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| **NUMERICAL ANALYSIS** |
| **1. Rootfinding:**Bisection method, Newton's method, Secant method, fixed-point algorithms, convergence of algorithms, Solution of Nonlinear System of equations, Newton's method for Nonlinear Systems. **2.Solutions of Linear System of Equations:**Direct methods, Gauss elimination, pivoting, LU factorization, Cholesky factorization, error analysis.  Iterative Methods, Jacobi and Gauss-Seidel method, convergence of iterative methods. **3.Interpolation:** Polynomial interpolation (Lagrange and Hermite interpolations),  error of polynomial interpolation, splines ( piecewise interpolation), Chebychev interpolation **4.Approximation:**Approximation in L-inf norm, Existence and and Uniqueness of best polynomial approximation in L-inf L\_2, Oscillation theorem. Minimax approximation to x^(n+1). Gram-Schmidt orthogonalization, Orthogonal polynomials and least-squares approximations. Construction of best approximation  polynomials in L-inf  and L\_2. **5.Numerical Integration:**Interpolatory numerical integration, Newton-Cotes formulas, Gaussian Quadrature, errors of quadrature formulas. **6. Numerical Differentiation:**Approximating  to Function Derivatives, Finite Difference operators and their truncation error. Difference Equations and their solution **7.Numerical Solution of Ordinary Differential Equations:** Numerical methods for initial value problems: One-step methods (Taylor Series method, Runge-Kutta methods), Linear multistep methods (explicit and implicit methods),  Absolute and zero stability. Convergence analysis. Two point boundary value problems.  **Main References:**   1. Kendall E. Atkinson, “ An Introduction to Numerical Analysis” 2rd Ed., John Wiley  & Sons. Suggested Sections: 2.2-2.5, 3.1-3.2-3.3-3.4-3.6-3.7-4.3-4.4-4.5, 5.2-5.3- .4, 6.2 to 6.6, 6.8, 6.10, 8.1 to 8.7 2. Endre Suli and David F. Mayers, “ An Introduction to Numerical Analysis”, Cambridge University Press, 2003 3. A. Quarteroni, R. Sacco, F. Valeri, “Numerical Mathematics”, 2000, Springer-Verlag New York, Inc. 4. Numerical Solution of Ordinary Differential Equations E. S¨uli, August 12, 2010.   **Suggested References:**   1. 1.K.Atkinson and W.Han, “Elementary Numerical Analysis”, 3rd Ed., Wiley 2004. 2. R. J. LeVeque, Finite Difference Methods for Ordinary and Partial Differential Equations, Steady State and Time Dependent Problems, SIAM, 2007. 3. D. Kincaid and W. Cheney, “Numerical Analysis: Mathematics of Scientific Computation” 3rd Ed., Brooks/Cole, 2002. Suggested Sections: 3.1-3.4, 4-0 to 4.6, 6.0-6.4, 6.7-6.9, 6.12, 7.1-7.4, 8.0-8.5. |