logNormalNoise

logNormalNoise(*m*,*s*)

The logNormalNoise function returns a pseudo-random value from the lognormal distribution function whose probability distribution function is

$$f(x,m,s)=\frac{1}{xs\sqrt{2\pi}}\exp\left\{-\frac{\left[\ln(x)-m\right]^2}{2s^2}\right\},$$

with a mean $\exp\left(m+\frac{1}{2}s^2\right)$,

and variance $\exp\left(2m+s^2\right)\left[\exp(s^2)-1\right]$.

The random number generator initializes using the system clock when Igor Pro starts. This almost guarantees that you will never repeat a sequence. For repeatable "random" numbers, use **SetRandomSeed**. The algorithm uses the Mersenne Twister random number generator.

See Also

The **SetRandomSeed** operation.

Noise Functions on page III-390.

Chapter III-12, **Statistics** for a function and operation overview.

LombPeriodogram

LombPeriodogram [*flags*] ***srcTimeWave***, ***srcAmpWave*** **[**, ***srcFreqWave*** **]**

The LombPeriodogram is used in spectral analysis of signal amplitudes specified by *srcAmpWave* which are sampled at possibly random sampling times given by *srcTimeWave*. The only assumption about the sampling times is that they are ordered from small to large time values. The periodogram is calculated for either a set of frequencies specified by *srcFreqWave* (slow method) or by the flags /FR and /NF (fast method). Unless you specify otherwise, the results of the operation are stored by default in W_LombPeriodogram and W_LombProb in the current data folder.

Flags

/DESP=*datafolderAndName*

Saves the computed P-values in a wave specified by *datafolderAndName*. The destination wave will be created or overwritten if it already exists. *dataFolderAndName* can include a full or partial path with the wave name.

Creates by default a wave reference for the destination wave in a user function. See **Automatic Creation of WAVE References** on page IV-72 for details.

If this flag is not specified, the operation saves the P-values in the wave W_LombProb in the current data folder.

/DEST=*datafolderAndName*

Saves the computed periodogram in a wave specified by *datafolderAndName*. The destination wave will be created or overwritten if it already exists. *datafolderAndName* can include a full or partial path with the wave name (`/DEST=root:bar:destWave`).

Creates by default a wave reference for the destination wave in a user function. See **Automatic Creation of WAVE References** on page IV-72 for details.

If this wave is not specified the operation saves the resulting periodogram in the wave W_LombPeriodogram in the current data folder.

/FR=fRes
: Use /FR to specify the frequency resolution of the output. This flag is used together with /NF to specify the range of frequencies for which the periodogram is computed. Note that *fRes* is also the lowest frequency in the output.

/NF=numFreq
: Use /NF to specify the number of frequencies at which the periodogram is computed. The range of frequencies of the periodogram is then [*fRes*, (*numFreq*-1)**fRes*].

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

/Z
: Do not report any errors.

Details

The LombPeriodogram (sometimes referred to as "Lomb-Scargle" periodogram) is useful in detection of periodicities in data. The main advantage of this approach over Fourier analysis is that the data are not required to be sampled at equal intervals. For an input consisting of N points this benefit comes at a cost of an O(N^2) computations which becomes prohibitive for large data sets. The operation provides the option of computing the periodogram at equally spaced (output) frequencies using /FR and /NF or at completely arbitrary set of frequencies specified by *srcFreqWave*. It turns out that when you use equally spaced output frequencies the calculation is more efficient because certain parts of the calculation can be factored.

The Lomb periodogram is given by

$$LP(\omega)=\frac{1}{2\sigma^2}\left\{\frac{\left[\sum_{i=0}^{N-1}(y_i-\bar{y})\cos\left[\omega(t_i-\tau)\right]\right]^2}{\sum_{i=0}^{N-1}\cos^2\left[\omega(t_i-\tau)\right]}+\frac{\left[\sum_{i=0}^{N-1}(y_i-\bar{y})\sin\left[\omega(t_i-\tau)\right]\right]^2}{\sum_{i=0}^{N-1}\sin^2\left[\omega(t_i-\tau)\right]}\right\}$$

Here yi is the ith point in *srcAmpWave*, ti is the corresponding point in *srcTimeWave*,

$$\bar{y}=\frac{1}{N}\sum_{i=0}^{N-1}y_i,$$

$$\tan(2\omega\tau)=\frac{\sum_{i=0}^{N-1}\sin(2\omega t_i)}{\sum_{i=0}^{N-1}\cos(2\omega t_i)}.$$

and

$$p=1-\left\{1-\exp\left[LP(w)\right]\right\}^{N_{ind}}.$$

In the absence of a Nyquist limit, the number of independent frequencies that you can compute can be estimated using:

$$N_{ind}=-6.362+1.193N+0.00098N^2.$$

This expression was given by Horne and Baliunas derived from least square fitting. Nind is used to compute the P-values as: