

# Curve Fitting Toolbox 2

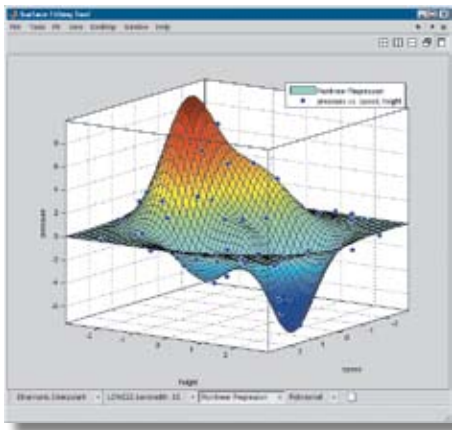
## Fit curves and surfaces to data using regression, interpolation, and smoothing

Curve Fitting Toolbox™ provides graphical user interfaces (GUIs) and command-line functions for fitting curves and surfaces to data. The toolbox lets you perform exploratory data analysis, preprocess and post-process data, compare candidate models, and remove outliers. You can conduct regression analysis using the library of linear and nonlinear models provided or specify your own custom equations. The toolbox also supports nonparametric modeling techniques, such as interpolation and smoothing.

### Working with Curve Fitting Toolbox

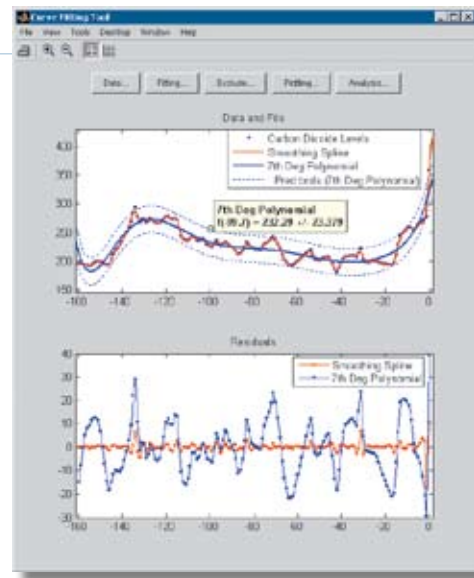
The toolbox provides GUIs that simplify standard curve- and surface-fitting tasks and accelerate analysis. Command-line functions let you extend the toolbox by creating customized graphs or analytic routines. You can also create functions that replicate an analysis, a useful technique for batch processing or report generation.

The toolbox enables you to move easily between the GUIs and the command line. You can use the GUIs to generate MATLAB code. The GUIs also generate specialized fit objects that store the results of fitting operations; you can operate on these objects using command-line functions and methods.



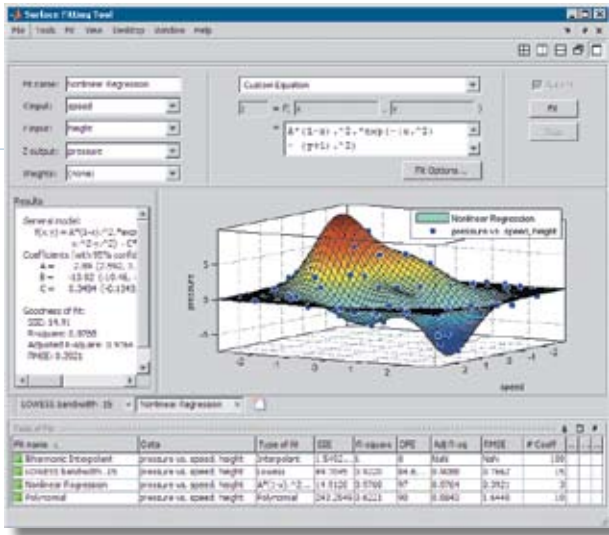
### KEY FEATURES

- Linear and nonlinear parametric models with optimized starting points and solver parameters for nonlinear models
- Custom equations for linear and nonlinear regression
- Nonparametric fitting methods, including splines, interpolants, and localized regression
- Interactive graphical user interfaces for curve and surface fitting
- Preprocessing routines, including data scaling, sectioning, smoothing, and outlier removal
- Post-processing routines, including interpolation, extrapolation, confidence intervals, integrals, and derivatives

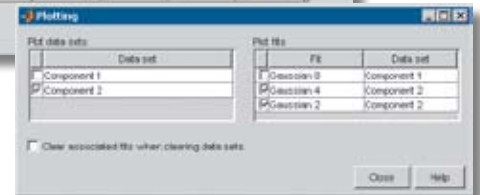
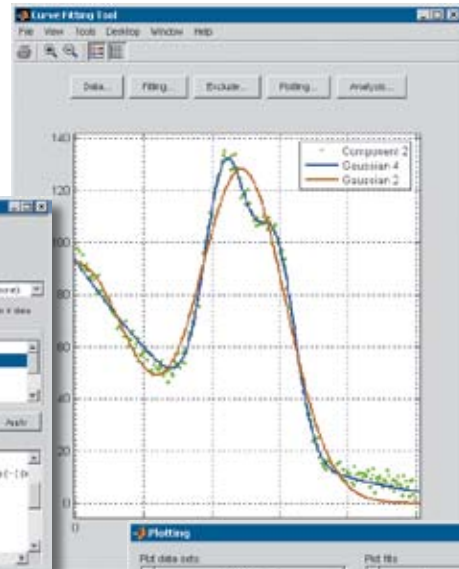


Fitting multiple candidate models to a data set using the Curve Fitting Tool.

Surface generated using the Custom Equation option of the Surface Fitting Tool. The tool supports a variety of fitting methods, including linear regression, nonlinear regression, interpolation, and smoothing.



The Surface Fitting Tool (left) and the Curve Fitting Tool (below). You can evaluate goodness of fit using a combination of descriptive statistics, visual inspection, and validation.



## Fitting Models and Methods

Curve Fitting Toolbox provides a variety of fitting methods, including:

- Linear regression
- Nonlinear regression (trust-region, Levenberg-Marquardt, and Gauss-Newton algorithms)
- Interpolation (linear, biharmonic, nearest neighbor, cubic spline, shape-preserving spline)
- Smoothing (moving average, loess, lowess, smoothing spline, and Savitzky-Golay)

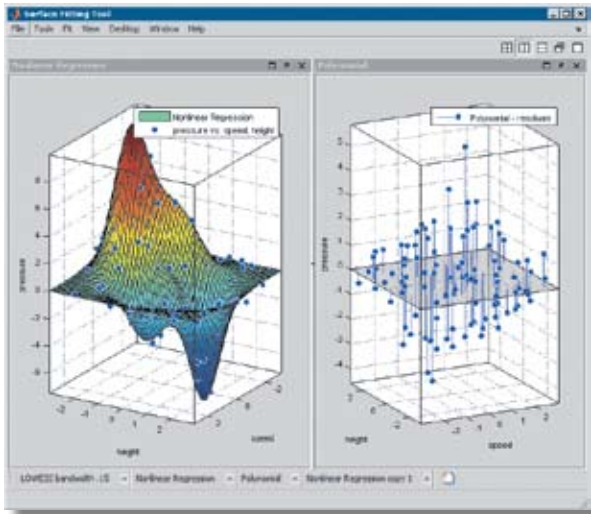
You can specify your own custom equations or choose from a library of linear, nonlinear, and nonparametric fitting models, including:

- Polynomials (to ninth degree for curves and fifth degree for surfaces)
- Exponential functions
- Rational (to degree 5/5)
- Peak (Gaussian)
- Distribution (Weibull)
- Fourier and power series
- Sum of sines

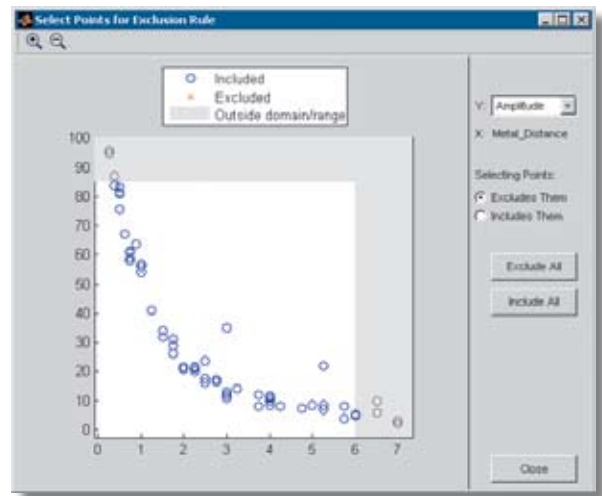
You can assign both weights and bounds on your coefficients. You can also choose from two forms of robust fitting: bisquare or least absolute residual.

## Previewing and Preprocessing Data

Curve Fitting Toolbox supports a comprehensive workflow that progresses from exploratory data analysis through developing and comparing predictive models to post-processing analysis. Graphical user interfaces let you plot a data set in two or three dimensions. Visual inspection of the data set enables you to develop intuition regarding appropriate fitting methods, identify outliers, and look for change points. The toolbox also includes specialized functions for removing outliers, sectioning data series, and weighting or excluding data points.



Using the Surface Fitting Tool to search for patterns in the residuals.



Preprocessing routines to preview and exclude data. You can remove outliers or select subsets of the data.

## Developing, Comparing, and Managing Models

Curve Fitting Toolbox lets you fit multiple candidate models to a data set. You can then evaluate goodness of fit using a combination of descriptive statistics, visual inspection, and validation.

### Descriptive Statistics

Curve Fitting Toolbox provides a wide range of descriptive statistics, including:

- R-square and adjusted R-square
- Sum of squares due to errors and root mean squared error
- Degrees of freedom

The Table of Fits lists all of the candidate models in a sortable table, enabling you to quickly compare and contrast large numbers of candidate models.

### Visual Inspection of Data

The toolbox enables you to visually inspect candidate models to reveal problems with fit that are not apparent in summary statistics. For example, you can generate a surface plot and a residual plot side by side and search for patterns in the residuals; you can simultaneously plot multiple models to compare how well they fit the data in critical regions; or you can plot the differences between two models as a new surface.

### Validation Techniques

Curve Fitting Toolbox also supports validation techniques that help protect against overfitting. You can generate a predictive model using a training data set, apply your model to a validation data set, and then evaluate goodness of fit.

### Post-Processing Analysis

Once you have selected the curve or surface that best describes your data series, you can perform post-processing analysis. Curve Fitting Toolbox enables you to:

- Use your model to estimate values (evaluation)
- Calculate confidence intervals
- Create prediction bounds
- Determine the area under your curve (integration)
- Calculate derivatives

## Required Products

MATLAB®

## Related Products

### Bioinformatics Toolbox™

Read, analyze, and visualize genomic, proteomic, and microarray data

### Financial Toolbox™

Analyze financial data and develop financial algorithms

### Optimization Toolbox™

Solve standard and large-scale optimization problems

### Spline Toolbox™

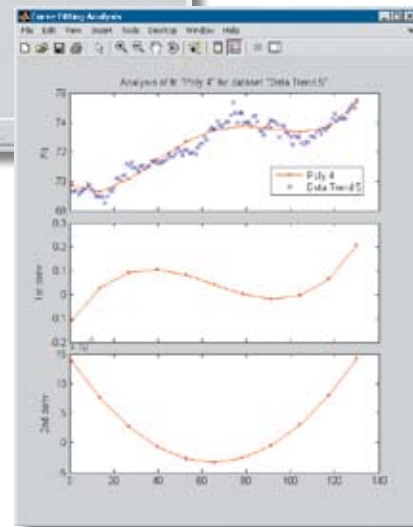
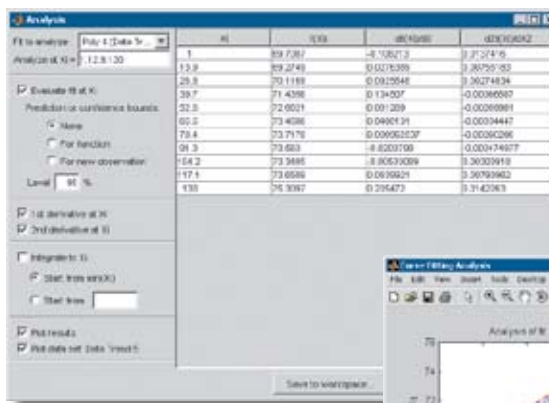
Create and manipulate spline approximation models of data

### Statistics Toolbox™

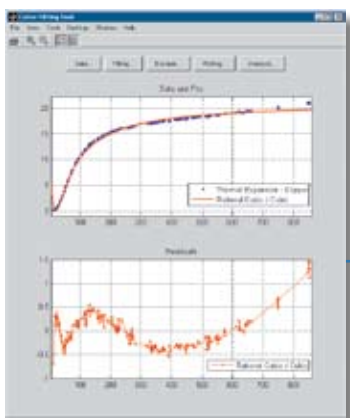
Perform statistical analysis, modeling, and algorithm development

## Platform and System Requirements

For information on platform and system requirements, visit [www.mathworks.com/products/curvefitting](http://www.mathworks.com/products/curvefitting).



The Analysis Tool. You can estimate values, calculate confidence intervals, create prediction bounds, determine the area under a curve, and calculate derivatives.



```

1 function fitNormalExp()
2 %FITTING: Create plot of data and fit
3 % RESIDUALS:
4 % Create a plot, similar to the one in the data curve
5 % fitting window, using the data from the graph.
6 %
7 % Number of data points: 1
8 % Number of fits: 1
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10 % Data from MATLAB "Normal Expansion - Copper":
11 %
12 % Take caution the coordinates generated on 10-Feb-2006
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14 % Set up figure to show the data and fit
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```

MATLAB code generated automatically by Curve Fitting Toolbox. You can export your fits as commented code to automate fitting routines and preserve your work.

## Learn More

[www.mathworks.com/products/curvefitting](http://www.mathworks.com/products/curvefitting)

## Resources

### VISIT

[www.mathworks.com](http://www.mathworks.com)

### TECHNICAL SUPPORT

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