$$F(a,b) = \frac{1}{\sqrt{a}} \int_{-\infty}^{+\infty} f(t)\, \psi^*\left(\frac{t-b}{a}\right) dt$$

Concepts on Wavelets Transform

Shouke Wei, Ph.D. Professor

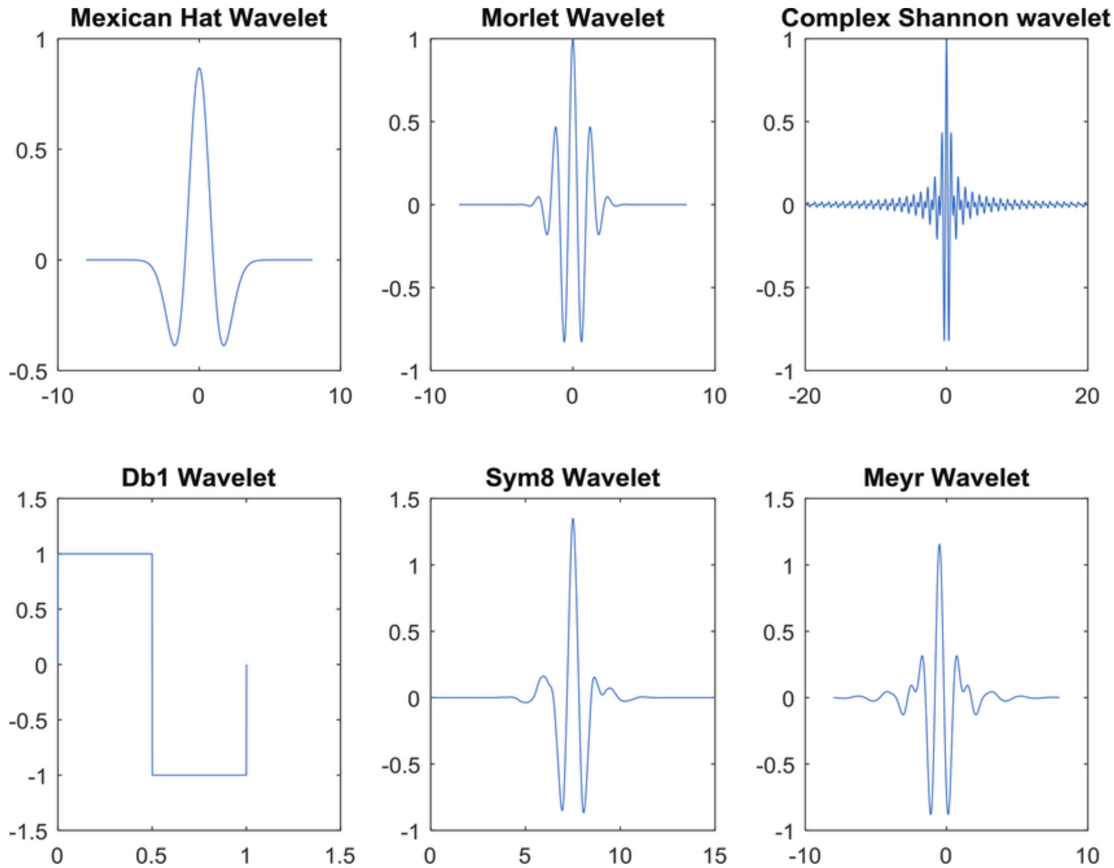
Email: shouke.wei@gmail.com

Objective

- introduce briefly some basic concepts on wavelet and wavelet transform

1. What's a Wavelet?

- a wave-like oscillation, it is a "brief oscillation"or "small oscillation"
- its amplitude begins at zero,
    - increases or decreases, and then
    - returns to zero one or more times



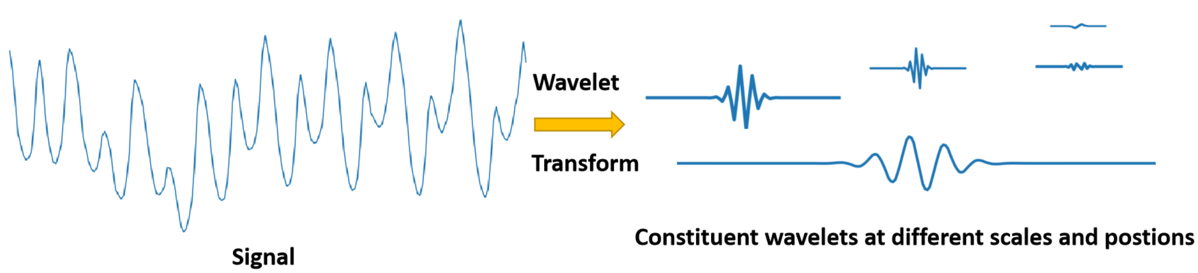
2. Wavelet Transform

- in the signal processing context
- a method to decompose an input signal of interest into a set of elementary waveforms, i.e. “wavelets”
- provides a way to analyze the signal by examining the coefficients (or weights) of these wavelets

The wavelet transform or wavelet analysis is probably the most recent solution to overcome the shortcomings of the Fourier transform.

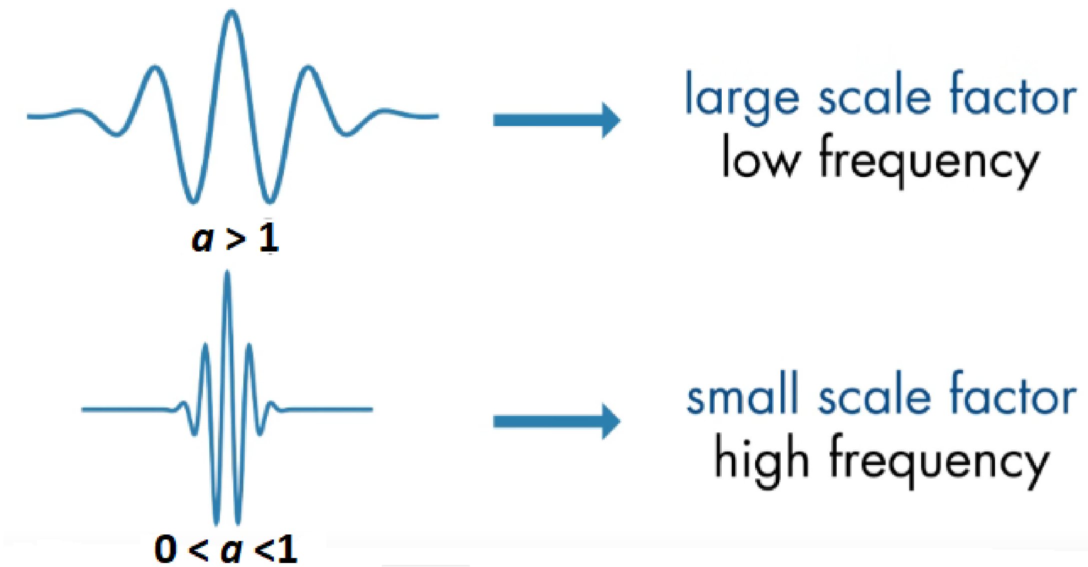
(1) Two basic factors

- scale (or dilation): Stretched or compressed (or shrunk) wavelet
- shift (or location): the positions of the wavelet



Wavelet Transform uses inner products to compare the similarity between a signal and the wavelet at various scales and positions, i.e. shifted and compressed and stretched versions of a wavelet, obtain the wavelet coefficients.

(2) The general correspondence between scale and frequency is:



- Small scale a ⇒ Compressed wavelet ⇒ Rapidly changing details ⇒ High frequency ω.
- Long scale a ⇒ Stretched wavelet ⇒ Slowly changing, coarse features ⇒ Low frequency ω.