the case if one of the previously existing layers were used. For consistency, this layer is also available in control panels.

See Also

Chapter III-3, **Drawing**.

SetDrawEnv, **SetDrawLayer**, **DrawBezier**, **DrawPoly**, **DrawAction**

DSPDetrend

DSPDetrend [***flags***] ***srcWave***

The DSPDetrend operation removes from *srcWave* a trend defined by the best fit of the specified function to the data in *srcWave*.

Flags

/A	Subtracts the average of *srcWave* before performing any fitting. Added in Igor Pro 7.00.
/F=*function*	*function* is the name of a built-in curve fitting function: gauss, lor, exp, dblexp, sin, line, poly (requires /P flag), hillEquation, sigmoid, power, lognormal, poly2d (requires /P flag), gauss2d. If *function* is unspecified, the defaults are line if *srcWave* is 1D or poly2d if *srcWave* is 2D.
/M=*maskWave*	Detrending will only affect points that are nonzero in *maskWave*. Note that *maskWave* must have the same dimensionality as *srcWave*.
/P=*n*	Specifies polynomial order for poly or poly2d functions (see **CurveFit** for details). When used with the 1D poly function *n* specifies the number of terms in the polynomial. By default *n*=3 for the 1D case and *n*=1 for poly2d.
/Q	Quiet mode; no error reporting.

Details

DSPDetrend sets V_flag to zero when the operation succeeds, otherwise it will be set to -1 or will contain an error code from the curve fitting routines. Results are saved in the wave W_Detrend (for 1D input) or M_Detrend (for 2D input) in the current data folder. If a wave by that name already exists in the current data folder it will be overwritten.

See Also

CurveFit for more information about V_FitQuitReason and the built-in fitting functions.

DSPPeriodogram

DSPPeriodogram [***flags***] ***srcWave*** [***srcWave2***]

The DSPPeriodogram operation calculates the periodogram, cross-spectral density or the degree of coherence of the input waves. The result of the operation is stored in the wave W_Periodogram in the current data folder or in the wave that you specify using the /DEST flag.

To compute the cross-spectral density or the degree of coherence, you need to specify the second wave using the optional *srcWave2* parameter. In this case, W_Periodogram will be complex and the /DB and /DBR flags do not apply.

Flags

/DB	Expresses results in dB using the maximum value as reference.
/DBR=*ref*	Express the results in dB using the specified *ref* value.
/COHR	Computes the degree of coherence. This flag applies when the input consists of two waves.

/DEST=*destWave* Specifies the output wave created by the operation.

The /DEST flag was added in Igor Pro 8.00.

It is an error to specify the same wave as both *srcWave* and *destWave*.

When used in a function, the DSPPeriodogram operation by default creates a real wave reference for the destination wave. See **Automatic Creation of WAVE References** on page IV-72 for details.

/DLSG When computing the periodogram, cross-spectral density or the degree of coherence using multiple segments the operation by default pads the last segment with zeros as necessary. If you specify this flag, an incomplete last segment is dropped and not included in the calculation.

/DTRD Detrends segments by subtracting the linear regression of each segment before multiplication by the window function. /DTRD affects segments and is not compatible with /NODC=1. /DTRD was added in Igor Pro 8.00.

/NODC=*val* Suppresses the DC term:

val=1: Removes the DC by subtracting the average value of the signal before processing and before applying any window function (see /Win below).

val=2: Suppresses the DC term by setting it equal to the second term in the FFT array.

val=0: Computes the DC term using the FFT (default).

/NOR=*N* Sets the normalization, N, in the periodogram equation. By default, it is the number of data points times the square norm of the window function (if any).

N=0 or 1: Skips default normalization.

Any other value of *N* is used as the only normalization.

/PARS Sets the normalization to satisfy Parseval's theorem even when using a window function.

The /PARS flag was added in Igor Pro 8.00. It overrides the /NOR flag.

See **Normalization Satisfying Parseval's Theorem** on page V-185 for further information.

/Q Quiet mode; suppresses printing in the history area.

/SEGN={*ptsPerSegment*, *overlapPts*}

Use this flag to compute the periodogram, cross-spectral density or degree of coherence by averaging over multiple segments taken from the input waves. The size of each interval is *ptsPerSegment*. *overlapPts* determines the number of points at the end of each interval that are included in the next segment.

/R=[*startPt*, *endPt*] Calculates the periodogram for a limited range of the wave. *startPt* and *endPt* are expressed in terms of point numbers in *srcWave*.

/R=(*startX*, *endX*) Calculates the periodogram for a limited range of the wave. *startX* and *endX* are expressed in terms of x-values. Note that this option will convert your x-specifications to point numbers and some roundoff may occur.

/WIN=*windowKind* Specifies the window type. If you omit the /W flag, DSPPeriodogram uses a rectangular window for the full wave or the range of data selected by the /R flag.

Choices for *windowKind* are:

Bartlett, Blackman367, Blackman361, Blackman492, Blackman474, Cos1, Cos2, Cos3, Cos4, Hamming, Hanning, KaiserBessel20, KaiserBessel25, KaiserBessel30, Parzen, Poisson2, Poisson3, Poisson4, and Riemann.

See **FFT** for window equations and details.

/Z Do not report errors. When an error occurs, V_flag is set to -1.

Details

The default periodogram is defined as

$$Periodogram = \frac{|F(s)|^2}{N},$$

where F (s) is the Fourier transform of the signal s and N is the number of points.

In most practical situations you need to account for using a window function (when computing the Fourier transform) which takes the form

$$Periodogram = \frac{|F(s \cdot w)|^2}{N_p N_w},$$

where w is the window function, N_p is the number of points and N_w is the normalization of the window function.

If you compute the periodogram by subdividing the signal into multiple segments (with any overlap) and averaging the results over all segments, the expression for the periodogram is

$$Periodogram = \frac{\sum_{i=1}^{M} |F(s_i \cdot w)|^2}{MN_s N_w},$$

where si is the ith segment s, Ns is the number of points per segment and M is the number of segments.

When calculating the cross-spectral density (csd) of two waves s_1 and s_2, the operation results in a complex valued wave

$$csd = \frac{F(s_A)[F(s_B)]^*}{N},$$

which contains the normalized product of the Fourier transform of the first wave S_A with the complex conjugate of the Fourier transform of the second wave S_B. The extension of the csd calculation to segment averaging has the form

$$csd = \frac{\sum_{i=0}^{M} F(s_{Ai})[F(s_{Bi})]^*}{MN_s N_w},$$

where S_{Ai} is the ith segment of the first wave, M is the number of segments and N_s is the number of points in a segment.

The degree of coherence is a normalized version of the cross-spectral density. It is given by