

**TOPICS IN
NUMERICAL ANALYSIS FOR ENGINEERING APPLICATIONS**

Chapter 0. Linear Algebra

Operation counts, Banded matrices and Gauss elimination, LU decomposition, Round-off error, Ill-conditioned matrices, Stiffness, Cayley–Hamilton theorem

Chapter 1. Interpolation

Lagrange interpolation, Spline interpolation

Chapter 2. Numerical Differentiation – Finite Differences

Taylor table, Modified wavenumber, Padé approximation

Chapter 3. Numerical Integration

Trapezoidal rule, Simpson’s rule, Error analysis, Romberg integration, Richardson extrapolation, Adaptive quadrature, Gauss quadrature

Chapter 4. Numerical Solution of Ordinary Differential Equations

Initial value problems, Accuracy, Stability, Implicit methods, Linearization, Runge–Kutta methods, Multi-step methods, Boundary value problems

Chapter 5. Numerical Solution of Partial Differential Equations

von Neumann stability analysis, Modified wavenumber analysis, Approximate factorization, Alternating direction implicit methods, Iterative methods for elliptic PDE’s

Chapter 6. Discrete Transform Methods

Discrete Fourier series, Aliasing error, Fourier spectral numerical differentiation, Discrete Chebyshev transform