Lecture 27

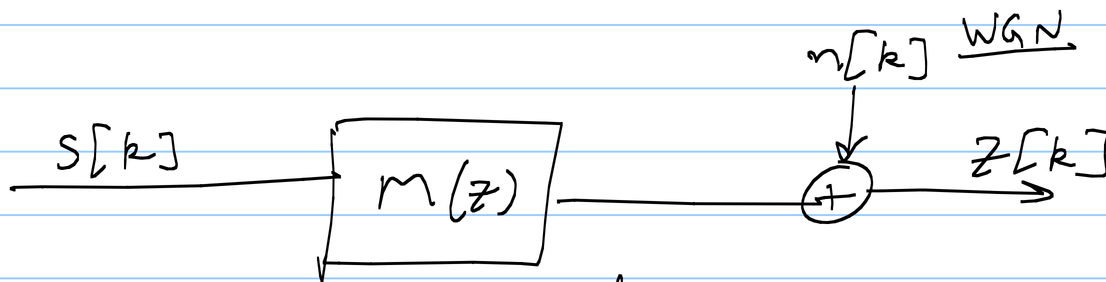
Note Title 9/22/2008

$$\Gamma_{MLSD} = \Gamma_{MF} = \frac{4(1+\alpha^2)}{\sigma^2} \rightarrow ?$$

$$\Gamma_{ZF-LE} = \frac{4(1-\alpha^2)}{\sigma^2}$$

SNR = ?

$$\Gamma_{ZF-DFE} = \frac{4}{\sigma^2}$$



monic, causal,
loosely minimum phase

WMF front end:

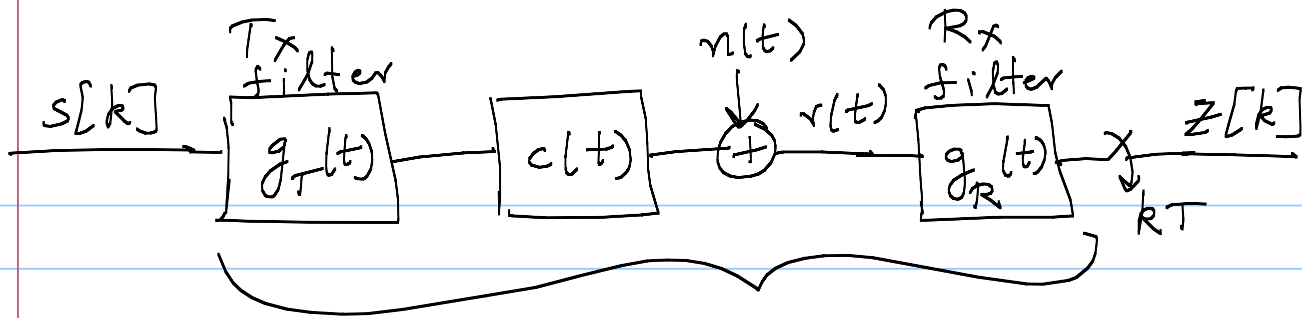
MF : $h^*(-t)$?

Whitening: ?

$\longrightarrow$ Equalization model with a non-WMF front end.

$\longrightarrow$ Still symbol-rate sampled.

$\longrightarrow$ ZF criterion: may not be the best.



$$h(t) = g_T(t) * c(t) * g_R(t)$$

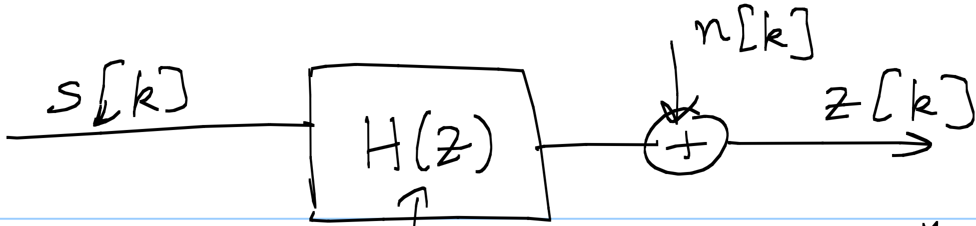
$$\Updownarrow$$

$$H(f) = G_T(f)\, C(f)\, G_R(f)$$

$$z[k] = \underbrace{\sum_{m=0}^{L-1} s[m]\, h(t-mT)}\Big|_{kT} + n[k]$$

$$h(t)\Big|_{kT} = h[k]$$

$$z[k] = s[k] * h[k] + n[k]$$



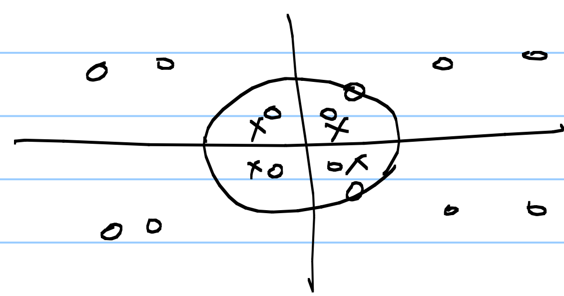
"General Equalization model"

$$H(z) \xleftrightarrow{ZT} h[k] \xleftrightarrow{DTFT} H(e^{j2\pi fT}) = \frac{1}{T}\sum_{m=-\infty}^{\infty} H\left(f-\frac{m}{T}\right)$$

$n[k] \sim$ Gaussian, PSD $= N_0 \cdot \frac{1}{T}\sum_{m=-\infty}^{\infty}\left|G\left(f-\frac{m}{T}\right)\right|^2$

PSD: $S_n(z)$ (or) $S_n(e^{j\theta})$

$H(z)$

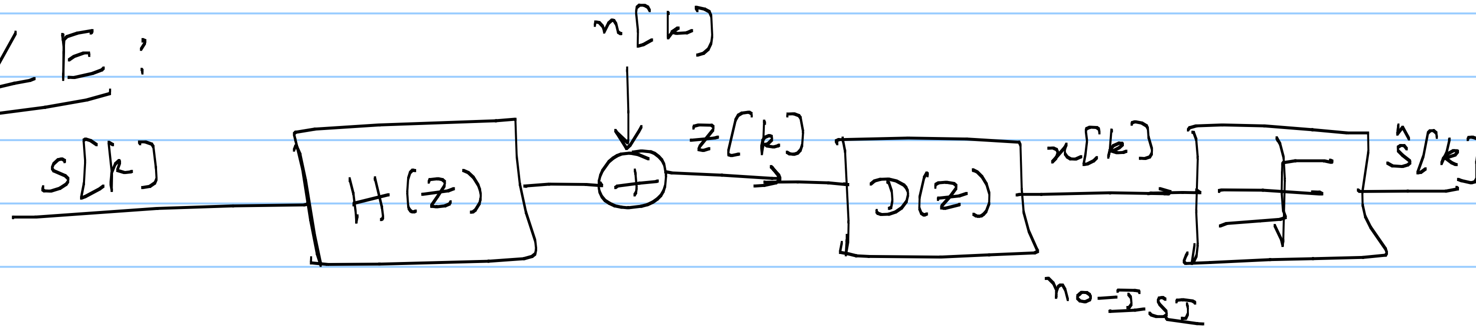


poles: inside u.c.

zeros: inside (or) outside u.c.

$$H = H_0 \, \overset{\text{omit}}{z^{r}} \, \underbrace{H_{min}}_{\text{minimum phase}} \, \underbrace{H_{max}}_{\text{zeros outside u.c. (FIR)}} \, \underbrace{H_{zero}}_{\text{zeros on u.c.}}$$

ZF-LE:

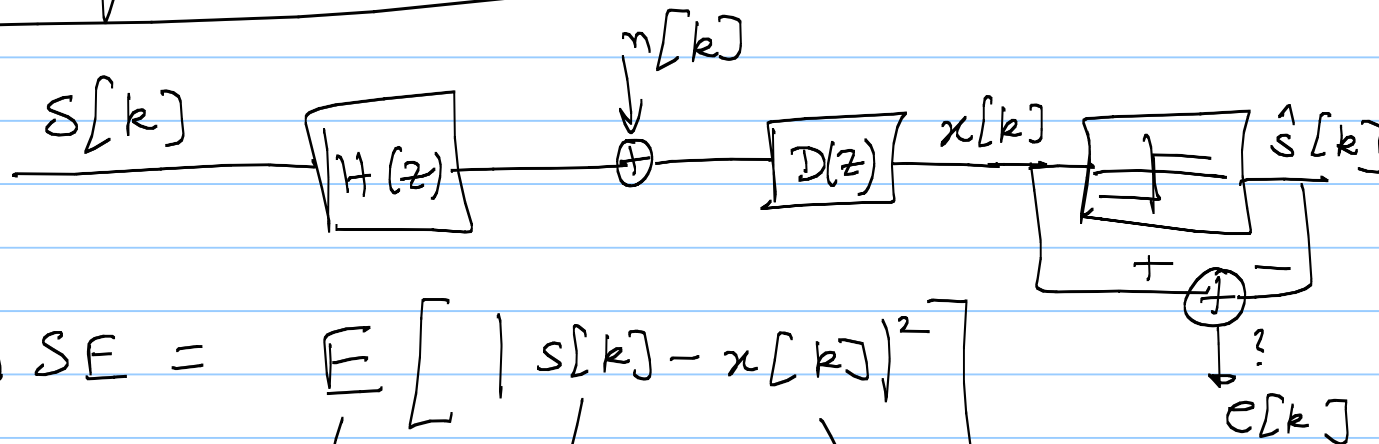


$$D(z) = \frac{1}{H(z)} \approx \frac{1}{H_{max} \, H_{min} \, H_{zero}}$$

→ Stability $\Rightarrow H_{zero} = 1$.

H_{max}^{-1} : ??

Mean Squared Error: (MSE)



$$MSE = E\left[\,|s[k] - x[k]|^2\,\right]$$

E → ?

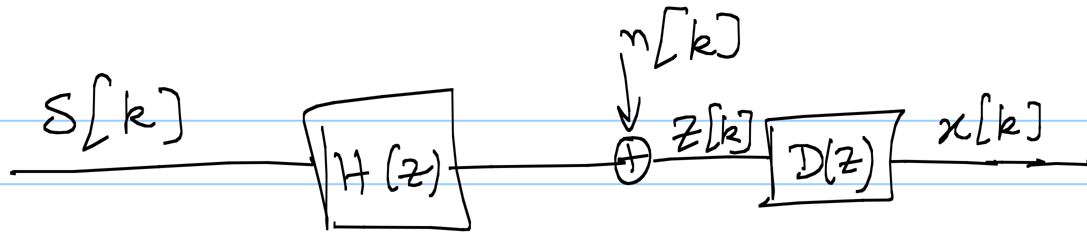
$s[k]$ → random process (iid uniform)

$x[k]$ → induced RP

Error RP: $e[k] = x[k] - s[k]$

$e[k] \leftrightarrow S_e(e^{j\theta})$

$$MSE = \langle S_e \rangle_A$$



$$e[k] = x[k] - s[k]$$

$$= s[k] * h[k] * d[k] + n[k] * d[k] - s[k]$$

$$= \underbrace{s[k] * \left(h[k] * d[k] - \delta[k]\right)} + \underbrace{n[k] * d[k]}$$

$$S_e = \underbrace{S_s}_{E\left[|s[k]|^2\right]} \underbrace{\left|HD - 1\right|^2}_{\text{signal}} + S_n \underbrace{|D|^2}_{\text{noise}}$$

$$S_e = S_z \left| D - E_s S_z^{-1} H^* \right|^2 + E_s S_n S_z^{-1}$$

$$S_z = S_n + E_s |H|^2$$