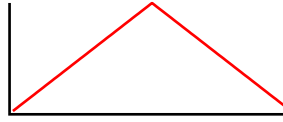


You can create other windows by writing a user-defined function or by executing a simple wave assignment statement such as this one which applies a triangle window:

```
data *= 1-abs(2*p/numpts(data)-1)
```



Use point indexing to avoid X scaling complications. You can determine the effect a window has by applying it to a perfect cosine wave, preferably a cosine wave at 1/4 of the sampling frequency (half the Nyquist frequency).

Other windows are provided in the WaveMetrics-supplied “DSP Window Functions” procedure file.

Multidimensional Windowing

When performing FFTs on images, artifacts are often produced because of the sharp boundaries of the image. As is the case for 1D waves, windowing of the image can help yield better results from the FFT.

To window images, you will need to use the ImageWindow operation, which implements the Hanning, Hamming, Bartlett, Blackman, and Kaiser windowing filters. See the **ImageWindow** operation on page V-435 for further details. For a windowing example, see **Correlations** on page III-362.

Power Spectra

Periodogram

The periodogram of a signal $s(t)$ is an estimate of the power spectrum given by

$$P(f) = \frac{|F(f)|^2}{N},$$

where $F(f)$ is the Fourier transform of $s(t)$ computed by a Discrete Fourier Transform (DFT) and N is the normalization (usually the number of data points).

You can compute the periodogram using the FFT but it is easier to use the DSPPeriodogram operation, which has the same built-in window functions but you can also select your own normalization to suppress the DC term or to have the results expressed in dB as:

$$20\log_{10}(F/F_0)$$

or

$$10\log_{10}(P/P_0)$$

where P_0 is either the maximum value of P or a user-specified reference value.

DSPPeriodogram can also compute the cross-power spectrum, which is the product of the Fourier transform of the first signal with the complex conjugate of the Fourier transform of the second signal:

$$P(f) = \frac{F(f)G^*(f)}{N}$$

where $F(f)$ and $G(f)$ are the DFTs of the two waves.

Power Spectral Density Functions

The PowerSpectralDensity routine supplied in the “Power Spectral Density” procedure file computes Power Spectral Density by averaging power spectra of segments of the input data. This is an early procedure file that does not take advantage of the new built-in features of the FFT or DSPPeriodogram operations. The procedure is still supported for backwards compatibility.