Sketch of Numerical Methods

Weinan E\textsuperscript{1,2} and Tiejun Li\textsuperscript{2}

\textsuperscript{1}Department of Mathematics, Princeton University, Princeton, NJ 08544, USA
Email: weinan@princeton.edu

\textsuperscript{2}School of Mathematical Sciences, Peking University, Beijing 100871, P.R. China
Email: tieli@pku.edu.cn

Lect1 Introduction

Chap1 Solving linear system
Lect2 Direct methods for solving linear system
Lect3 Iterative methods for solving linear system
Lect4 Eigenvalue problem for linear system
Lect5 Singular value decomposition and applications (PCA)

Chap2 Optimization
Lect6 Linear programming
Lect7 Nonlinear programming
Lect8 Integer programming and other topics

Chap3 Solving nonlinear system
Lect9 Solving nonlinear system

Chap4 Approximation of functions
Lect10 Polynomial interpolation (with ENO)
Lect11 Fast Fourier Transform (FFT)
Lect12 Wavelets and applications

Chap5 Numerical integration
Lect13 Numerical integration: basics
Lect14 Numerical integration: adaptive and Gaussian quadrature

Chap6 Monte Carlo methods
Lect15 Generation of RVs
Lect16 Monte Carlo integration
Lect17 Metropolis algorithm and SSA
Lect18 Simulated annealing and Genetic algorithm

Chap7 Numerical ODEs
Lect19 One-step method for numerical ODEs
Lect20 Multi-step method and stability condition
Lect21 Stability regions and stiff ODEs
Lect22 Symplectic algorithm