

Lecture 41

Frequency Domain Analysis

(1) Z-transform

Fourier Transform

$$\text{Laplace} \Big|_{z=e^{sT}} \Rightarrow \text{Z transform}$$

$$\text{Z transform} \Big|_{z=e^{j\omega}} \Rightarrow \text{Fourier Transform}$$

(2) Discrete Fourier Transform
Fast Fourier Transform

(3) Filter Design

OSR Applications

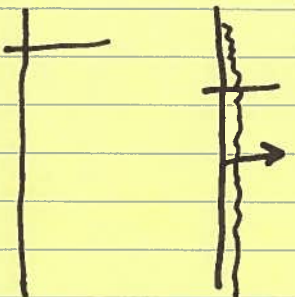
(1) Linear Filtering

(2) Correlation \Rightarrow remove additive noise

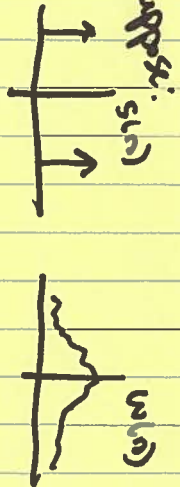
$$x(n) = s(n) + w(n)$$

(3) Homomorphic Processing

$$x(n) = s(n)w(n)$$



Suppose: $s(n)$

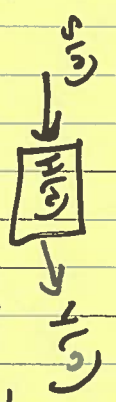


$$x(n) = s(n)w(n)$$



(4) Interpolation:
Upsampling
Downsampling

(5) Machine Learning:
optimize coefficients of a model



$$y(n) = \sum a_i s(n-i)$$

$$y(n) = \sum a_i y(n-i) + e(n)$$