

# Lecture 13

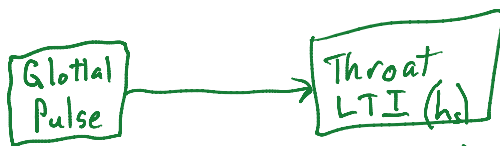
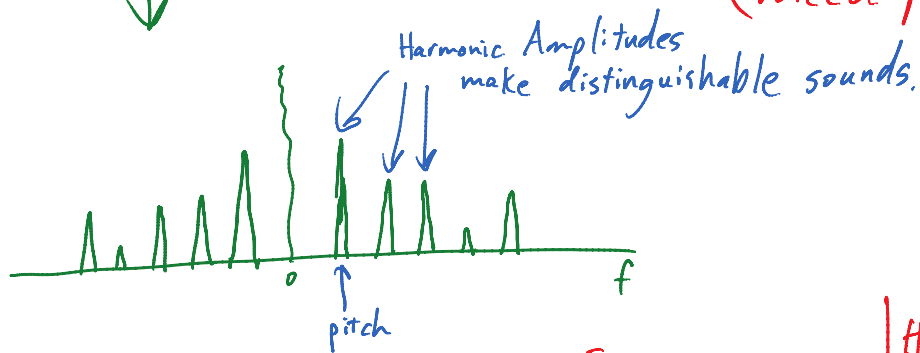
Tuesday, November 08, 2011  
11:49 AM

## Signal Processing Example - Speech

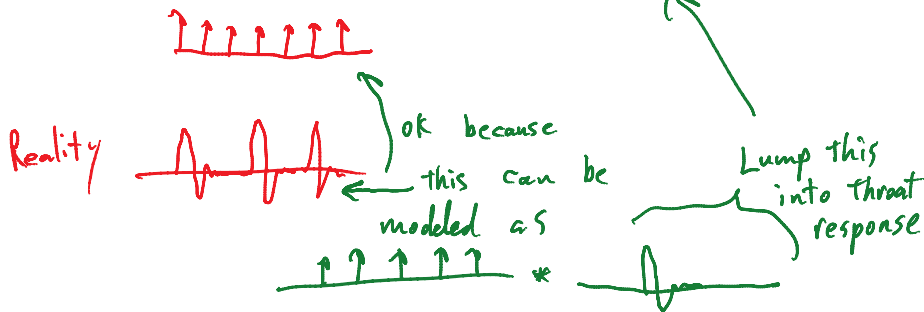
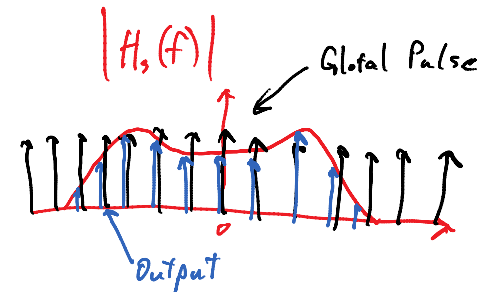


Fourier Transform

Periodic  
(voiced parts)

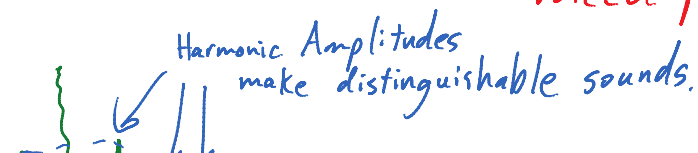


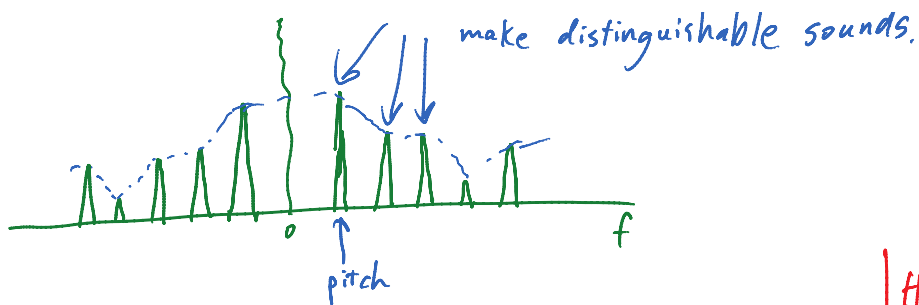
Frequency Domain



Back to original look at speech signal.

voiced parts





$$|H_s(f)|$$

## Laplace Transform and Z Transform

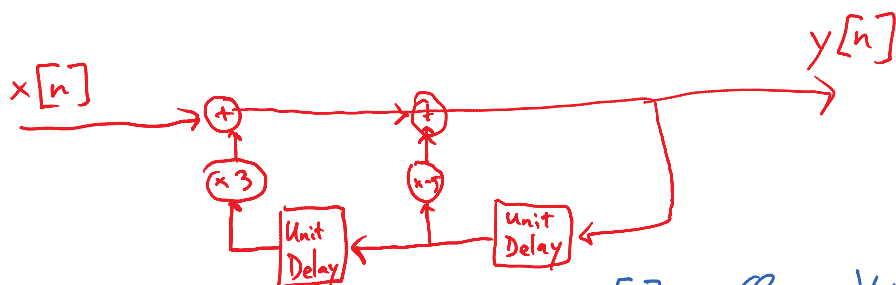


Lecture 13

Audio recording started: 1:42 PM Tuesday, November 08, 2011

We would like to be able to analyze unstable signals and systems.

For example, we might want to stabilize a system.



Diff. Equation:

$$y[n] = x[n] - 5y[n-1] + 3y[n-2]$$

Impulse Response:

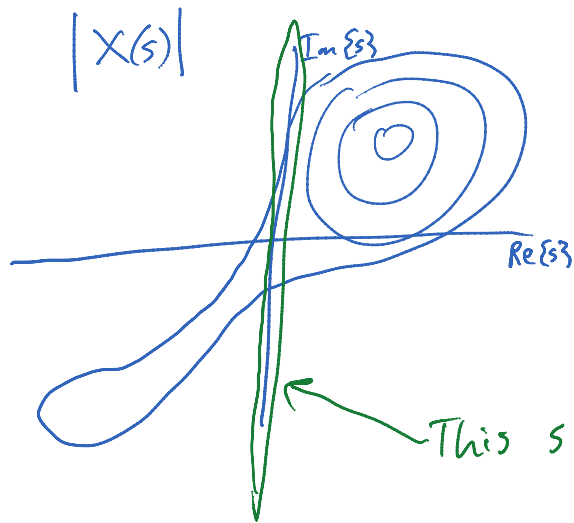
$$\begin{aligned} y[n] &= 0 \quad \forall n < 0 \\ y[0] &= x[0] = 1 \\ y[1] &= -5 \\ y[2] &= 28 \\ y[3] &= -155 \end{aligned}$$



Laplace Transform:  $L[x(t)] = \int_{-\infty}^{\infty} x(t) e^{-st} dt$  where  $s \in \mathbb{C}$

If  $s = j\omega$  (is purely imaginary)

$$|X(s)| \quad \text{Amplitude}$$



Region of Convergence :

