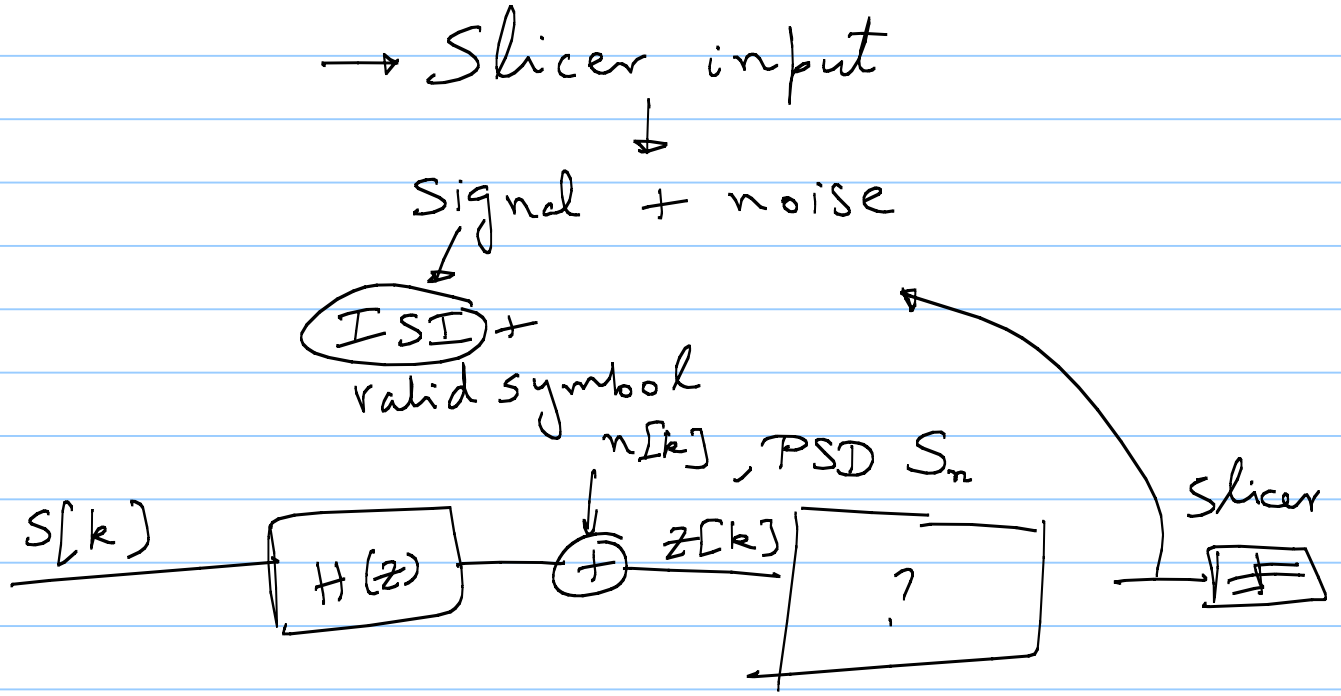
Lecture 28

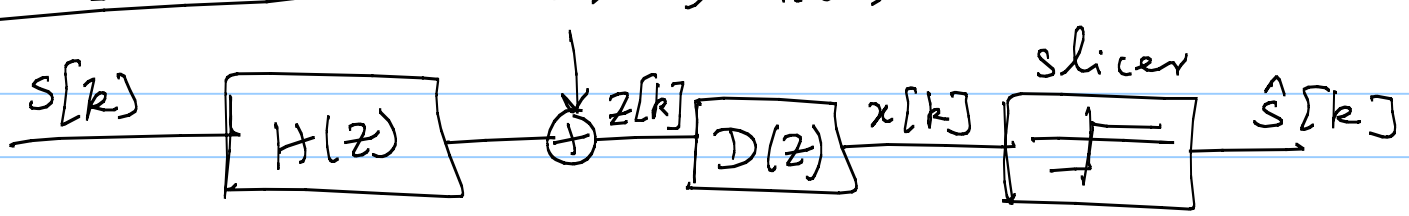
Note Title 9/23/2008

Equalizers:



$e[k] =$ slicer i/p $- s[k]$

MMSE-LE:



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

$$S_e = E_s |HD-1|^2 + S_n |D|^2 \longrightarrow$$

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

$$\left(S_z = E_s |H|^2 + S_n \right)$$

$$D = \frac{E_s H^*}{E_s |H|^2 + S_n}$$

$$MMSE = \left\langle \frac{E_s S_n}{E_s |H|^2 + S_n} \right\rangle_A$$

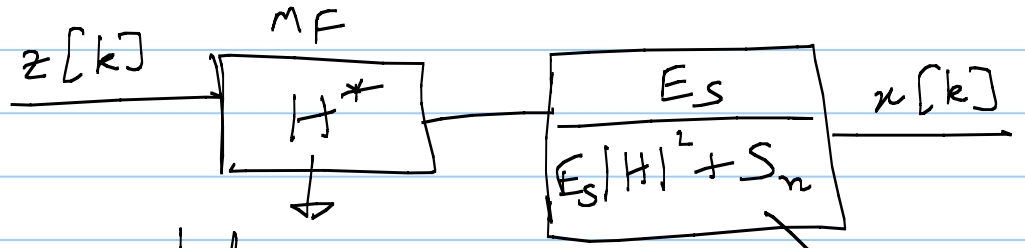
MMSE-LE:

$$D = \frac{E_s H^*}{E_s |H|^2 + S_n}$$

$$MMSE = \left\langle \frac{E_s S_n}{E_s |H|^2 + S_n} \right\rangle_A$$

$$H = H_0 \, H_{min} \, H_{max} \, H_{zero}$$

Remarks:



poles outside U.C. is possible.

U.C stable.

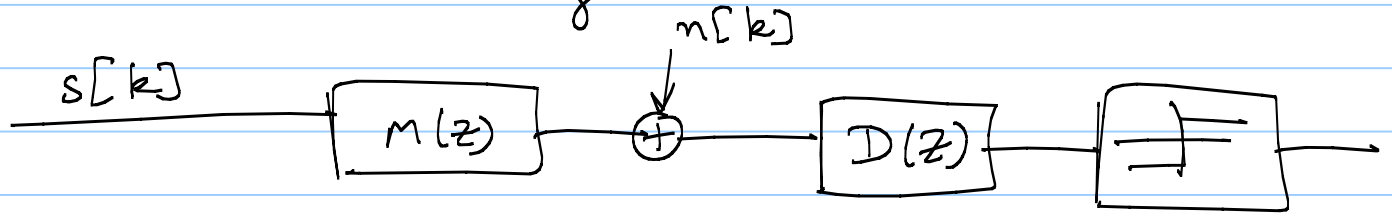
→ Not as bad as $\frac{1}{H}$.

$S_n \to 0 \Rightarrow MMSE \to ZF$.

Special case: $H(z) = M(z)$

(monic, min. phase)

$$S_n = \frac{N_0}{\gamma^2}, \text{ white}$$



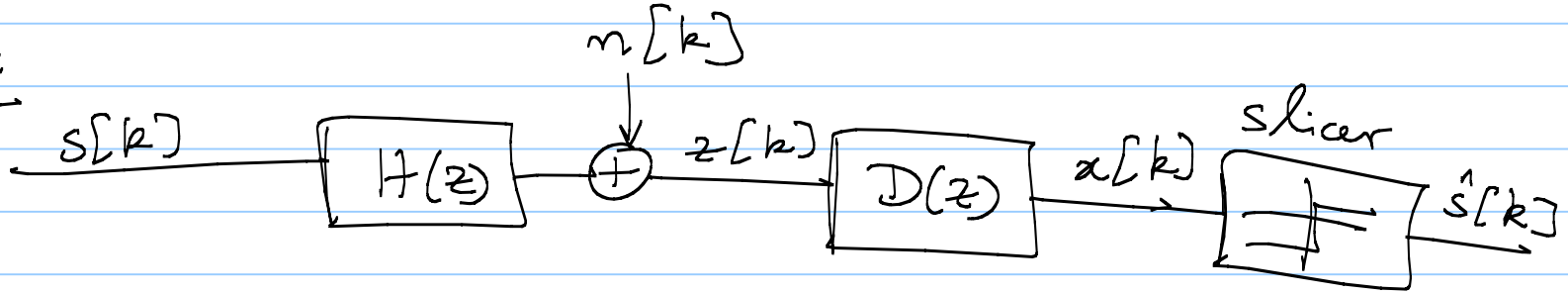
$$D = \frac{E_s M^*}{E_s |M|^2 + \frac{N_0}{\gamma^2}} = \frac{M^*}{|M|^2 + \frac{N_0}{E_s \gamma^2}}$$

$$MMSE = \left\langle \frac{E_s \cdot \frac{N_0}{\gamma^2}}{E_s |M|^2 + \frac{N_0}{\gamma^2}} \right\rangle_A = \left\langle \frac{N_0}{\gamma |M|^2 + \frac{N_0}{E_s}} \right\rangle_A$$

ZF-LE: $MSE = \left\langle \frac{N_0}{\gamma |M|^2} \right\rangle_A$

→ DFE: ZF & MMSE.

LE:

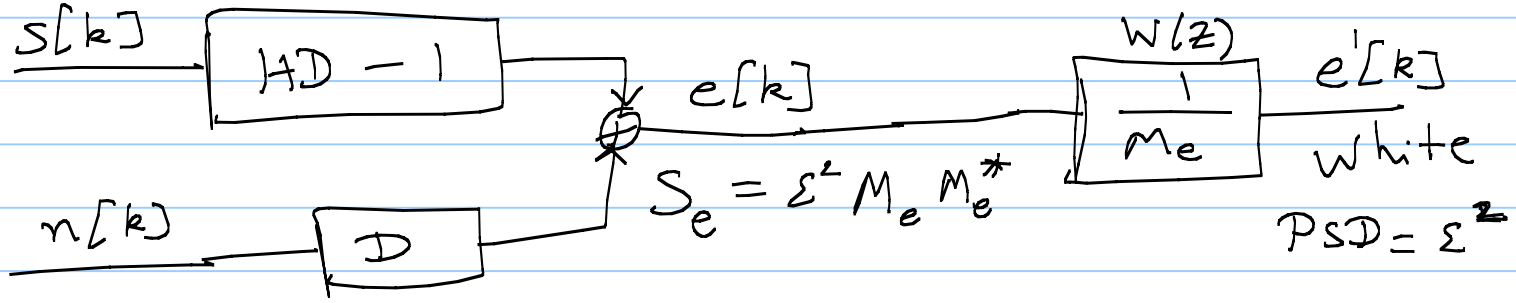


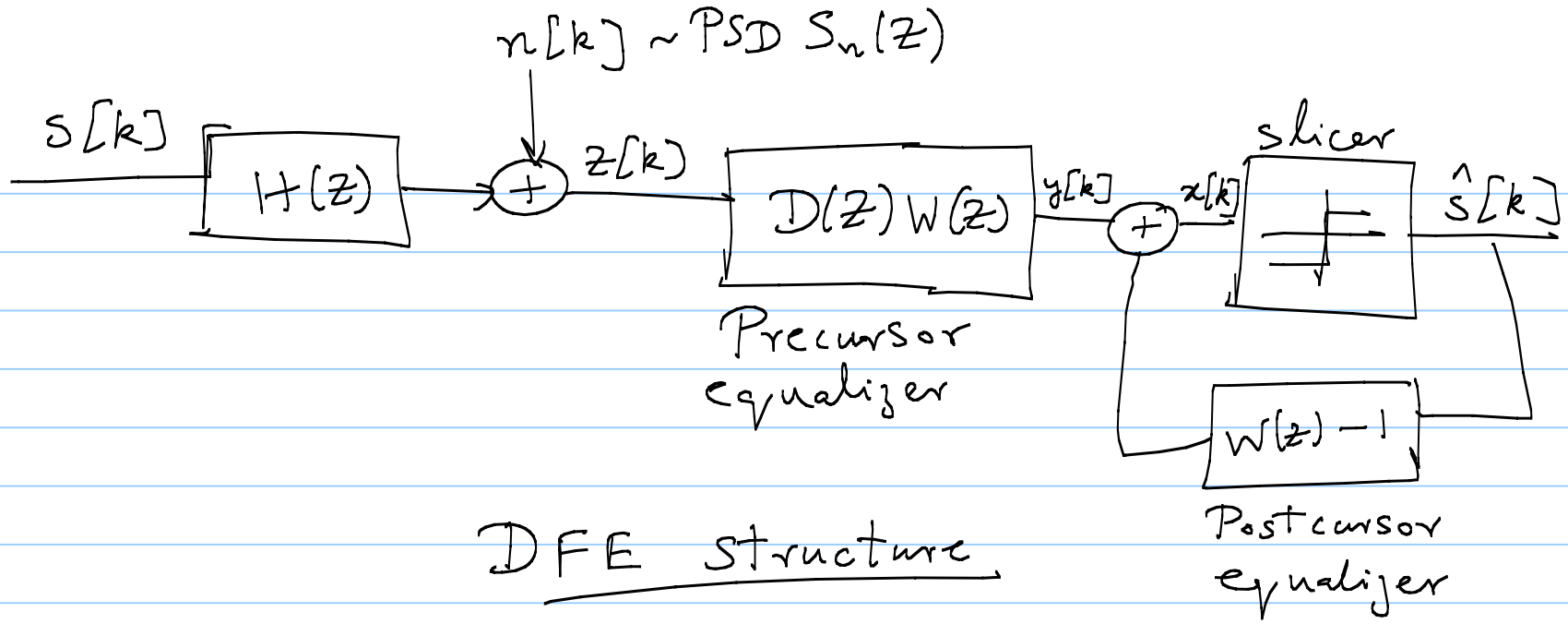
$e[k] = x[k] - s[k]$

↓

non-white

→ Can we whiten $e[k]$? Will it decrease MSE?





DFE structure

→ achieves noise whitening if $\hat{s}[k]$ are accurate.