

MATH 3341: Introduction to Scientific Computing Lab

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Lab 08: MATLAB Interpolation Routines & Their Derivatives





Polynomial Interpolation Routines



polyfit: Fit polynomial to data

- $P = \text{polyfit}(X, Y, N)$: finds the coefficients of a polynomial $P(X)$ of degree N that fits the data Y best in a least-squares sense. P is a row vector of length $N+1$ containing the polynomial coefficients in descending powers, $P(1)*X^N + P(2)*X^{(N-1)} + \dots + P(N)*X + P(N+1)$.



polyval: Evaluate polynomial

- $Y = \text{polyval}(P,X)$: returns the value of a polynomial P evaluated at X . P is a vector of length $N+1$ whose elements are the coefficients of the polynomial in descending powers. $Y = P(1)*X^N + P(2)*X^{(N-1)} + \dots + P(N)*X + P(N+1)$.



spline: Cubic spline data interpolation

- `PP = spline(X,Y)`: provides the piecewise polynomial form of the cubic spline interpolant to the data values `Y` at the data sites `X`, for use with the evaluator `PPVAL` and the spline utility `unmkpp`. `X` must be a vector.
- `YY = spline(X,Y,XX)`: is the same as `YY = ppval(spline(X,Y),XX)`, thus providing, in `YY`, the values of the interpolant at `XX`.



ppval: Evaluate piecewise polynomial.

- $V = \text{ppval}(PP, XX)$: returns the value, at the entries of XX , of the piecewise polynomial f contained in PP , as constructed by `pchip`, `spline`, `interp1`, or the spline utility `mkpp`.



pchip: Piecewise Cubic Hermite Interpolating Polynomial

- $PP = \text{pchip}(X,Y)$: provides the piecewise polynomial form of a certain shape-preserving piecewise cubic Hermite interpolant, to the values Y at the sites X , for later use with `ppval` and the spline utility `unmkpp`. X must be a vector.
- $YY = \text{pchip}(X,Y,XX)$ is the same as $YY = \text{ppval}(\text{pchip}(X,Y),XX)$, thus providing, in YY , the values of the interpolant at XX .





Derivatives of Interpolation Polynomials



polyder: Differentiate polynomial

- `polyder(P)`: returns the derivative of the polynomial whose coefficients are the elements of vector `P`.

