Hamming–windowed, synthetic [a] vowel
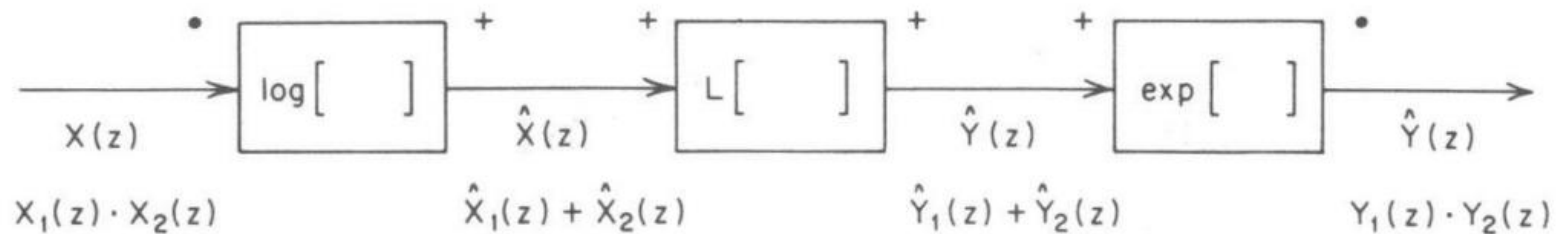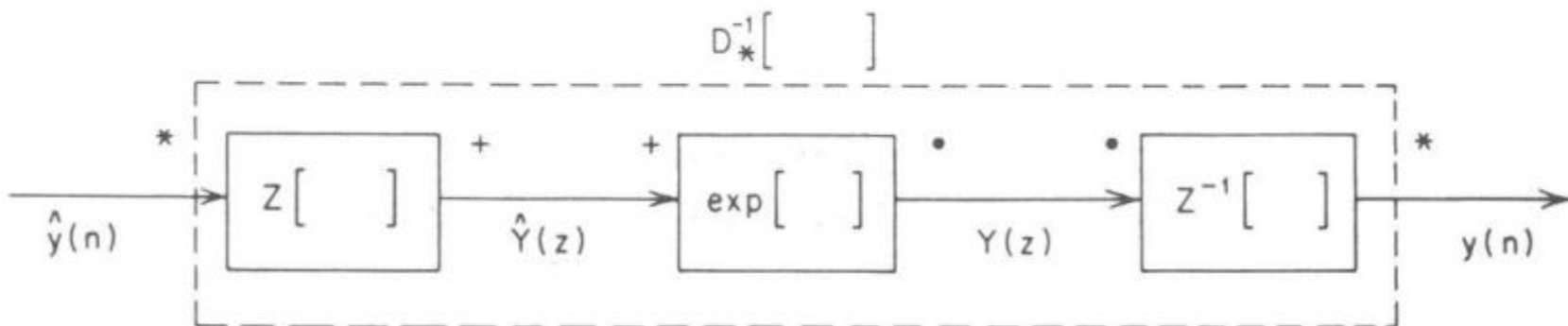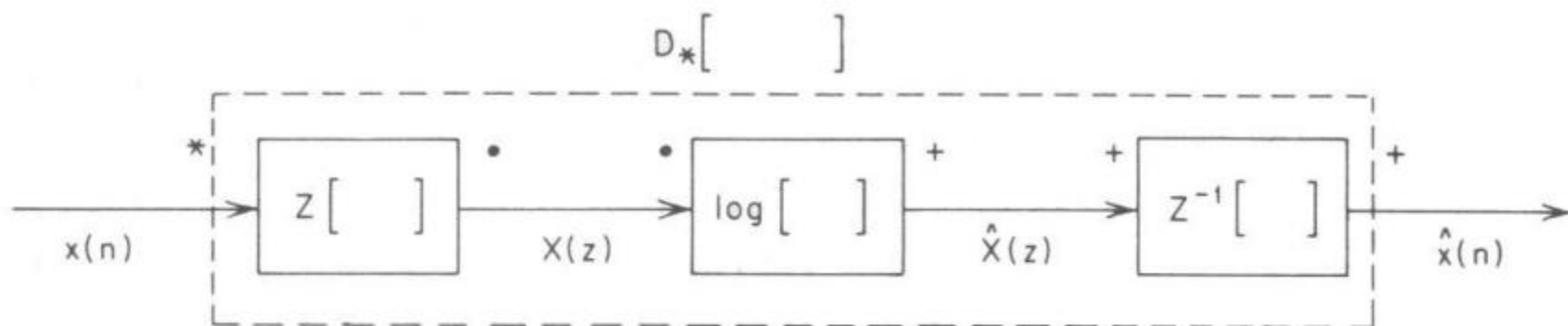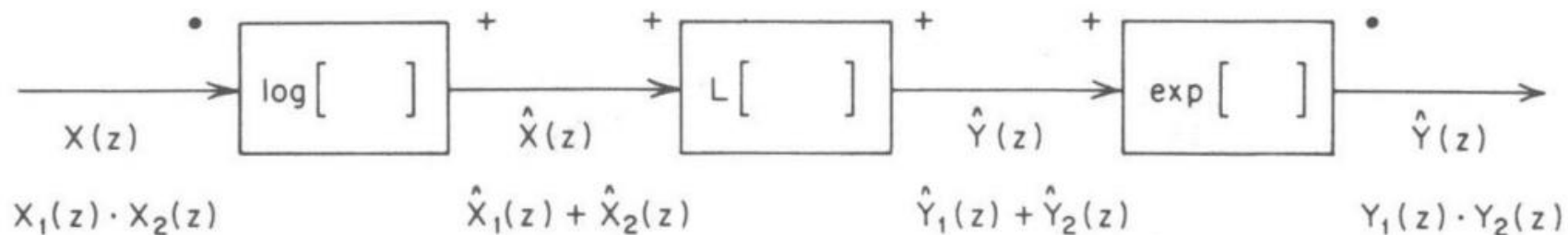
Spectrum of windowed, synthetic [a] vowel

Can we separate into excitation and vocal tract response – deconvolution.

https://ccrma.stanford.edu/~jos/SpecEnv/LPC_Envelope_Example_Speech.html

Thus, the frequency domain representation of a homomorphic system for deconvolution can be represented as

$$X(z) \longrightarrow \boxed{\log[\quad]} \longrightarrow \hat{X}(z) \longrightarrow \boxed{L[\quad]} \longrightarrow \hat{Y}(z) \longrightarrow \boxed{\exp[\quad]} \longrightarrow \hat{Y}(z)$$

$$X_1(z) \cdot X_2(z) \qquad \hat{X}_1(z) + \hat{X}_2(z) \qquad \hat{Y}_1(z) + \hat{Y}_2(z) \qquad Y_1(z) \cdot Y_2(z)$$

Top diagram:

• → log[ ] → + → L[ ] → + → exp[ ] → •

$X(z)$ $\hat{X}(z)$ $\hat{Y}(z)$ $\hat{Y}(z)$

$X_1(z) \cdot X_2(z)$ $\hat{X}_1(z) + \hat{X}_2(z)$ $\hat{Y}_1(z) + \hat{Y}_2(z)$ $Y_1(z) \cdot Y_2(z)$

Middle diagram:

$D_*[\quad]$

* → Z[ ] → • → log[ ] → + → $Z^{-1}[ ]$ → +

$x(n)$ $X(z)$ $\hat{X}(z)$ $\hat{x}(n)$

Bottom diagram:

$D_*^{-1}[\quad]$

* → Z[ ] → + → exp[ ] → • → $Z^{-1}[ ]$ → *

$\hat{y}(n)$ $\hat{Y}(z)$ $Y(z)$ $y(n)$

Terminology

- **Spectrum** – Fourier transform of signal autocorrelation
- **Cepstrum** – inverse Fourier transform of log spectrum
- **Analysis** – determining the spectrum of a signal
- **Alanysis** – determining the cepstrum of a signal
- **Filtering** – linear operation on time signal
- **Liftering** – linear operation on cepstrum
- **Frequency** – independent variable of spectrum
- **Quefrency** – independent variable of cepstrum
- **Harmonic** – integer multiple of fundamental frequency
- **Rahmonic** – integer multiple of fundamental frequency