

# Spline Toolbox Release Notes

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The “Spline Toolbox 3.2.2 Release Notes” on page 1-1 describe the changes included in Version 3.2.2 of the Spline Toolbox since Version 3.2.1. The following topics are discussed in these Release Notes:

- “New Features” on page 1-2
- “Upgrading from an Earlier Release” on page 1-3.

If you are upgrading from a release earlier than Release R14 with Service Pack 1, you should also see the “Spline Toolbox 3.2.1 Release Notes” on page 2-1 and possibly the “Spline Toolbox 3.2 Release Notes” on page 3-1.

## **Printing the Release Notes**

If you would like to print these Release Notes, you can link to a PDF version on the MathWorks web site.



# Spline Toolbox 3.2.2

## Release Notes

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## New Features

This section summarizes the new features and enhancements introduced in the Spline Toolbox 3.2.2 since Version 3.2.1 (Release 14 with Service Pack 2)

If you are upgrading from the Spline Toolbox 3.2, then you should also see “New Features” on page 2-2 in the Spline Toolbox 3.2.1 Release Notes.

### **rsmak Now Provides an Arc**

rsmak now provides the rBform of an arc for which you can specify the center, radius, and extent.

rsmak(object, varargin) returns the specific geometric shape specified by the string object. For example,

```
rsmak('arc', radius, center, alpha, beta)
```

provides a quadratic rational that describes the arc of the given radius (default 1) and center (default (0,0)) of total arc length  $\leq \text{radius} \cdot \pi$  that covers the angle interval between the given alpha (default 0) and beta (default pi).

### **Changes to Spline Tool**

- The last of the examples offered during startup now starts, appropriately, with spline interpolation rather than cubic spline interpolation.
- Deleting the Spline Tool window after a spline approximation has been generated now brings up a request for confirmation.
- During longer calculations, the cursor now becomes the hour glass symbol to inform the user that the Spline Tool is working.

## Upgrading from an Earlier Release

This section describes the upgrade issues involved in moving to the Spline Toolbox 3.2.2 from Version 3.2.1.

If you are upgrading from a version earlier than Version 3.2.1, then you should also see “Upgrading from an Earlier Release” on page 3-5 of the Spline Toolbox 3.2 Release Notes.

### **B-form Evaluation Outside the Basic Interval Returns 0**

Evaluation of a multivariate spline in B-form at scattered sites now conforms to the definition that such a spline is zero outside its basic interval. `fnval` now returns the value 0 at any site outside the basic interval of a spline in B-form.

Although this has been the documented behavior, it was not previously enforced.

### **spaps Handles Vector-Valued Data Correctly in the Case of Zero Tolerance.**

For the smoothing spline function, `spaps`, if you provide vector-valued data and specify a tolerance of 0 as a way of interpolating the data, `spaps` now handles the data correctly. Prior to this change, `spaps` produced an error message.

### **fncmb Returns Error if Only One Coefficient Array Is a Scalar**

`fncmb` now performs stricter input checking to enforce that the two splines `f` and `g` in the command `fncmb(f,g)` have the same order and the same knot or break sequences. Previously, if one but not the other of the coefficient arrays of the splines `f` or `g` was a scalar, `fncmb` may have produced incorrect results or a confusing error message.



# Spline Toolbox 3.2.1

## Release Notes

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### **New Features**

The Spline Toolbox 3.2.1 (Release 14 and Release 14 with Service Pack 1) includes bug fixes but no new features. It contains no substantive changes from the Spline Toolbox 3.2.

If you are upgrading from the Spline Toolbox 3.1.1, then you should also see “New Features” on page 3-2 in the Spline Toolbox 3.2 Release Notes.



# Spline Toolbox 3.2 Release Notes

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### New Features

This section summarizes the new features and enhancements introduced in the Spline Toolbox 3.2 since Version 3.1.1 (Release 13)

If you are upgrading from the Spline Toolbox 3.0, then you should also see “New Features” on page 4-2 in the Spline Toolbox 3.1.1 Release Notes.

### ND-Valued Data and Spline Functions

All *\*ap\** toolbox functions now accept matrix- and ND-valued data. These functions are: `csape`, `csapi`, `csaps`, `spap2`, `spapi`, `spaps`, `tpaps`. All toolbox *fn\** functions can now handle the resulting matrix- or ND-valued spline functions.

### Repeated Sites

All *\*ap\** toolbox functions now accept data with repeated sites, hence so does the GUI `splinetool`. Specifically,

<code>csape</code> , <code>csapi</code>	Replace data points having the same site by their average.
<code>csaps</code> , <code>spaps</code> , <code>spap2</code> , <code>tpaps</code>	Replace data points with the same site by their weighted average, with its weight the average of the corresponding weights. These functions are concerned with smoothing or least-squares approximation.
<code>spaps</code>	Adjusts the given tolerance in order to make up for the resulting change in the value of the error measure.
<code>spapi</code>	Continues to interpret data with repeated sites as a request for osculatory interpolation

### Updated Demos

Several demos have been enlarged to include additional illustrations and examples. You can now access the Spline Toolbox demos from the **Demos** tab in the Help browser, or you can run them by typing `playshow demoname` at the command line.

## Toolbox Function Summary

Version 3.2 of the Spline Toolbox provides the following:

- “New Functions” on page 3-3
- “Functions with New or Changed Capabilities” on page 3-3

### New Functions

Function	Purpose
fnchg	A new toolbox function <code>fnchg(fn,part,value)</code> enables you to change the target dimension or the basic interval of the form in <code>fn</code> .

### Functions with New or Changed Capabilities

Function	Purpose
csape	<p>Input of specific end conditions for the univariate case is now the same as for the multivariate case. In both cases, you now supply specific values for endpoint conditions as additional data values. See the reference page for details.</p> <p>In earlier versions, you used a fourth argument, <code>valconds</code>, to supply specific values for endpoint conditions in the univariate case. This argument remains valid for backward compatibility, but it may be removed in a future release, and you are encouraged to discontinue its use.</p>
fnbrk	<p>An expanded syntax,  <code>[out1,...,outn] = fnbrk(f,part1,...,partm)</code>,  returns the part(s) of the form in <code>f</code> specified by <code>part1,...,partn</code>, where <math>n \leq m</math>. These are the parts used when the form was put together, in <code>spmak</code>, <code>ppmak</code>, <code>rpmak</code>, <code>rsmak</code>, or <code>stmak</code>, but also other parts derived from these.</p>
fnval	You can now use a multidimensional array to specify the sites at which <code>fnval</code> is to evaluate a spline function.

<b>Function</b>	<b>Purpose</b>
spap2, spapi	Now require that, in case of data x,y with y an array, the data value corresponding to x(j) is y(:,j), not y(j,:). See “Updated spap2, spapi Input Requirements” on page 3-5 for more information.
splinetool	From the new Tools menu, you can now toggle the grid and the legend. From the Help menu, you can also look up short descriptions of technical terms used.

## Upgrading from an Earlier Release

This section describes the upgrade issues involved in moving to the Spline Toolbox 3.2 from Version 3.1.1.

If you are upgrading from a Version 3.1, then you should also see “Upgrading from an Earlier Release” on page 4-6 of the Spline Toolbox 3.1.1 Release Notes.

### NaNs and Infs

Prior to Version 3.2, NaNs or Infs in the given data would propagate in the normal way through the calculations, leading to NaNs and/or Infs in the numbers that make up the output.

Now, any data point containing NaN or Inf is ignored, but a warning to that effect is printed in the command window. This affects all *\*ap\** commands, i.e., *csape*, *csapi*, *csaps*, *spap2*, *spapi*, *spaps*, and *tpaps*.

### Simplified *csape* Input

In the multivariate case, you supply specific values for endpoint conditions as additional data values. Starting with Version 3.2, you should use the same scheme in the univariate case.

In earlier versions, you used a fourth argument, *valconds*, to supply specific values for endpoint conditions in the univariate case. This argument remains valid for backward compatibility, but it may be removed in a future release, and you are encouraged to discontinue its use.

### Updated *spap2*, *spapi* Input Requirements

For the sake of uniformity with other *\*ap\** commands, *spap2(knots, order, x, y)* and *spapi(knots, x, y)* now require that, when *y* is an array, *y* must have as many columns as there are data sites in the vector *x*. That is, the data value corresponding to *x(j)* is *y(:, j)*, not *y(j, :)*. This change originally appeared in Version 3.2 Release 13+.

Prior to Version 3.2, if *x* was a column vector, and *y* was an array, then *spap2* and *spapi* would take *y(j, :)*, rather than *y(:, j)*, to be the data value at *x(j)*.

