

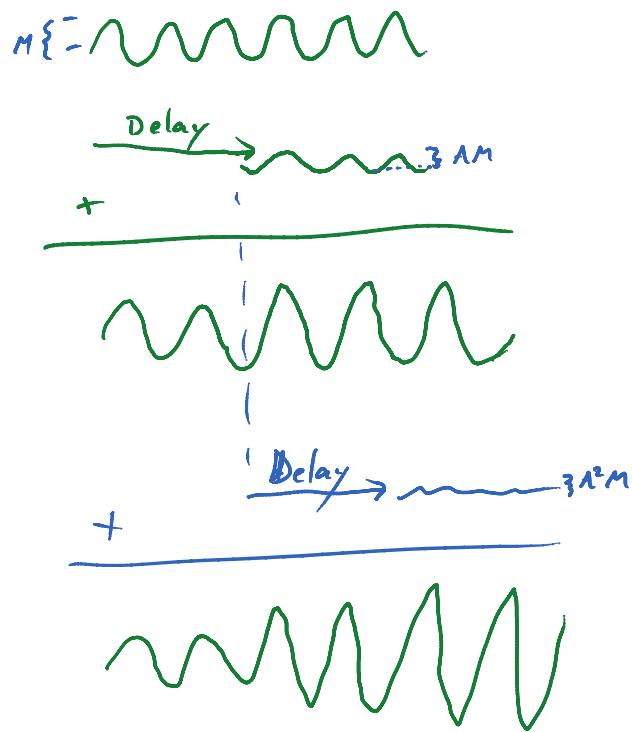
Lecture 22

Tuesday, December 13, 2011
1:35 PM



"Feed back"
- than annoying sound

Constructive Combining



Magnitude : $M + AM + A^2M \dots$

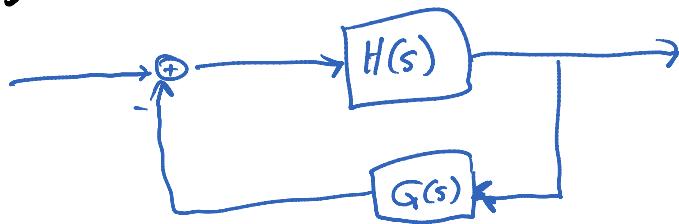
$$M \sum_{k=0}^{\infty} A^k \quad \text{Loud Feedback if } A \geq 1$$

(Constructive means "in phase")

If there is a phase shift, it changes the addition.

Gain Margin (Used often in practice)

Phase Margin



We know that $H(s)G(s) = -1$ for some $s=j\omega$ is a bad thing (unstable).

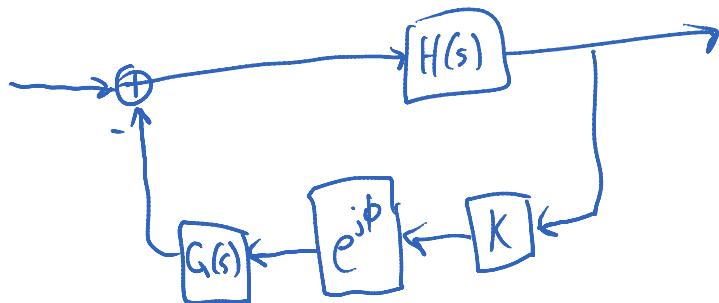
$$Q(s) = \frac{H(s)}{1 + H(s)G(s)}$$

Phase margin and gain margin use the Fourier Transform to give an optimistic bound on the tolerance (to maintain stability).

Assume Feedback system is stable:

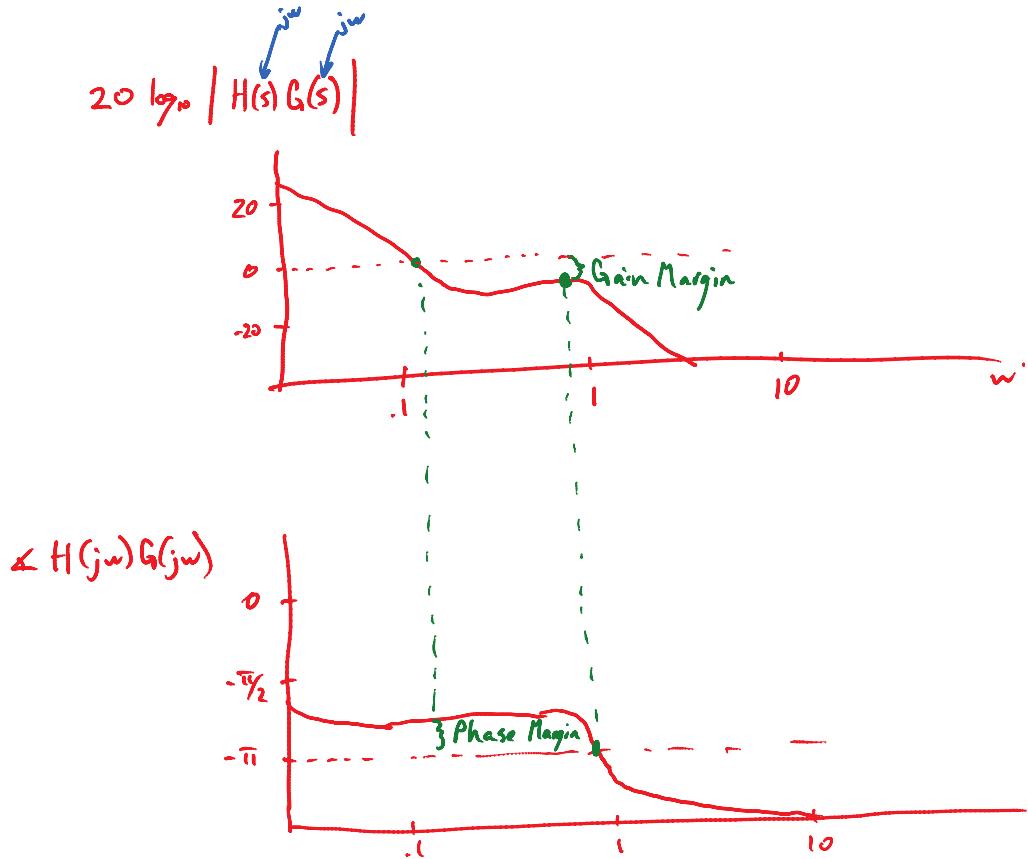
Gain Margin: Smallest increase in gain that would cause $H(s)G(s) = -1$ for some $s=j\omega$.
(usually in dB)

Phase Margin: Smallest change in phase that would cause $H(s)G(s) = -1$ for some $s=j\omega$

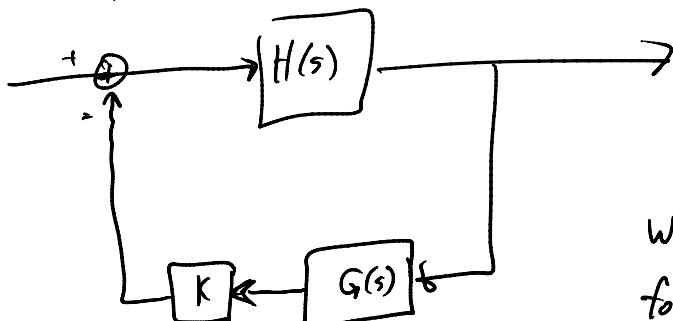


Example:

$$G(s)H(s) = \frac{4(1 + \frac{1}{2}s)}{s(1+2s)(1 + .05s + (0.125s)^2)}$$



Nyquist Criterion:

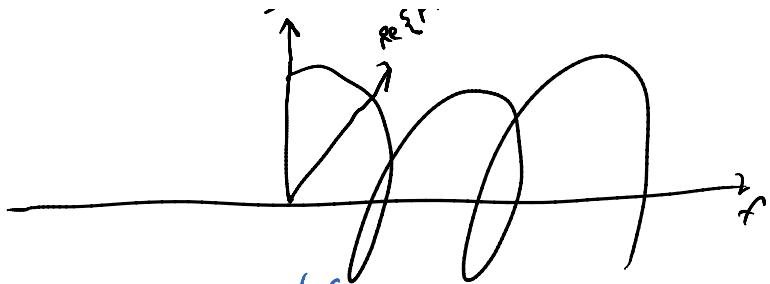


Want to design K
for stability.
(Like the Root-Locus setting.)

- Only uses the Fourier Transform (i.e. $H(s)G(s)$ for $s=j\omega$)
(but we do assume $H(s)G(s)$ is rational and you know how many poles and zeros are in the right half-plane.)

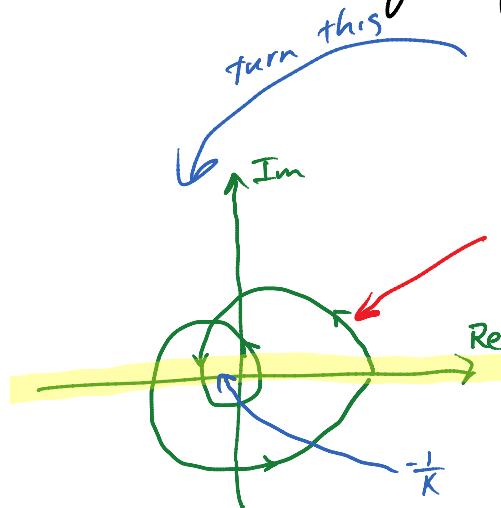
Consider a 3D plot of FT:





Nyquist Criterion

Look the species up.

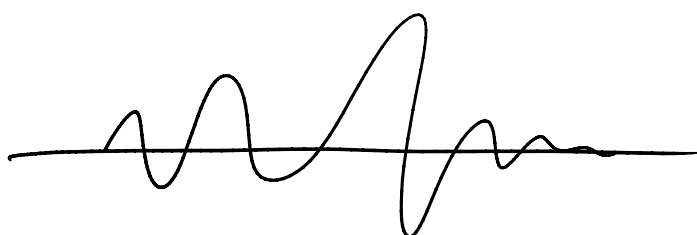


Suppose 4 poles and
2 zeros were in RHP of
 $H(s) G(s)$.

$$4 - 2 = 2$$

Find a point on real line s.t.
the path circles it CCW twice

Wavelet Transform:

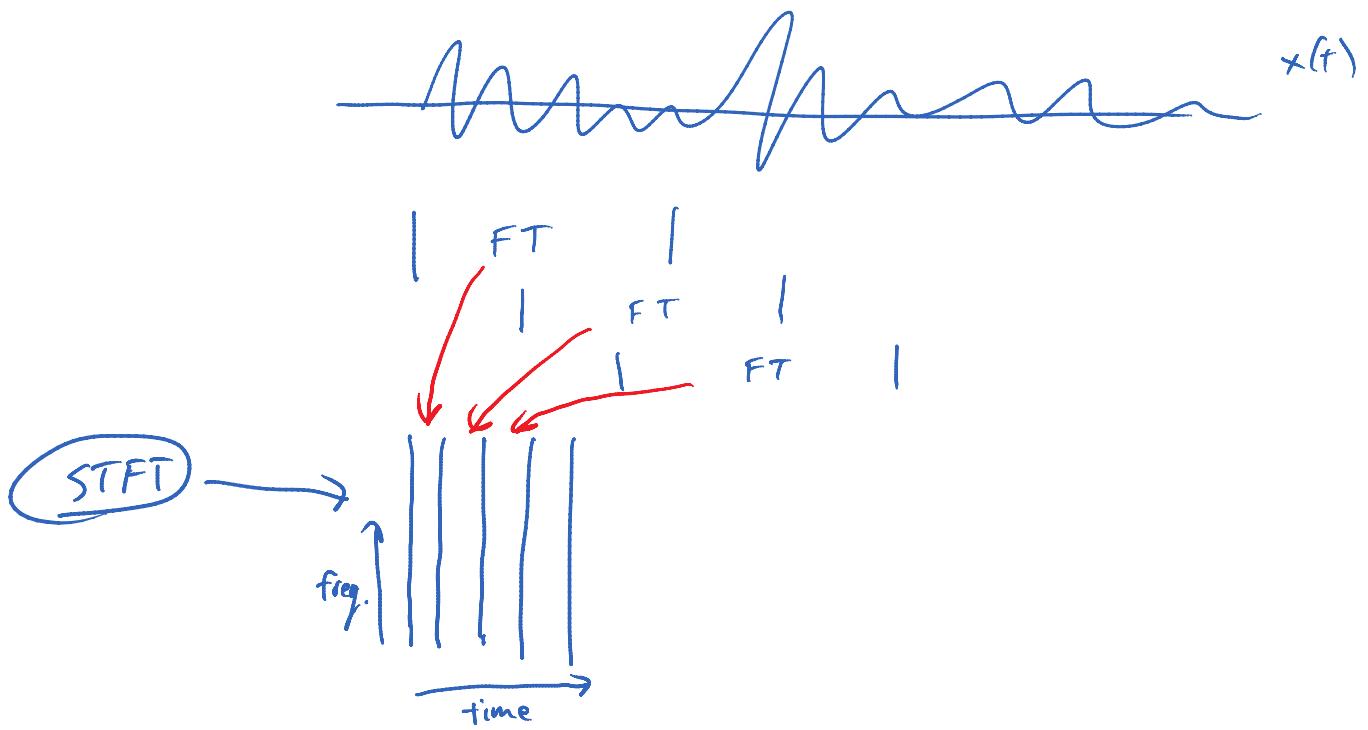


A wavelet is
a localized signal.

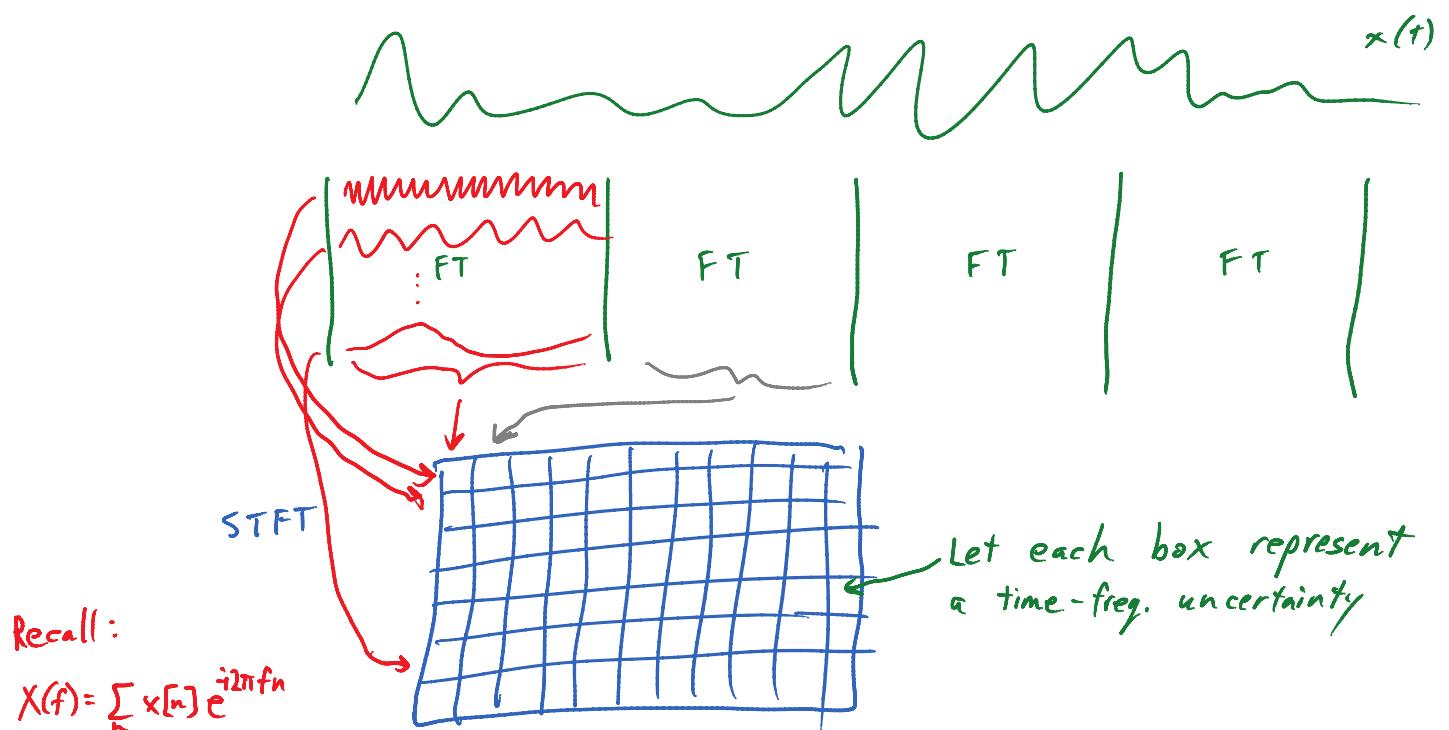
Many types of
wavelet transforms.

Motivation for the Wavelet Transform:

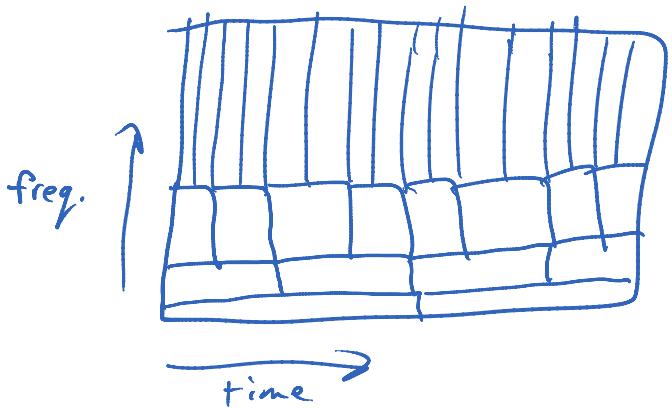
Consider Short-time Fourier's Transform:



Consider Doing this with no redundancy.



What if we could design The uncertainty like this:



Notice that you could have implemented the STFT by sampling the outputs of a bank of bandpass filters.

(non-ideal sinc shaped transfer function)