

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 .



The background of the slide features a large, faint watermark of the University of Wyoming seal. The seal is circular with a rope-like border. Inside the border, the words "UNIVERSITY OF WYOMING" are at the top, "EQUALITY" is in the center, and "1886" is at the bottom. In the middle of the seal is an open book.

Derivatives of Interpolation Polynomials



polyder: Differentiate polynomial

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

