

Spline Toolbox 3.2

Create and manipulate spline approximation models of data

The Spline Toolbox extends MATLAB® with tools for creating, viewing, and analyzing spline approximations of data. Splines are smooth piecewise polynomials that can be used to represent functions over large intervals, where it would be impractical to use a single approximating polynomial. They have become a standard tool for modeling arbitrary functions.

The Spline Toolbox includes a graphical user interface (GUI) that provides easy access to functions for creating, visualizing, and manipulating splines. The toolbox also contains functions that enable you to evaluate, plot, combine, differentiate, and integrate splines.

Because all toolbox functions are implemented in the open MATLAB language, you can inspect the algorithms, modify the source code, and create your own custom functions.

Working with the Spline Toolbox

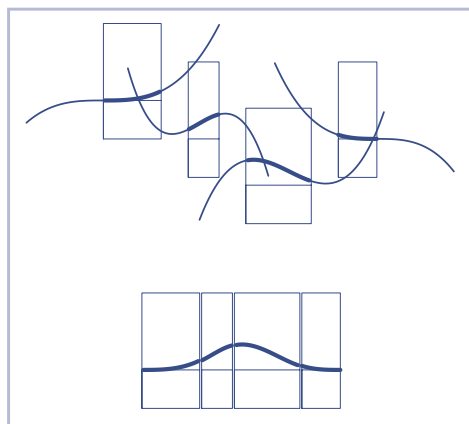
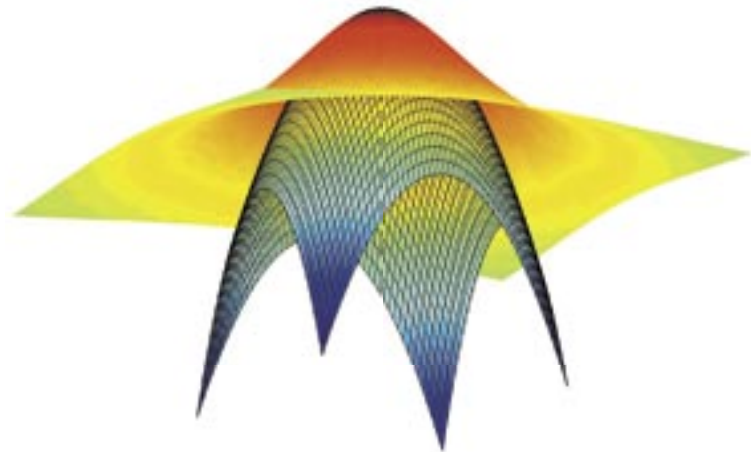
All toolbox functions can be accessed from the toolbox GUI. You can use the GUI to:

- Create splines through interpolation, approximation, and smoothing methods
- Vary spline parameters and tolerances
- View and modify data, breaks, knots, and weights
- View the first or second derivative of a spline or its error
- Observe the toolbox commands that generated your spline
- Compare and manage multiple splines

The Spline Tool GUI also enables you to create and import data and save splines to the workspace.

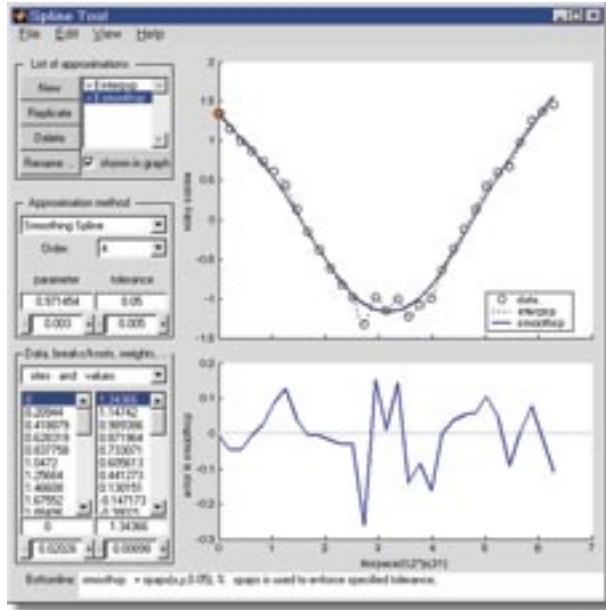
KEY FEATURES

- GUIs that let you create, view, and manipulate splines and manage and compare spline approximations
- Functions for advanced spline operations, including differentiation, integration, break/knot manipulation, and optimal knot placement
- Support for piecewise polynomial form (ppform) and basis form (B-form) splines
- Support for tensor-product splines and rational splines (including NURBS)



A cubic B-spline and the four polynomials from which it is made. The spline model is often used when the function to be modeled is given only as the solution of a functional equation.

The top window of the Spline Tool GUI displays and compares spline approximations. The bottom window shows spline error or the first or second derivative.



Selecting Knots

Several of the spline-creation commands in the toolbox require you to select an appropriate knot sequence that will identify the kind of spline to be used. Default knot sequences are provided for use when it is difficult to choose a knot sequence for your data. The toolbox also includes a command for improving a given knot sequence.

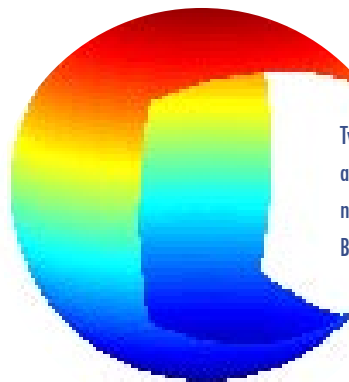
Representing Splines

The Spline Toolbox enables you to represent a polynomial spline in ppform and B-form. The ppform provides a description in terms of breakpoints and local polynomial coefficients, and is useful when the spline will be evaluated extensively. The B-form describes a spline as a linear combination of B-splines, specifically, the knot sequence and B-spline coefficients. The B-form is particularly useful during the construction of a spline.

All polynomial splines can be represented in ppform and B-form for both univariate and multivariate functions

(using the tensor-product construct). This means that the toolbox commands for constructing spline approximations can accommodate gridded data in any number of dimensions. The data being fitted can be vector-valued, enabling you to create curves and surfaces in any number of dimensions.

The toolbox also provides thin-plate splines to enable the smooth approximation of scattered bivariate data.



Two-thirds of a sphere, as described by a nonuniform rational B-spline (NURBS).

Required Products

MATLAB

Related Products

Curve-Fitting Toolbox. Perform model fitting and analysis

Genetic Algorithm and Direct Search Toolbox. Solve optimization problems using genetic and direct search algorithms

Neural Network Toolbox. Design and simulate neural networks

Optimization Toolbox. Solve standard and large-scale optimization problems

Statistics Toolbox. Apply statistical algorithms and probability models

Platform and System Requirements

For platform and system requirements, visit www.mathworks.com/products/splines ■

For demos, application examples, tutorials, user stories, and pricing:

- Visit www.mathworks.com

- Contact The MathWorks directly

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