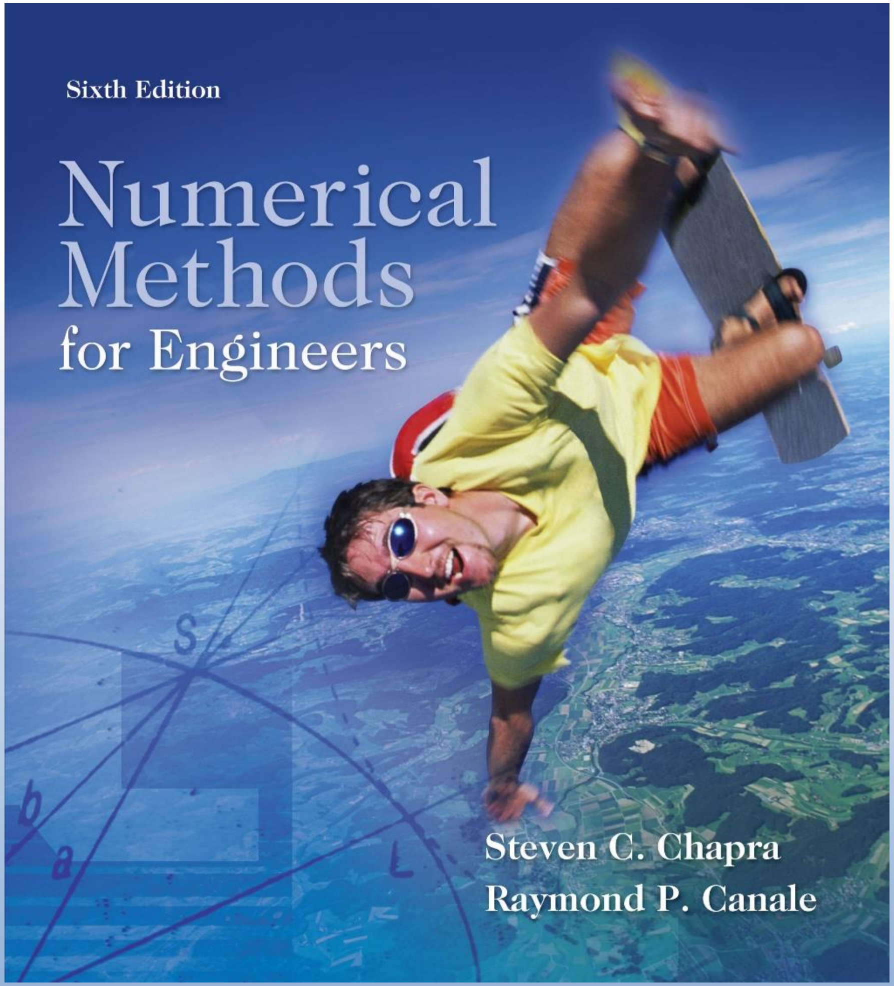
Environment: Visual C++ 2k12

Library: OpenCV 3.0

Blackboard

Textbook #1

Numerical Methods for Engineers 6th Edition



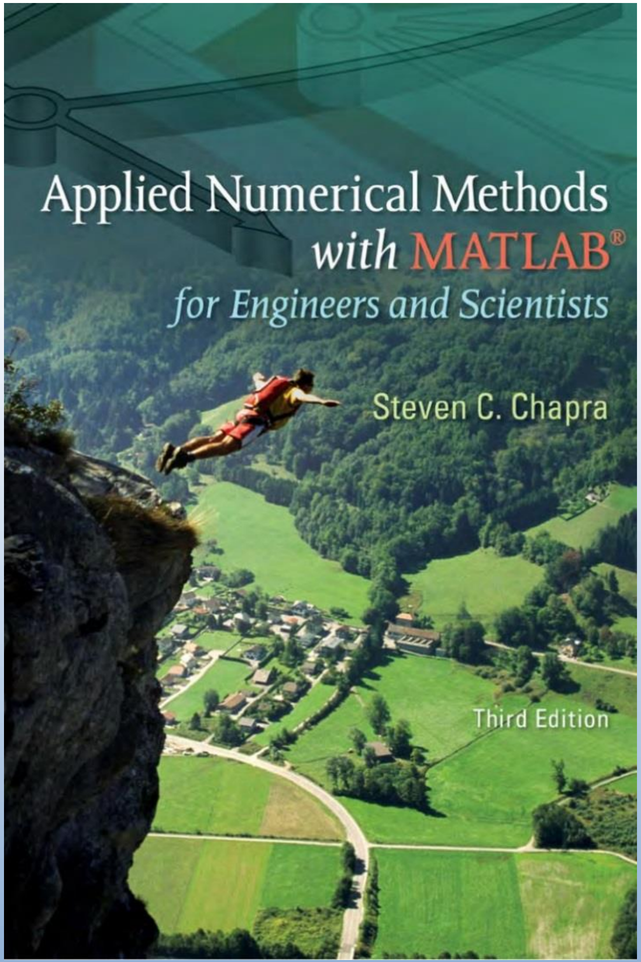
Sixth Edition

Numerical Methods for Engineers

Steven C. Chapra
Raymond P. Canale

Textbook #2

Applied Numerical Methods with MATLAB for Enginneers and Scientists



Applied Numerical Methods
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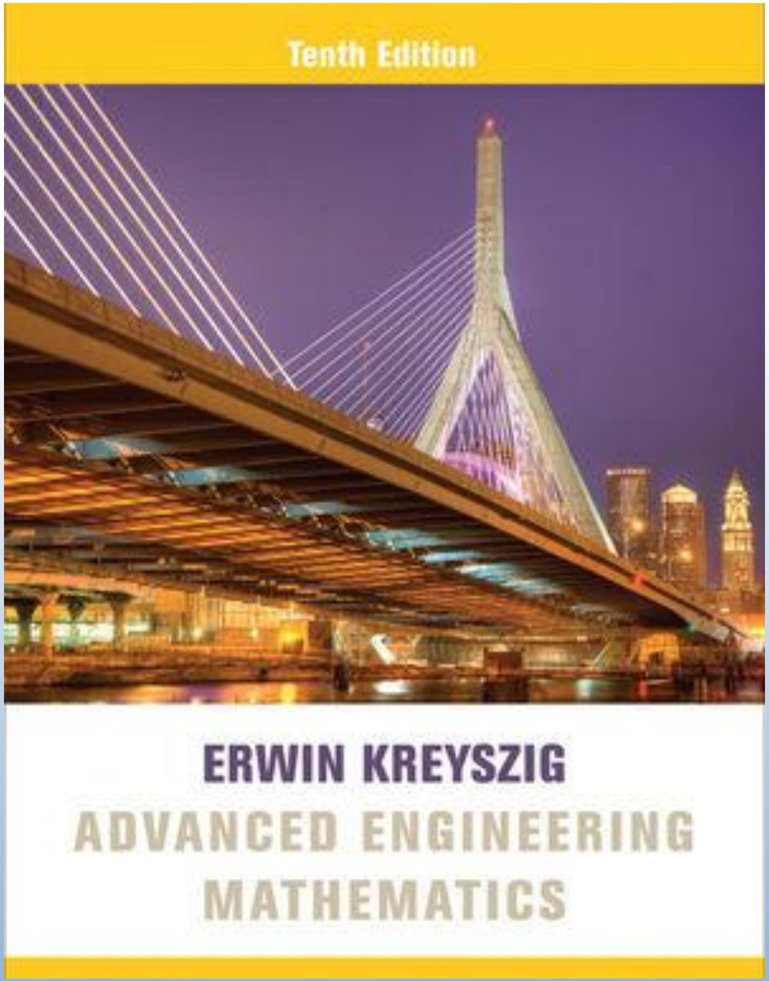


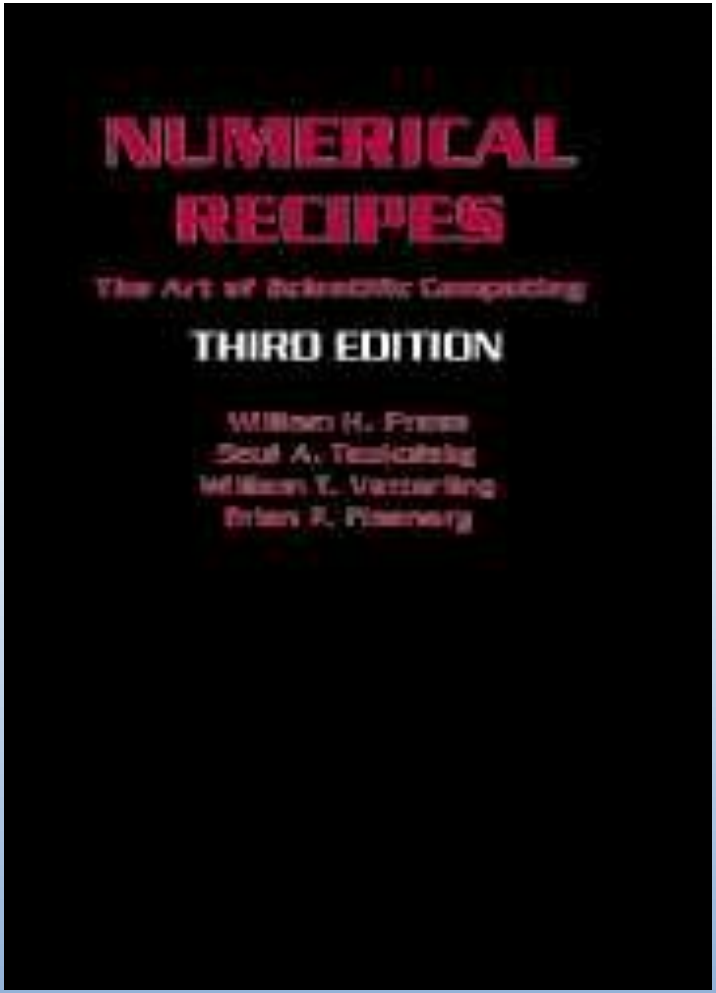
Tenth Edition

ERWIN KREYSZIG

ADVANCED ENGINEERING MATHEMATICS

Textbook #4

Numerical Recipes: The Art of Scientific Computing



NUMERICAL RECIPES

The Art of Scientific Computing

THIRD EDITION

Grading

Quiz: 10%

Lab. Assignments: 20%

Midterm Test: 30% (open-book test)

Final Exam: 40% (open-book test)

Any Questions?

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