## Smoothing Spline Parameters

The smoothing spline operation requires a standard deviation parameter and a smoothing factor parameter. The standard deviation parameter should be a good estimate of the standard deviation of the noise in your Y data. The smoothing factor should nominally be close to 1.0, assuming that you have an accurate standard deviation estimate.

Using the Standard Deviation section of the Interpolate2 dialog, you can choose one of three options for the standard deviation parameter: None, Constant, From Wave.

If you choose None, Interpolate2 uses an arbitrary standard deviation estimate of 0.05 times the amplitude of your Y data. You can then play with the smoothing factor parameter until you get a pleasing smooth spline. Start with a smoothing factor of 1.0. This method is not recommended.

If you choose Constant, you can then enter your estimate for the standard deviation of the noise and Interpolate2 uses this value as the standard deviation of each point in your Y data. If your estimate is good, then a smoothing factor around 1.0 will give you a nice smooth curve through your data. If your initial attempt is not quite right, you should leave the smoothing factor at 1.0 and try another estimate for the standard deviation. For most types of data, this is the preferred method.

If you choose From Wave then Interpolate2 expects that each point in the specified wave contains the estimated standard deviation for the corresponding point in the Y data. You should use this method if you have an appropriate wave.

## Interpolate2's Pre-averaging Feature

A linear or cubic spline interpolation goes through all of the input data points. If you have a large, noisy data set, this is probably not what you want. Instead, use the smoothing spline.

Before Interpolate2 had a smoothing spline, we recommended that you use the cubic spline to interpolate through a decimated version of your input data. The pre-averaging feature was designed to make this easy.

Because Interpolate2 now supports the smoothing spline, the pre-averaging feature is no longer necessary. However, we still support it for backward compatibility.

When you turn pre-averaging on, Interpolate2 creates a temporary copy of your input data and reduces it by decimation to a smaller number of points, called nodes. Interpolate2 then usually adds nodes at the very start and very end of the data. Finally, it does an interpolation through these nodes.

## Identical Or Nearly Identical X Values

This section discusses a degenerate case that is of no concern to most users.

Input data that contains two points with identical X values can cause interpolation algorithms to produce unexpected results. To avoid this, if Interpolate2 encounters two or more input data points with nearly identical X values, it averages them into one value before doing the interpolation. This behavior is separate from the pre-averaging feature. This is done for the cubic and smoothing splines except when the Dest X Coords mode is is Log Spaced or From Dest Wave. It is not done for linear interpolation.

Two points are considered nearly identical in X if the difference in X between them (dx) is less than 0.01 times the nominal dx. The nominal dx is computed as the X span of the input data divided by the number of input data points.

## Destination X Coordinates from Destination Wave

This mode, which we call "X From Dest" mode for short, takes effect if you choose From Dest Wave from the Dest X Coords pop-up menu in the Interpolate2 dialog or use the Interpolate2 /I=3 flag. In this mode the number of output points is determined by the destination wave and the /N flag is ignored.

In X From Dest mode, the points at which the interpolation is done are determined by the destination wave. The destination may be a waveform, in which case the interpolation is done at its X values. Alternatively