|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Taylor**  **Series:** | |  | | | | | | | **Root finding**: False Position: | GJG 14042003 |
| **Root finding**: Newton-Raphson: | | | | Secant: | | | | Modified Newton-Raphson: | | |
| **System of linear algebraic equations**: [A] {X} = {B}. Set [L] [U] = [A] with [L] and [U] as follows: | | | | | | | | | | |
| LU (Doolittle) decomposition:  ; | | | | | | | Crout decomposition:  ; | | | |
| Gauss-Seidel: sufficient condition for convergence: | | |  | | | | using relaxation: | | | |
| **Polynomial least squares regression analysis**:  2x2 matrix (only ): linear,  3x3 matrix: quadratic, etc. | | | | | | | **Error Analysis for linear regression:**  Standard error of the estimate: | | | |
| **Nonlinear Regression:** | | | | | **Quadratic Regression:**  ; where | | | | | |
| **Lagrange interpolating polynomials**: ; where | | | | | | | | | | |
| **Cubic spline interpolation**: define  on interval  as follows: | | | | | | | | | | |
| **Numerical integration**: . left-to-right: trapezoidal, Simpson’s 1/3 and Simpson’s 3/8 rules | | | | | | | | | |
|  | | | | |  | | | | |
| Gauss quadrature (Gauss-Legendre polynomials):  where  and  are given as follows: | | | | | | | | | |
| **Numerical differentiation** using finite divided difference formulas: | | | | | | | | | |
| Forward:  ;  ; | | | | | | | | | |
| Backward:  ;  ; | | | | | | | | | |
| Centered: | | | | | | | | | |
| **System of nonlinear equations**  Newton’s algorithm: input *f(x)* and accuracy  *i=0;*  set initial point *xi*; evaluate *f(xi);*  while ( ){ evaluate *Df(xi)*;  *i=i+1*;}  output *xi+1* | | | | | | | | | |
| **Solving ODEs** (initial value problems): ;  given: One-step methods:  Euler:  Runge Kutta 2 (RK2) or Midpoint: , where  and  RK4: , where ; ;  and | | | | | | | | | |
| Solving ODEs (boundary value problems): ; in general: ;,  given  Finite difference method: replace all derivative terms by centered divided difference expressions of | | | | | | | | | |
| Solving linear, second-order PDEs (boundary value problems): Elliptic, Parabolic and Hyperbolic equations  Finite difference method: replace all partial derivative terms by centered difference expressions of | | | | | | | | | |

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