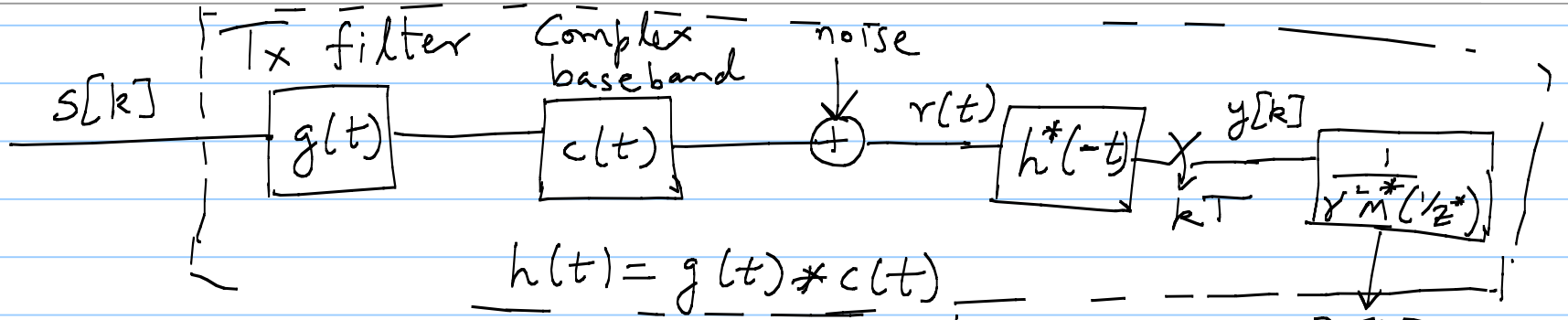
Lecture 20

Note Title 9/9/2008



$$h(t) = g(t) * c(t)$$

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

$$\rho_h[k] \overset{FT}{\longleftrightarrow} S_h(e^{j2\pi fT}) = \gamma^2 M(e^{j2\pi fT}) M^*(e^{j2\pi fT})$$

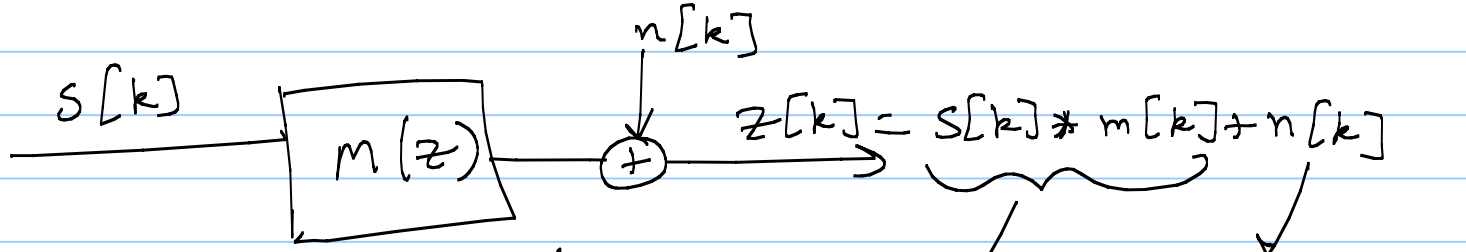
$$\gamma^2 = \exp\left\{\frac{1}{2\pi}\int_{-\pi}^{\pi} \log S_h(e^{j\theta})\, d\theta\right\}$$

$m[k]$: monic, causal minimum phase

$$Z[k] = s[k] * m[k] + n[k]$$

$n[k]$ ↳ iid, $N\left(0, \frac{N_0}{2\gamma^2}\right)$

Discrete-time ISI-AWGN model



m[k]: monic, causal, minimum phase

b[k]: received signal value.

iid, $N(0, \sigma^2)$

$$b[k] = \sum_{l=0}^{\infty} m[l]\, s[k-l]$$

Normalize s.t. $\sum_k (m[k])^2 = 1$

(Energy of $s[k]$ = Energy of $b[k]$)

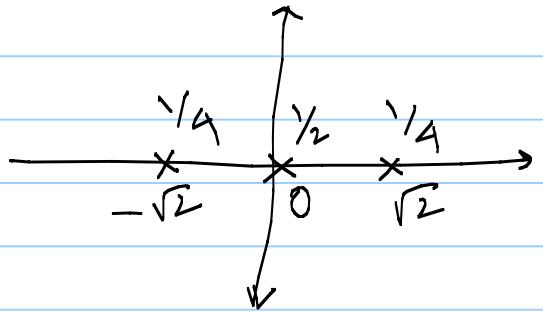
$$SNR = E_s / 2\sigma^2$$

Ex:

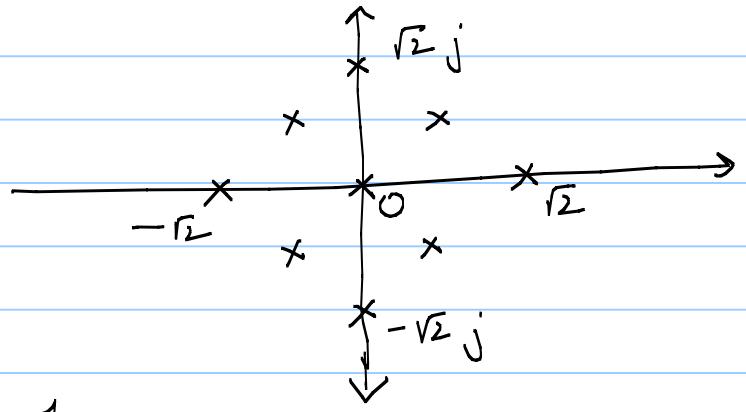
$$M(z) = \frac{1}{\sqrt{2}} - \frac{1}{\sqrt{2}} z^{-1}$$

$$Z[k] = \underbrace{\frac{1}{\sqrt{2}} s[k] - \frac{1}{\sqrt{2}} s[k-1]}_{b[k]} + n[k]$$

$\mathcal{X} = \{\pm 1\}$, BPSK



$\mathcal{X} = \{\pm 1, \pm j\}$, QPSK

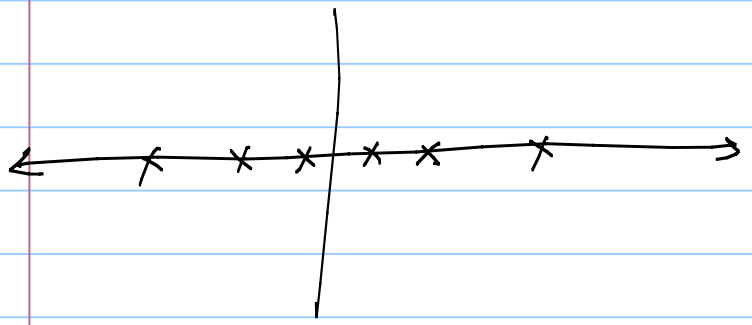


μ-tap $m(z) = m_0 + m_1 z^{-1} + \cdots + m_\mu z^{-\mu}$

# of points in Rx const. $\leq |\mathcal{X}|^{\mu+1}$

Ex: $M(z) = \frac{1}{\sqrt{2}} + \frac{1}{2} z^{-1} + \frac{1}{2} z^{-2}$

$\mathcal{X} = \{\pm 1\}$



$1 + \frac{1}{\sqrt{2}}$, $-1 - \frac{1}{\sqrt{2}}$

$\frac{1}{\sqrt{2}}$, $-\frac{1}{\sqrt{2}}$

$-1 + \frac{1}{\sqrt{2}}$, $1 - \frac{1}{\sqrt{2}}$

$\mathcal{X} = \{\pm 1, \pm j\}$

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