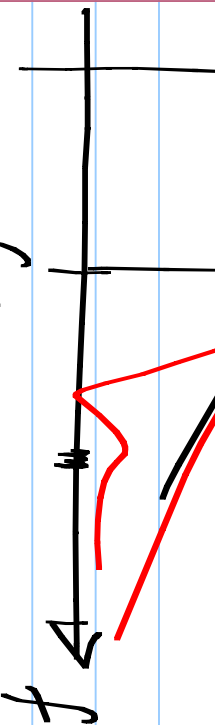
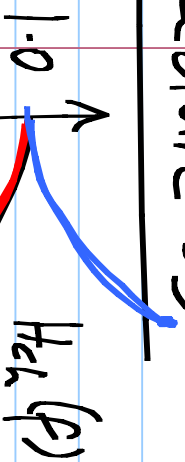
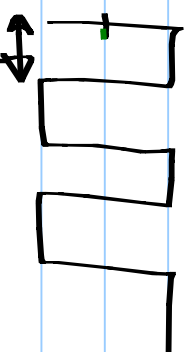


Lecture 33

Data rate: f_b .



$T_b = 1/f_b$ periodic @ $f_b/2$



$$\rho \approx \frac{4}{\pi} |H_{rc}(f_b/2)|$$

$f_b/2$

Attenuation @ $f_b/2$ specified as a compact description



Most channels: lowpass

$\Rightarrow$ Equalizers: high frequency emphasis (relative to dc)

DT or CT

$$z_1 < 1$$

$$H_{eq}(s) =$$

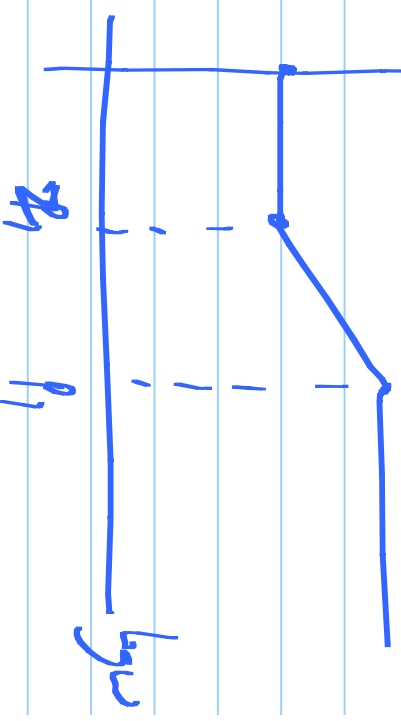
$$\left[\frac{1 + s/z_1}{(1 + s/p_1)} \dots \right]$$

CT equalizer:

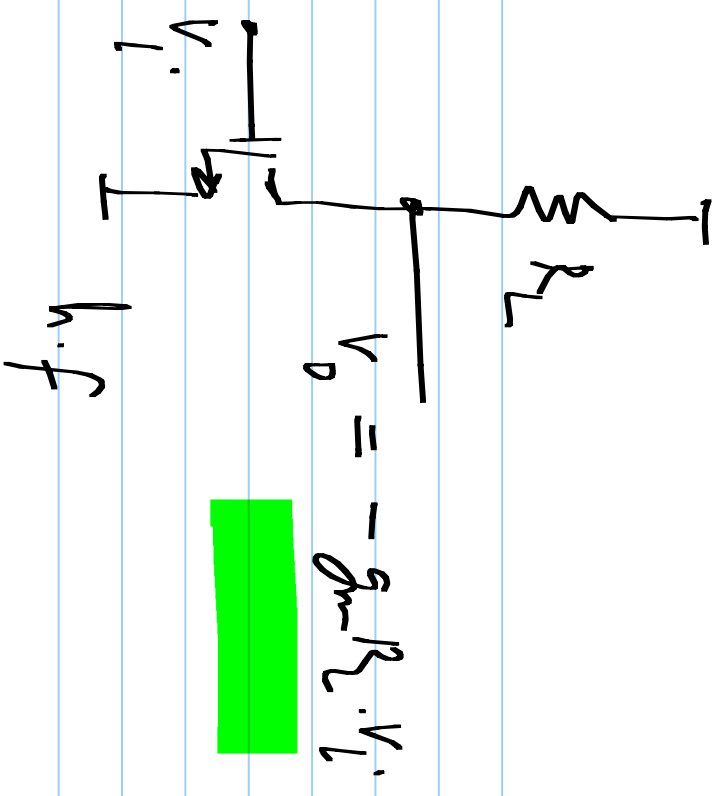
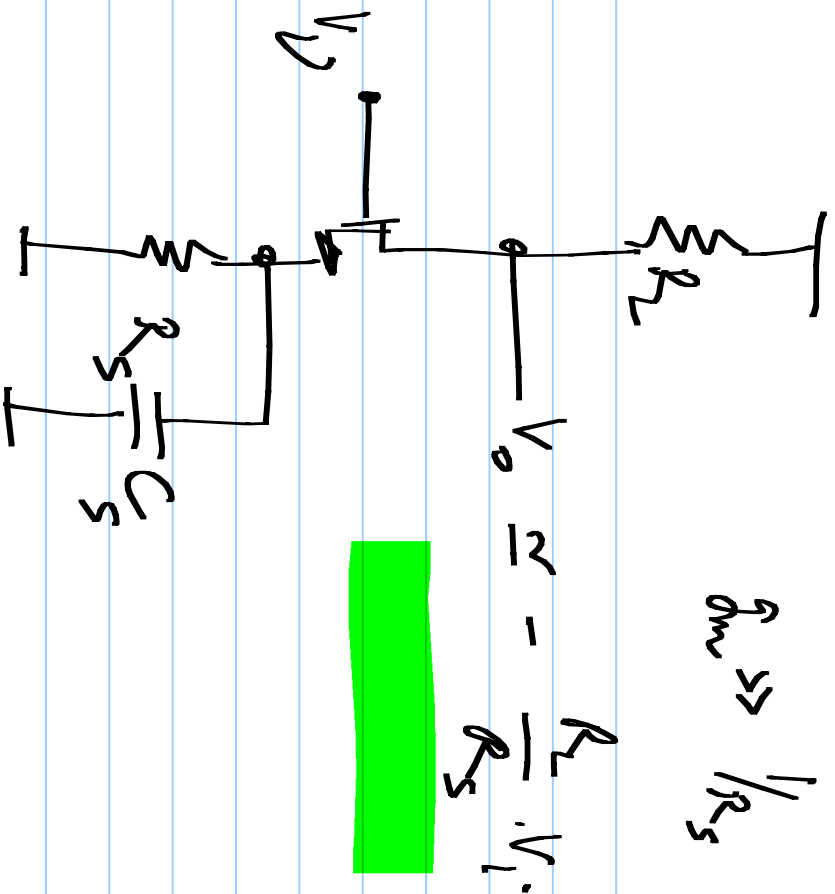
$\Rightarrow$ zeros for h.f.

(+ poles) emphasis

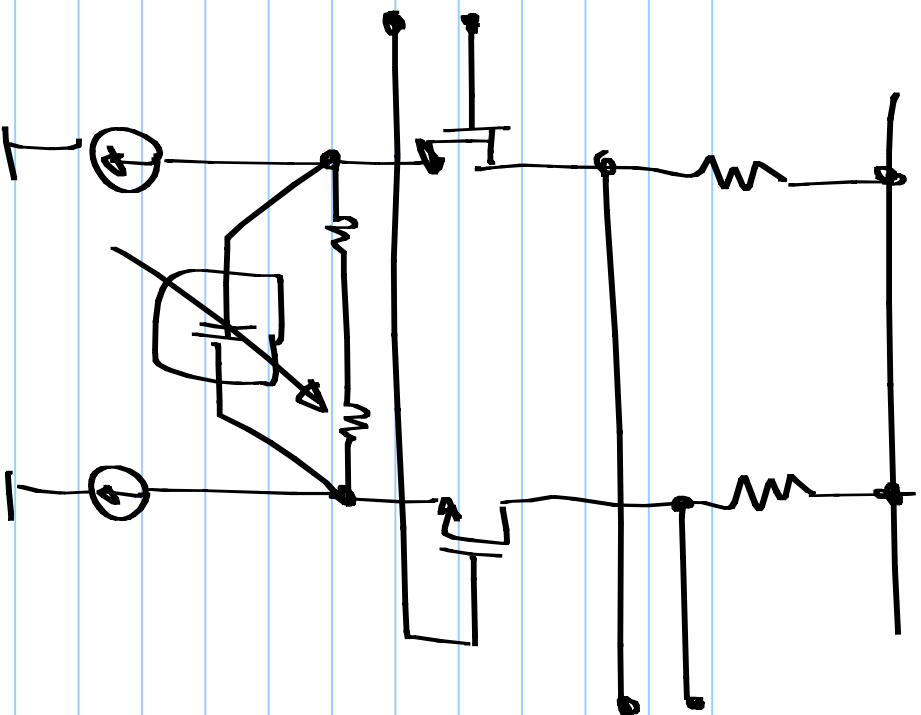
$|H_{eq}|$ (dB)



$$g_m \gg 1/R_s$$



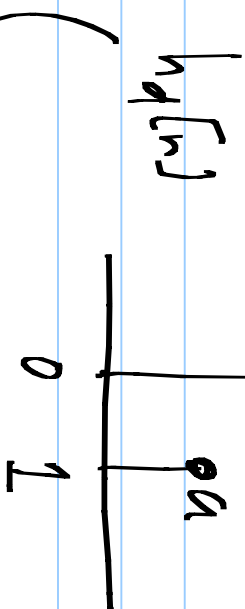
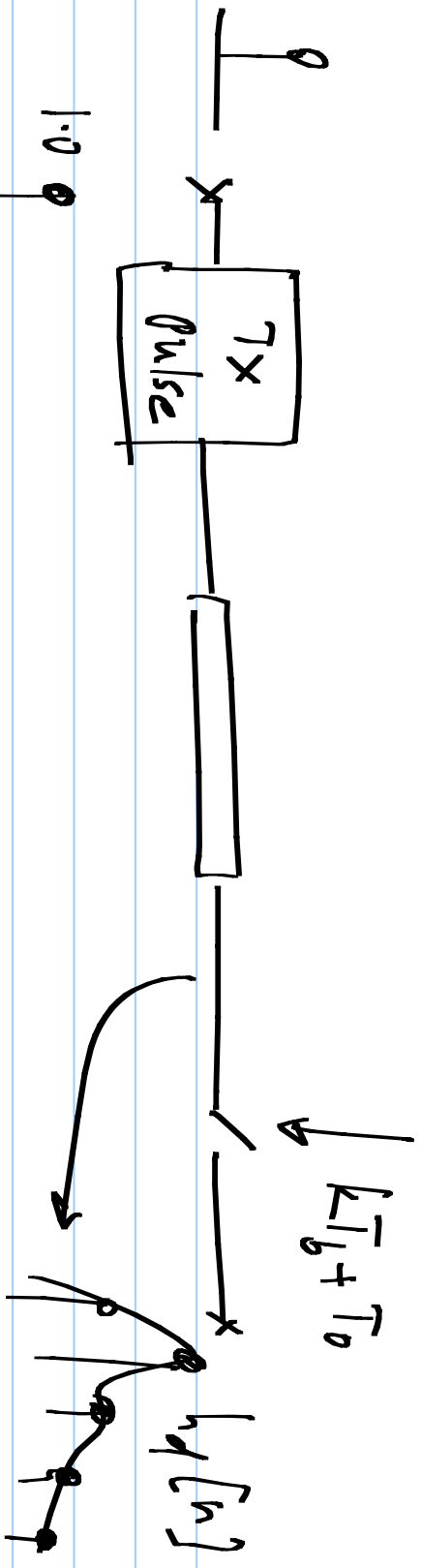
$$i.f \left(\frac{-g_m R_L}{1 + g_m R_s} \cdot \frac{1 + s C_s R_s}{1 + s C_s (R_s \parallel 1/g_m)} \right)$$



CTLE

(Continuous-time
linear equalizer)

used at the
receiver input



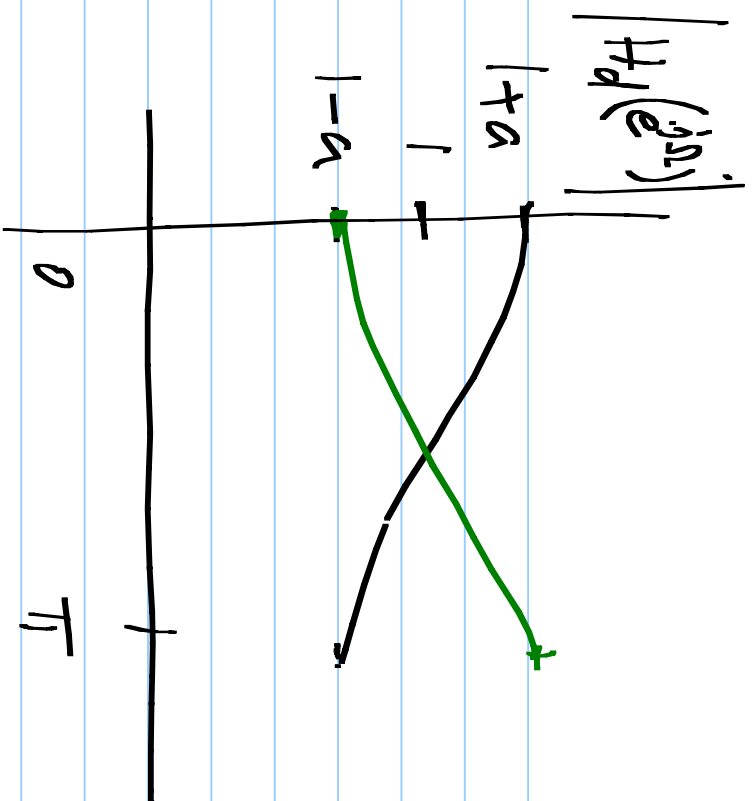
$$H_d(z) : \underline{1 + az^{-1}}$$

$$H_{eq}(z) = \underline{\frac{1}{1 + az^{-1}}}$$

FIR equalizers

$$H_{eq}(z) \approx \underline{1 - az^{-1}}$$

- * No stability concern
- * Easier for adaptation

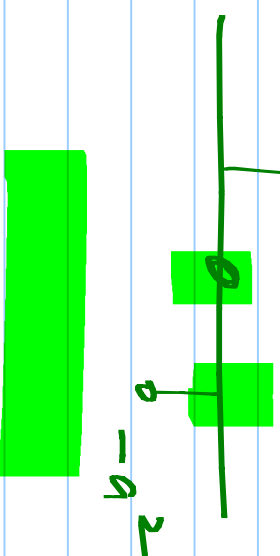


$$H_d(z) = 1 + az^{-1}$$

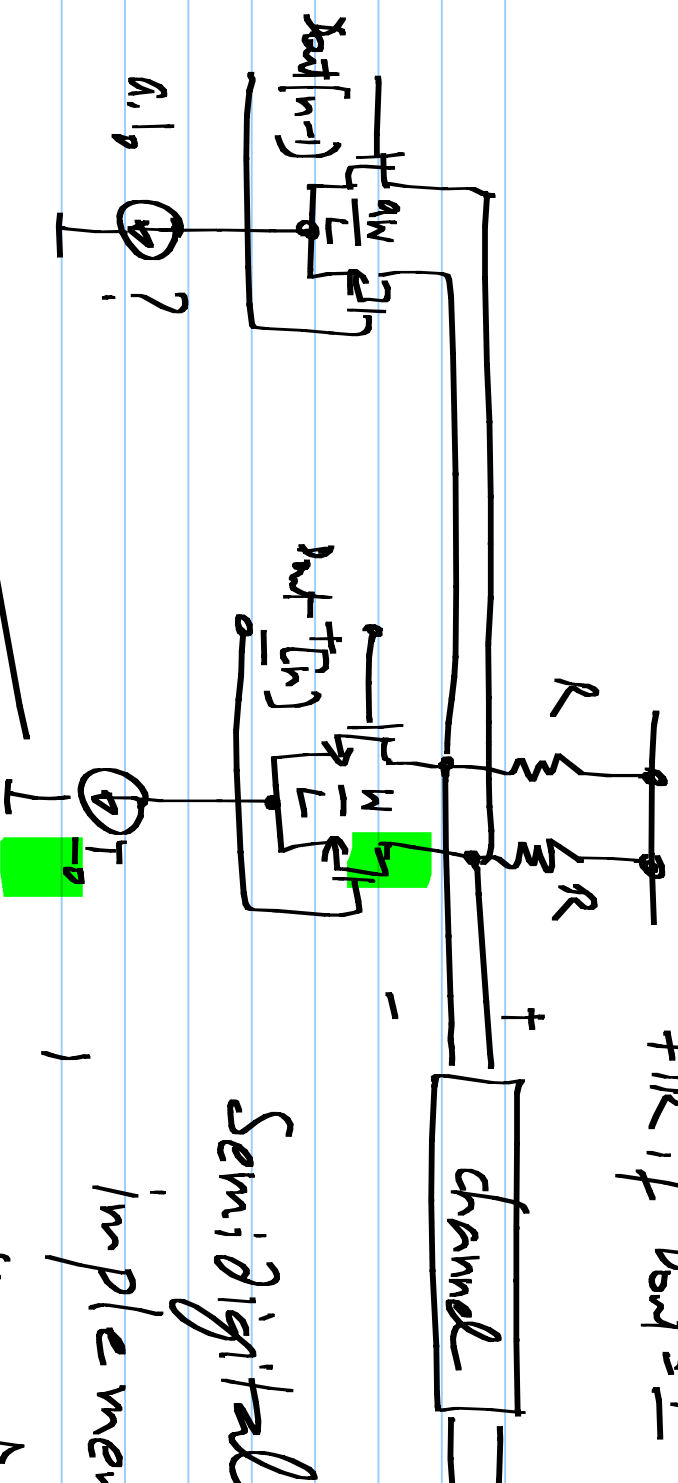
$$H_{eq}(z) \approx (1 - az^{-1})$$

$$H_d \cdot H_{eq} = 1 - a^2 z^{-2}$$

$$(1 + a^2 z^{-2})$$



+1R if $D_{out} = 1$

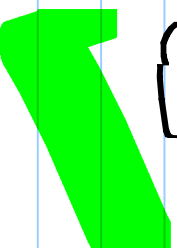
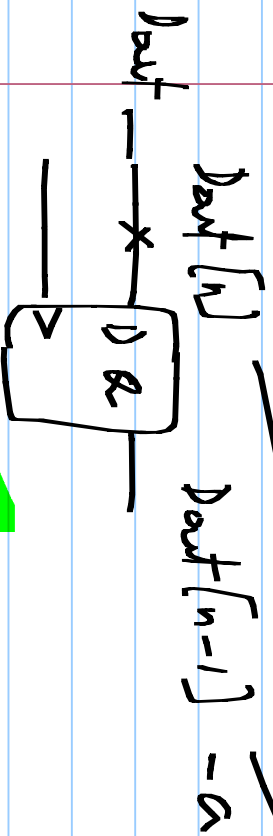


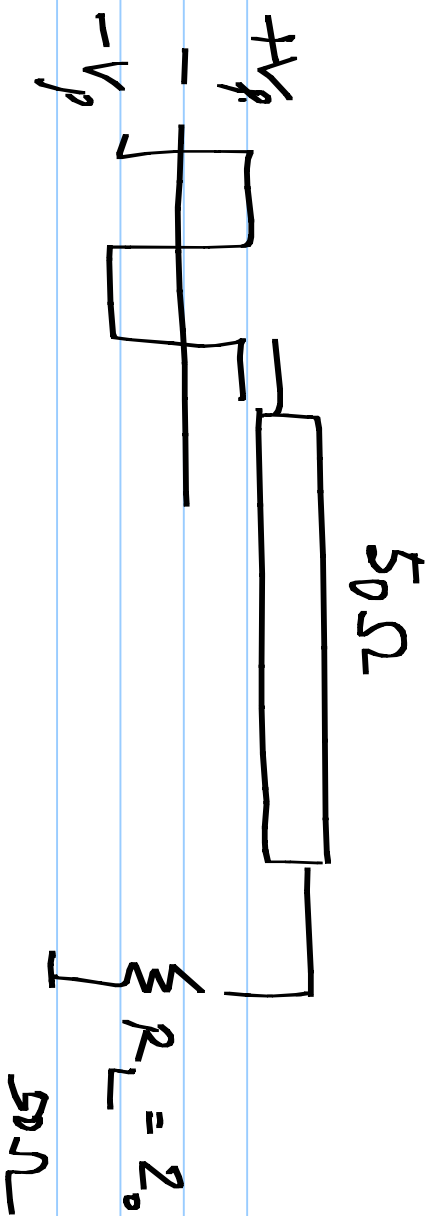
Semidigital

, implementation

of the FIR

filter @ Tx





$$V_p = 1V$$

$$\frac{V_p^2}{8Z_0}$$

4pJ/bit for $T_x + R_x$

$$20mW$$

$$10kb/s$$

$$40mW$$

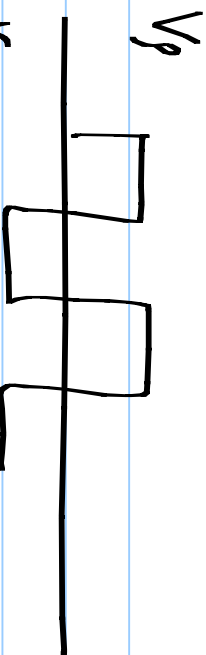
1) No equalization:

V_p : max. limit

$\frac{2V_p}{3}$

~~1/3~~

$\frac{-V_p}{3}$



$$2) h_0 + h_1 z^{-1}$$

$$[|h_0| + |h_1|]$$

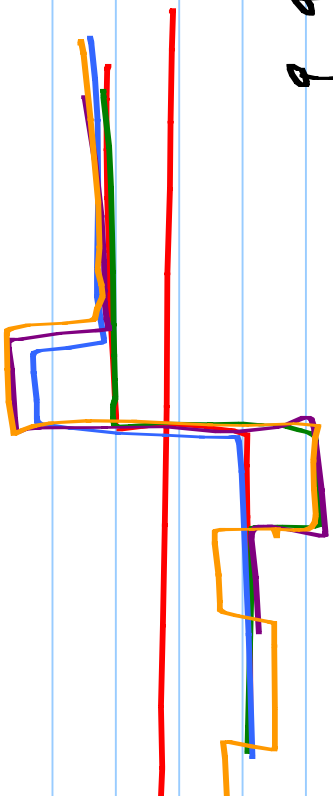
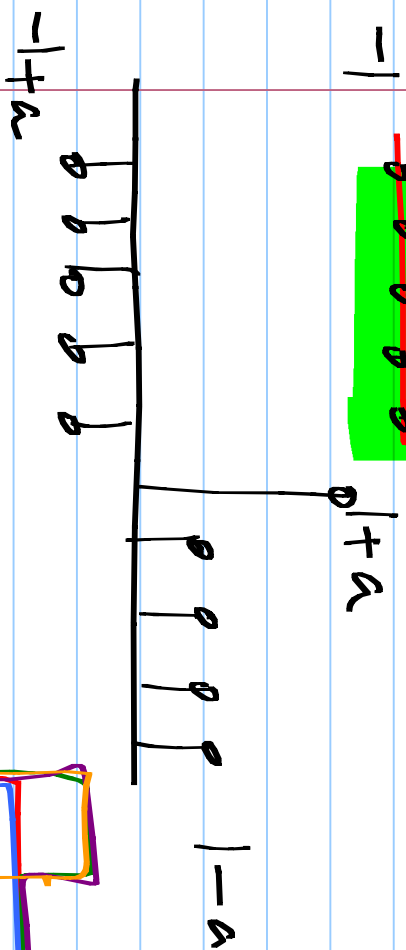
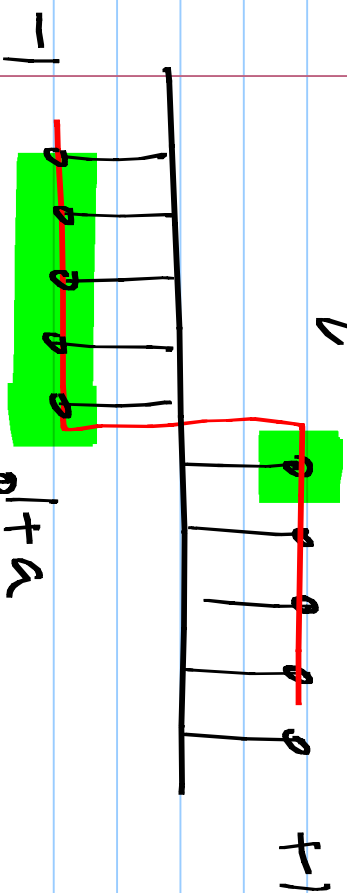
$$h_0 + h_1 z^{-1}$$

$$\{ \pm 1 \}$$

+1

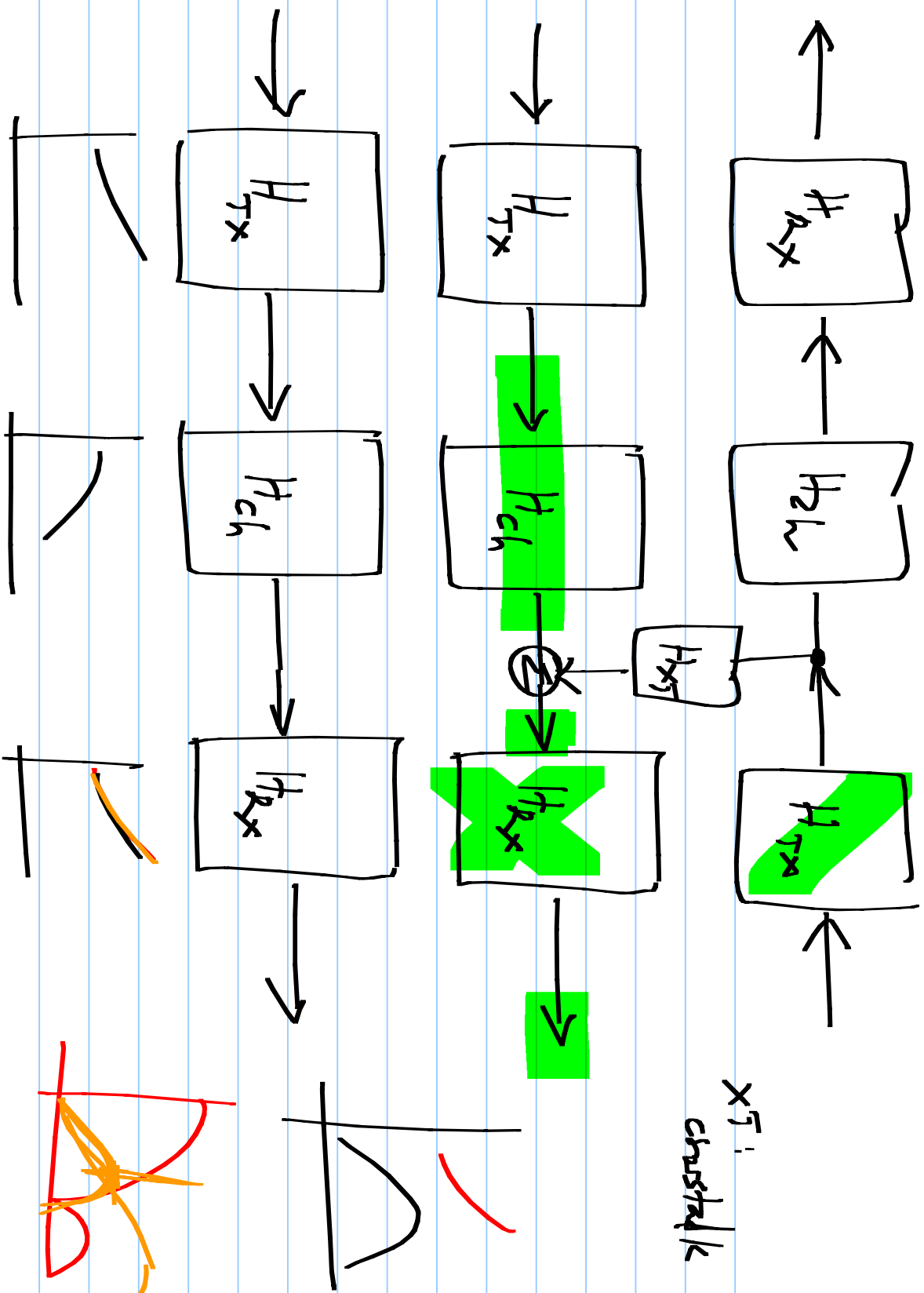
$$[-0.5 z^{-1}]$$

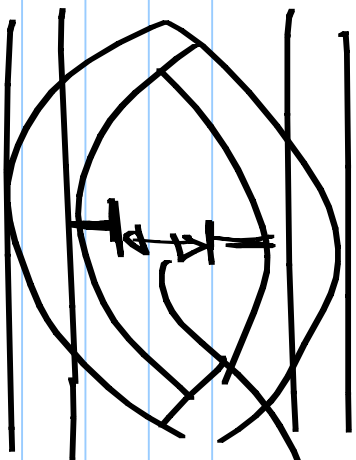
$$H(z) = 1 - az^{-1}$$



0 0 0

x^T :
chushtak

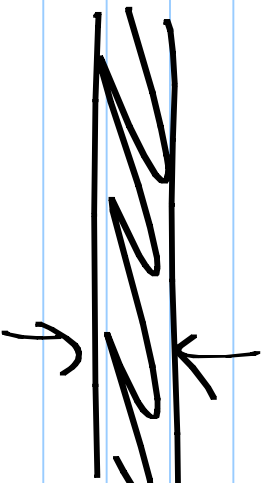




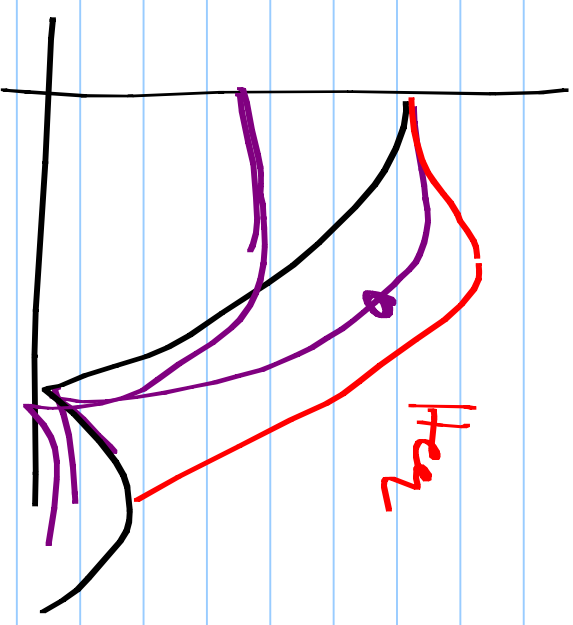
Desire)

==

reduced eye opening due to
XTank



ΔV_{x_1} Broszta k



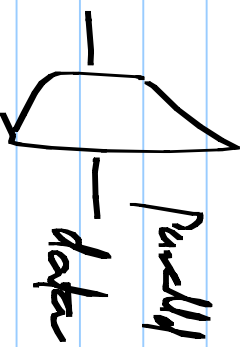
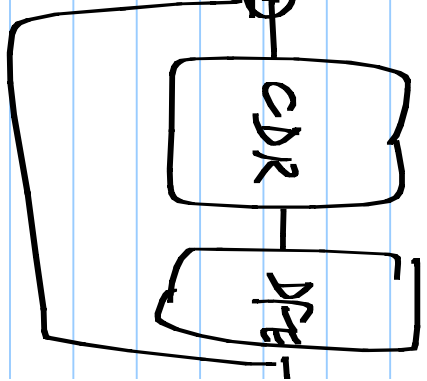
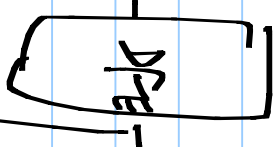
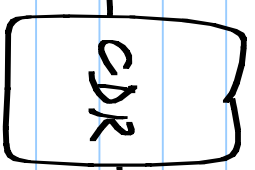
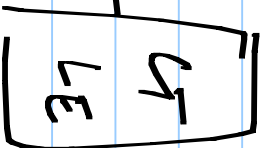
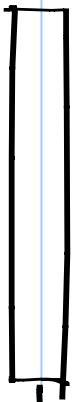
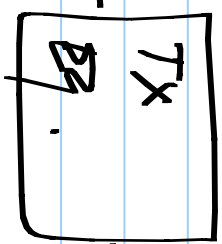
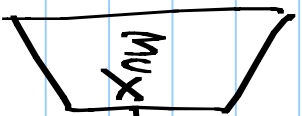
Linear equalizers @ Tx or Rx

boast- crosstalk and Noise

Not helpful beyond a point

[Decision feedback equalizer
(Non linear)]

Parallel
Data



Demux

