## 8.4 THE BASIC FITTING INTERFACE

The basic fitting interface is a tool that can be used to perform curve fitting and interpolation interactively. By using the interface the user can:

- Curve-fit the data points with polynomials of various degrees up to 10, and with spline and Hermite interpolation methods.

- Plot the various fits on the same graph so that they can be compared.

- Plot the residuals of the various polynomial fits and compare the norms of the residuals.

- Calculate the values of specific points with the various fits.

- Add the equations of the polynomials to the plot.

To activate the basic fitting interface, the user first has to make a plot of the data points. Then the interface is activated by selecting **Basic Fitting** in the **Tools** menu, as shown on the right. This opens the Basic Fitting Window, shown in Figure 8-3. When the window first opens, only one panel (the **Plot fits** panel) is visible. The window can be extended to show a second panel (the **Numerical results** panel) by clicking on the $\rightarrow$ button. One click adds the first section of the panel, and a second click makes the window look as shown in Figure 8-3. The window can be reduced back by clicking on the $\leftarrow$ button. The first two items in the Basic Fitting Window are related to the selection of the data points:
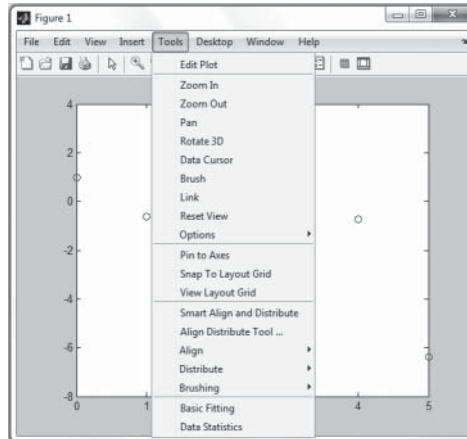
Select data: Used to select a specific set of data points for curve fitting in a figure that has more than one set of data points. Only one set of data points can be curve-fitted at a time, but multiple fits can be performed simultaneously on the same set.

Center and scale x data: When this box is checked, the data is centered at zero mean and scaled to unit standard deviation. This might be needed in order to improve the accuracy of numerical computation.

The next four items are in the **Plot fits** panel and are related to the display of the fit.

Check to display fits on figure: The user selects the fits to be displayed in the figure. The selections include interpolation with spline interpolant (interpolation method) that uses the `spline` function, interpolation with Hermite interpolant that uses the `pchip` function, and polynomials of various degrees
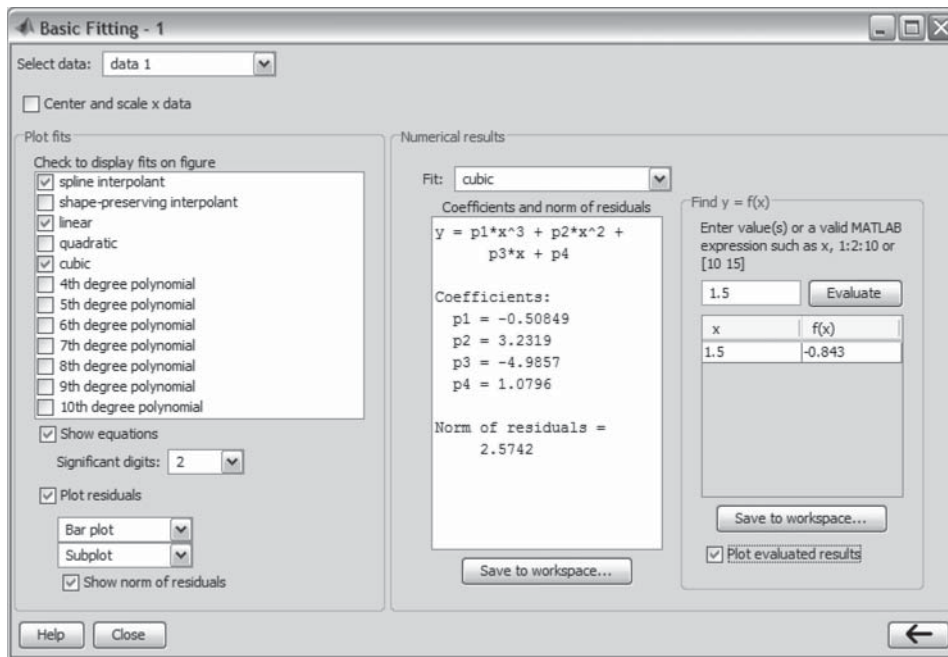
Figure 8-3: The Basic Fitting Window.

that use the `polyfit` function. Several fits can be selected and displayed simultaneously.

Show equations: When this box is checked, the equations of the polynomials that were selected for the fit are displayed in the figure. The equations are displayed with the number of significant digits selected in the adjacent sign menu.

Plot residuals: When this box is checked, a plot that shows the residual at each data point is created (residuals are defined in Section 8.2.1). Choices in the menus include a bar plot, a scatter plot, and a line plot that can be displayed as a subplot in the same Figure Window that has the plot of the data points or as a separate plot in a different Figure Window.

Show norm of residuals: When this box is checked, the norm of the residuals is displayed in the plot of the residuals. The norm of the residual is a measure of the quality of the fit. A smaller norm corresponds to a better fit.

The next three items are in the **Numerical results** panel. They provide the numerical information for one fit, independently of the fits that are displayed:

Fit: The user selects the fit to be examined numerically. The fit is shown on the plot only if it is selected in the **Plot fit** panel.

Coefficients and norm of residuals: Displays the numerical results for the polynomial fit that is selected in the **Fit** menu. It includes the coefficients of the polynomial and the norm of the residuals. The results can be saved by

clicking on the **Save to workspace** button.

<u>**Find y = f(x):**</u>   Provides a means for obtaining interpolated (or extrapolated) numerical values for specified values of the independent variable. Enter the value of the independent variable in the box, and click on the **Evaluate** button. When the **Plot evaluated results** box is checked, the point is displayed on the plot.

As an example, the basic fitting interface is used for fitting the data points from Sample Problem 8-3. The Basic Fitting Window is the one shown in Figure
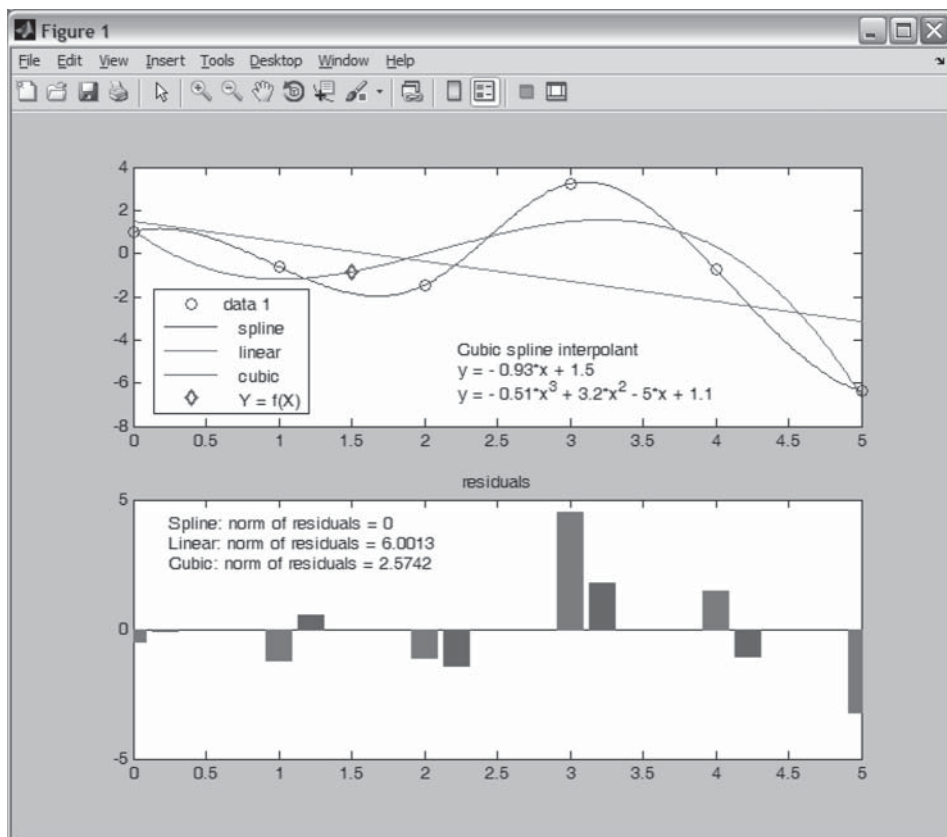

Figure 8-4: A Figure Window modified by the Basic Fitting Interface.

8-3, and the corresponding Figure Window is shown in Figure 8-4. The Figure Window includes a plot of the points, one interpolation fit (spline), two polynomial fits (linear and cubic), a display of the equations of the polynomial fits, and a mark of the point $x = 1.5$ that is entered in the **Find y = f(x)** box of the Basic Fitting Window. The Figure Window also includes a plot of the residuals of the polynomial fits and a display of their norm.