

Part 1 - Modeling, Computers, and Error Analysis

- 1) Mathematical Modeling and Engineering Problem Solving
- 2) Programming and Software
- 3) Approximations and Round-Off Errors
- 4) Truncation Errors and the Taylor Series

Part 2 - Roots of Equations

- 5) Bracketing Methods
- 6) Open Methods
- 7) Roots of Polynomials
- 8) Case Studies: Roots of Equations

Part 3 - Linear Algebraic Equations

- 9) Gauss Elimination
- 10) LU Decomposition and Matrix Inversion
- 11) Special Matrices and Gauss-Seidel
- 12) Case Studies: Linear Algebraic Equations

Part 4 - Optimization

- 13) One-Dimensional Unconstrained Optimization
- 14) Multidimensional Unconstrained Optimization
- 15) Constrained Optimization
- 16) Case Studies: Optimization

Part 5 - Curve Fitting

- 17) Least-Squares Regression
- 18) Interpolation

19) Fourier Approximation

20) Case Studies: Curve Fitting

Part 6 - Numerical Differentiation and Integration

21) Newton-Cotes Integration Formulas

22) Integration of Equations

23) Numerical Differentiation

24) Case Studies: Numerical Integration and Differentiation

Part 7 - Ordinary Differential Equations

25) Runge-Kutta Methods

26) Stiffness and Multistep Methods

27) Boundary-Value and Eigenvalue Problems

28) Case Studies: Ordinary Differential Equations

Part 8 - Partial Differential Equations

29) Finite Difference: Elliptic Equations

30) Finite Difference: Parabolic Equations

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32) Case Studies: Partial Differential Equations

Appendix A - The Fourier Series

Appendix B - Getting Started with Matlab

Appendix C - Getting Started with Mathcad

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