Lecture 7

Linear Systems, Eigenvalue Problem, and Data Analysis

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This PowerPoint Notes Is Based on the Textbook '***An Introduction to Computer Simulation Methods : Applications to Physical Systems***', 2nd Edition, Harvey Gould and Jan Tobochnik, Addison-Wesley(1996);

"A First Course in Computational Physics"; "Numerical Recipes";

"Elementary Numerical Analysis"; "Computational Methods in Physics and Engineering".

Required for Lecture 7

- Know how to solve linear equations.

- Familiar with library routines, e.g., LAPACK.

- Know how to obtain eigenvalues.

- Know how to perform data analysis and approximating curves.

- Familiar with some iterative approaches

Linear Systems

- Systems of Linear Equations
- Matrix Arithmetic
- Library Routines
- Gaussian Elimination
- The LU Factorization
- The Eigenvalue Problem
- Iteration Methods
- Singular Value Decomposition (SVD)
- Errors in Solving Linear Systems

Data Modeling

- Linear LSQ

- Weighted LSQ, Estimated Uncertainties

- Polynomial LSQ

- Orthogonal Polynomials LSQ

- General LSQ

- Nonlinear LSQ

See lecture note
Data_Modeling.pdf

Interpolation and Approximation

- Interpolation

- Cubic Splines and Interpolation

- Derivatives and Integration

- The Best Approximation Problem

See lecture note
Interpolation_Approximation.pdf

Lecture 7 Review

- Linear Systems.

- Data Modelling

- Interpolation and Approximation