

Numerical Analysis

- Vector space
 - Normed spaces
 - Inner product, norms
 - Fixed point theorem
 - Best approximation
- Linear system
 - Direct methods: Gauss elimination, LU (LR) and QR, Special types matrices, Banded System
 - Iterative methods: Jacobi and Gauss-Seidel methods, SOR, steepest descent, conjugate gradient
- Nonlinear system
 - Solution of nonlinear scalar equations
 - (a) fixed point method
 - (b) Newton's method and its variations, estimate of rate of convergence; error analysis
 - (c) secant and bisection method
 - Iterative methods: Successive and Newton's methods
- Eigenvalue problem
 - Existence and estimation
 - Numerical algorithms: Rayleigh quotient, Jacobi method, power iteration, inverse power, deflation, Givens and Householder transform and QR algorithm
 - Singular value decomposition
- Interpolation
 - Polynomial interpolation: Lagrange and Newton polynomials; error terms
 - Trigonometric interpolation: trig-interpolation formula; discrete Fourier transform
 - Splines: B-splines; cubic spline
- Numerical integration
 - Convergence
 - Interpolatory quadrature
 - Gaussian quadrature
- Initial Value Problems for ODEs
 - Forward/backward Euler method, Runge-Kutta Methods and linear multistep methods:
 - * local truncation errors
 - * consistency
 - * zero-stability and absolute stability
 - * consistency+stability \rightarrow convergence