

This file is the table of contents for lectures notes prepared by Moody Chu.

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+ The notes will be updated from time to time. Comments or suggestions
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+ are welcomed.
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+ Last updated: 9/15/16
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Chapter 1. Error Analysis

- Measurement of Errors
- Representation of Numbers
- Stability and Conditioning

Chapter 2. System of Linear Equations --- Direct Approach

- General Consideration
- Gaussian Elimination
 - Mathematical Pivoting
- Error Analysis
- Orthogonal Decomposition

Chapter 3. System of Linear Equations --- Iterative Approach

- General Consideration
- Relaxation Methods
- Acceleration Methods
- Conjugate Gradient Methods

(Additional supplementary comes from Tim Kelley's notes on GMRES.)

Chapter 4. Least Squares Problems

- Linear Least Squares Problems
- Singular Value Decomposition

Chapter 5. Algebraic Eigenvalue Problems

- Location and Perturbation Results
- Power Methods and Inverse Power Methods
- QR Algorithm

Chapter 6. System of Nonlinear Equations

- Theory of Newton-Raphson Method
- The Broyden Method
- Sturm Sequence
- Methods for Polynomials

Chapter 7. Approximation Theory

- Lagrangian Interpolation Formula
- Newton's Interpolation Formula
- Osculatory Interpolation
- Spline Interpolation
- Trigonometric Interpolation
- Fast Fourier Transform

Chapter 8. Differentiation and Integration

- Numerical Differentiation
- Richardson Extrapolation
- Newton-Cotes Quadrature
- Gaussian Quadrature
- Weight Functions and Special Integrals
- Adaptive Integration

Chapter 9. Numerical Ordinary Differential Equations - Initial Value Problems

- Linear Multi-step Methods
- Stability Theory of Multi-step Methods
- Predictor and Corrector Methods
- Runge-Kutta Methods

Chapter 10. Numerical Ordinary Differential Equations - Boundary Value Problems

- Ordinary Shooting Method --- An Example
- Multiple Shooting Methods --- The Set-up
- Solving Nonlinear Equations --- Homotopy Method
- Finite Difference Method
- Finite Element Methods