

Interactive Curve and Surface Fitting

Introducing the Curve Fitting App

You can fit curves and surfaces to data and view plots with the Curve Fitting app.

- Create, plot, and compare multiple fits.
- Use linear or nonlinear regression, interpolation, smoothing, and custom equations.
- View goodness-of-fit statistics, display confidence intervals and residuals, remove outliers and assess fits with validation data.
- Automatically generate code to fit and plot curves and surfaces, or export fits to the workspace for further analysis.

Fit a Curve

1. Load some example data at the MATLAB[®] command line:

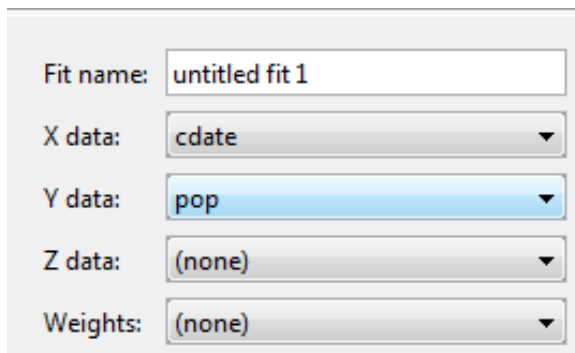
```
load census
```

2. Open the Curve Fitting app by entering:

```
cftool
```

Alternatively, click **Curve Fitting** on the **Apps** tab.

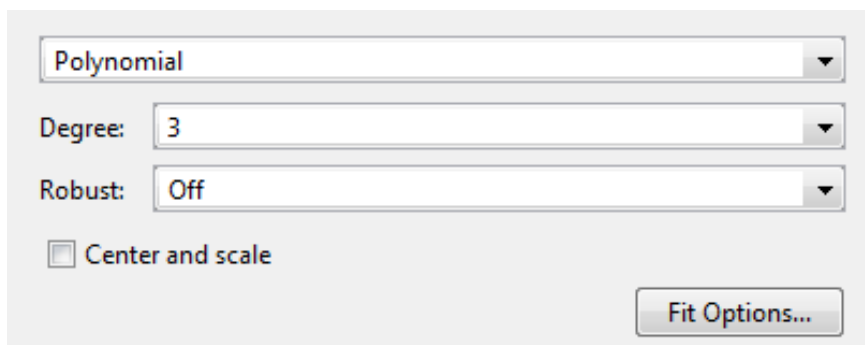
3. Select **X data** and **Y data**. For details, see [Selecting Data to Fit in Curve Fitting App](#).



The screenshot shows the data selection section of the Curve Fitting app. It contains five rows, each with a label and a dropdown menu: 'Fit name:' with 'untitled fit 1', 'X data:' with 'cdate', 'Y data:' with 'pop', 'Z data:' with '(none)', and 'Weights:' with '(none)'. The 'Y data:' dropdown is highlighted with a blue selection bar.

The Curve Fitting app creates a default polynomial fit to the data.

4. Try different fit options. For example, change the polynomial **Degree** to 3 to fit a cubic polynomial.



The screenshot shows the fit options section of the Curve Fitting app. It features three dropdown menus: 'Polynomial' (selected), 'Degree:' with '3', and 'Robust:' with 'Off'. Below these is a checkbox labeled 'Center and scale' which is currently unchecked. A 'Fit Options...' button is located at the bottom right of the panel.

5. Select a different model type from the fit category list, e.g., **Smoothing Spline**. For information about models you can fit, see [Model Types for Curves and Surfaces](#).



6. Select **File > Generate Code**.

The Curve Fitting app creates a file in the Editor containing MATLAB code to recreate all fits and plots in your interactive session.

Tip For a detailed workflow example, see [Compare Fits in Curve Fitting App](#).

To create multiple fits and compare them, see [Create Multiple Fits in Curve Fitting App](#).

Fit a Surface

1. Load some example data at the MATLAB command line:

```
load franke
```

2. Open the Curve Fitting app:

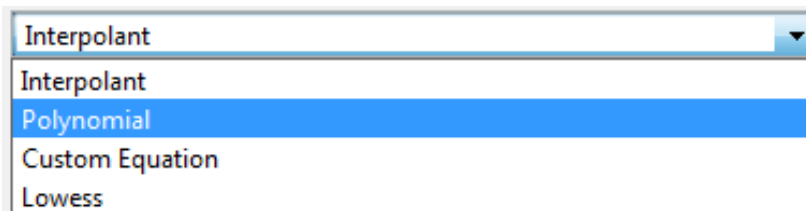
```
cftool
```

3. Select **X data**, **Y data** and **Z data**. For more information, see [Selecting Data to Fit in Curve Fitting App](#).

The Curve Fitting app creates a default interpolation fit to the data.

4. Select a different model type from the fit category list, e.g., **Polynomial**.

For information about models you can fit, see [Model Types for Curves and Surfaces](#).



5. Try different fit options for your chosen model type.

6. Select **File > Generate Code**.

The Curve Fitting app creates a file in the Editor containing MATLAB code to recreate all fits and plots in your interactive session.

Tip For a detailed example, see [Surface Fitting to Franke Data](#).

To create multiple fits and compare them, see [Create Multiple Fits in Curve Fitting App](#).

Model Types for Curves and Surfaces

Based on your selected data, the fit category list shows either curve or surface fit categories. The following table describes the options for curves and surfaces.

Fit Category	Curves	Surfaces
Regression Models		
Polynomial	Yes (up to degree 9)	Yes (up to degree 5)
Exponential	Yes	
Fourier	Yes	
Gaussian	Yes	
Power	Yes	
Rational	Yes	
Sum of Sine	Yes	
Weibull	Yes	
Interpolation		
Interpolant	Yes Methods: Nearest neighbor Linear Cubic Shape-preserving (PCHIP)	Yes Methods: Nearest neighbor Linear Cubic Biharmonic (v4) Thin-plate spline
Smoothing		
Smoothing Spline	Yes	
Lowess		Yes
Custom		
Custom Equation	Yes	Yes
Linear Fitting	Yes	

For information about these fit types, see:

- [Linear and Nonlinear Regression](#)
- [Custom Models](#)
- [Interpolation](#)
- [Smoothing](#)

Selecting Data to Fit in Curve Fitting App

To select data to fit, use the drop-down lists in the Curve Fitting app to select variables in your MATLAB workspace.

- To fit curves:
 - Select **X data** and **Y data**.
 - Select only **Y data** to plot Y against index ($x=1:\text{length}(y)$).
- To fit surfaces, select **X data**, **Y data** and **Z data**.

You can use the Curve Fitting app drop-down lists to select any numeric variables (with more than one element) in your MATLAB workspace.

Similarly, you can select any numeric data in your workspace to use as **Weights**.

The screenshot shows the 'Fit name' field set to 'untitled fit 1'. Below it are four dropdown menus: 'X data' is set to 'cdate', 'Y data' is set to 'pop', 'Z data' is set to '(none)', and 'Weights' is set to '(none)'.

For curves, X, Y, and Weights must be matrices with the same number of elements.

For surfaces, X, Y, and Z must be either:

- Matrices with the same number of elements
- Data in the form of a table

For surfaces, weights must have the same number of elements as Z.

For more information see [Selecting Compatible Size Surface Data](#).

When you select variables, the Curve Fitting app immediately creates a curve or surface fit with the default settings. If you want to avoid time-consuming refitting for large data sets, you can turn off **Auto fit** by clearing the check box.

Note: The Curve Fitting app uses a snapshot of the data you select. Subsequent workspace changes to the data have no effect on your fits. To update your fit data from the workspace, first change the variable selection, and then reselect the variable with the drop-down controls.

If there are problems with the data you select, you see messages in the **Results** pane. For example, the Curve Fitting app ignores Infs, NaNs, and imaginary components of complex numbers in the data, and you see messages in the **Results** pane in these cases.

If you see warnings about reshaping your data or incompatible sizes, read [Selecting Compatible Size Surface Data](#) and [Troubleshooting Data Problems](#) for information.

Save and Reload Sessions

- [Overview](#)
- [Saving Sessions](#)
- [Reloading Sessions](#)
- [Removing Sessions](#)

Overview

You can save and reload sessions for easy access to multiple fits. The session file contains all the fits and variables in your session and remembers your layout.

Saving Sessions

To save your session, first select **File > Save Session** to open your file browser. Next, select a name and location for your session file (with file extension `.sfit`).

After you save your session once, you can use **File > Save MySessionName** to overwrite that session for subsequent saves.

To save the current session under a different name, select **File > Save Session As**.

Reloading Sessions

Use **File > Load Session** to open a file browser where you can select a saved curve fitting session file to load.

Removing Sessions

Use **File > Clear Session** to remove all fits from the current Curve Fitting app session.

