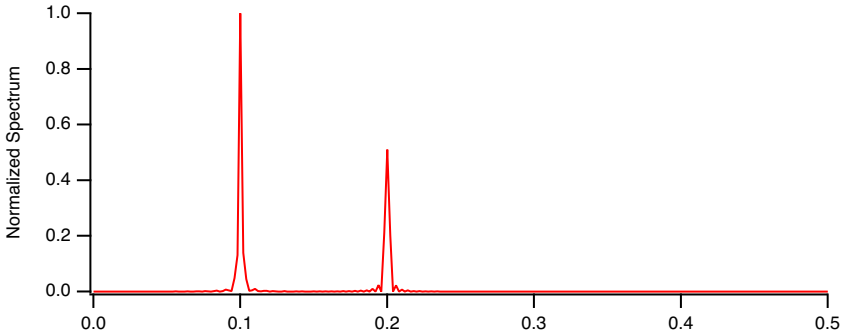
the presence of two frequencies it provides no indication of the temporal variation of the signal's frequency content. Furthermore, the different power in the two frequencies may be attributed to either a different duration or a different amplitude.



Continuous Wavelet Transform

The Continuous Wavelet Transform (CWT) is a time-frequency representation of signals that graphically has a superficial similarity to the Wigner transform.

A wavelet transform is a convolution of a signal s(t) with a set of functions which are generated by translations and dilations of a main function. The main function is known as the mother wavelet and the translated or dilated functions are called wavelets. Mathematically, the CWT is given by

$$W(a,b) = \frac{1}{\sqrt{a}}\int s(t)\psi\left(\frac{t-b}{a}\right)dt\,.$$

Here b is the time translation and a is the dilation of the wavelet.

From a computational point of view it is natural to use the FFT to compute the convolution which suggests that the results are dependent on proper sampling of s(t).

When the mother wavelet is complex, the CWT is also a complex valued function. Otherwise the CWT is real. The squared magnitude of the CWT $|W(a,b)|^2$ is equivalent to the power spectrum so that a typical display (image) of the CWT is a representation of the power spectrum as a function of time offset b. One should note however that the precise form of the CWT depends on the choice of mother wavelet y and therefore the extent of the equivalency between the squared magnitude of the CWT and the power spectrum is application dependent.

The **CWT** operation (see page V-137) is implemented using both the FFT and the direct sum approach. You can use either one to get a representation of the effective wavelet using a delta function as an input. When comparing two CWT results you should always check that both use exactly the same definition of the wavelet function, same normalization and same computation method. For example,

```
Make/N=1000 signal=sin(2*pi*x*50/1000)
CWT/OUT=4/SMP2=1/R2={1,1,40}/WBI1=Morlet/WPR1=5/FSCL signal
Rename M_CWT, M_CWT1
Display as "Morlet FFT"; AppendImage M_CWT1
```