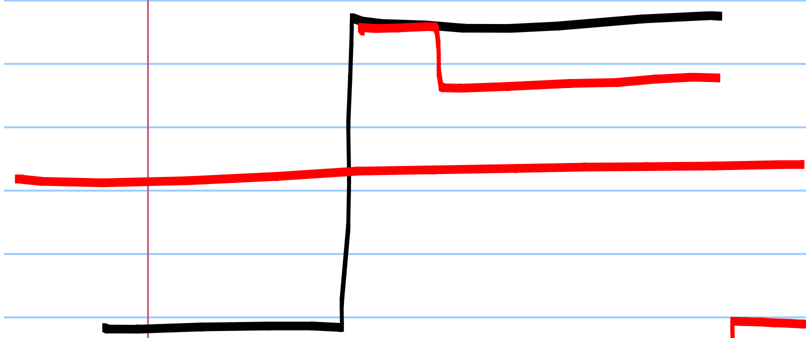
Equalization:

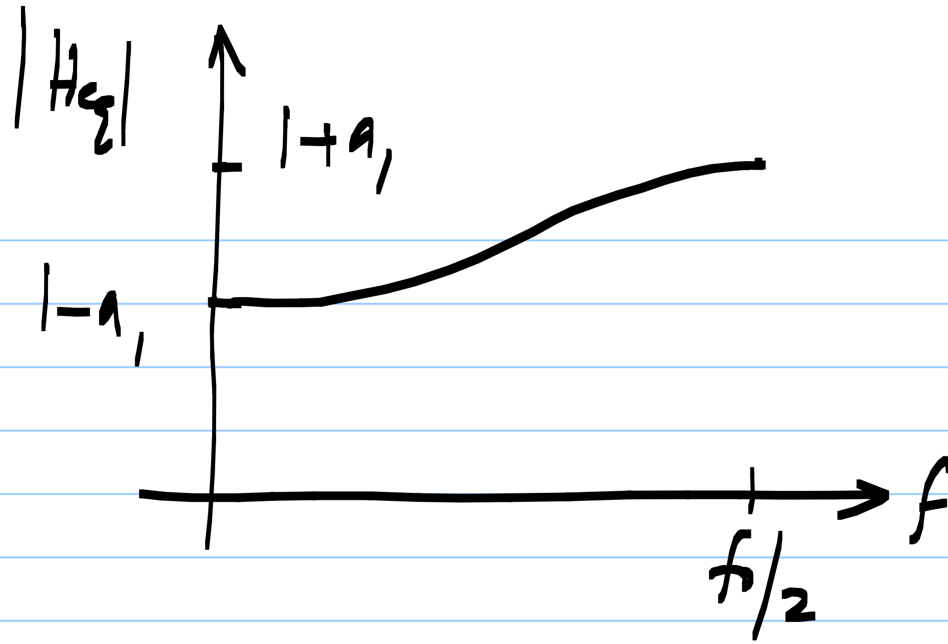
DT equalization
- Digital Tx (before the DAC)
  - Rx (after the ADC)
- Semi-digital Tx



$$H_{ch}(z) = 1 + a_1 z^{-1}$$

$$H_{eq}(z) = 1 - a_1 z^{-1}$$

@ f_0



1. post cursor-tap

$$H_{ch}(z) = 1 + a_1 z^{-1} \quad ; \quad H_{eq} = 1 - a_1 z^{-1}$$

1 pre-cursor tap

$$H_{ch}(z) = a_{-1} z + 1 \quad ; \quad H_{eq} = -a_{-1} z + 1$$

$$H_{ch} \cdot H_{eq} = -a_{-1}^2 z^2 + 1$$

$$H_{ch}(z) = \sum_{k=-M}^{N} a_k z^{-k}$$

M+N coeff.

$$H_{eq}(z) = \frac{1}{[illegible]} = \sum_{-\infty}^{\infty} b_k z^{-k}$$

$$H_{eq}(z) = \sum_{-\infty}^{\infty} b_k z^{-k} \qquad \hat{H}_{eq}(z) = \sum_{K \text{ coeff}} b_k z^{-k}$$

$$H_{ch}(z)\, H_{eq}(z) = \sum_{-\infty}^{\infty} c_k z^{-k}$$

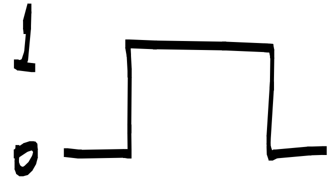
Choose K b_k such that K values of $\{c_k\}$ are zero

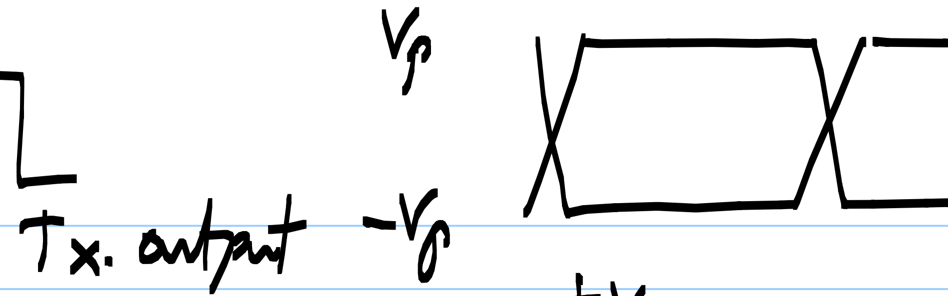
N=1

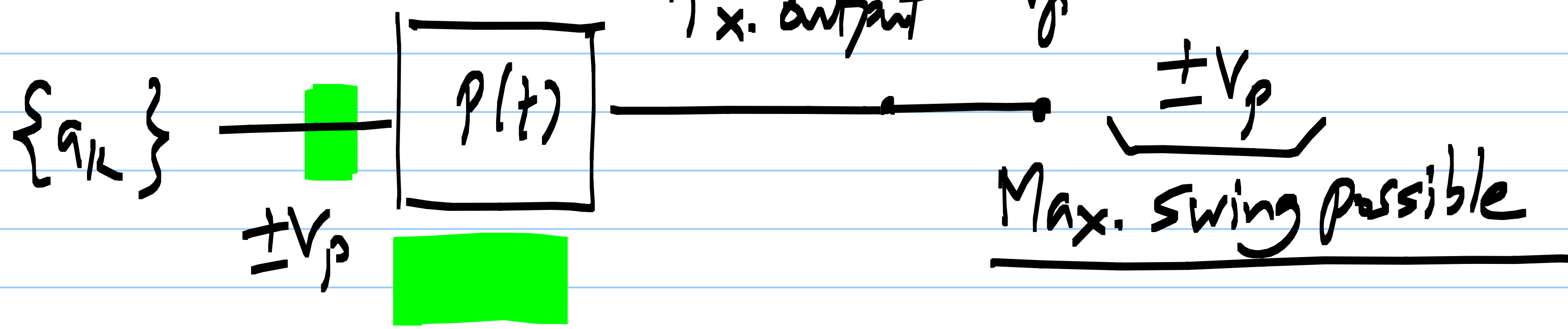
$$\underbrace{(1 + a_1 z^{-1})}_{ch}\ \underbrace{(1 + b_1 z^{-1})}_{eq} = 1 + \text{[illegible]} + a_1 b_1 z^{-2}$$

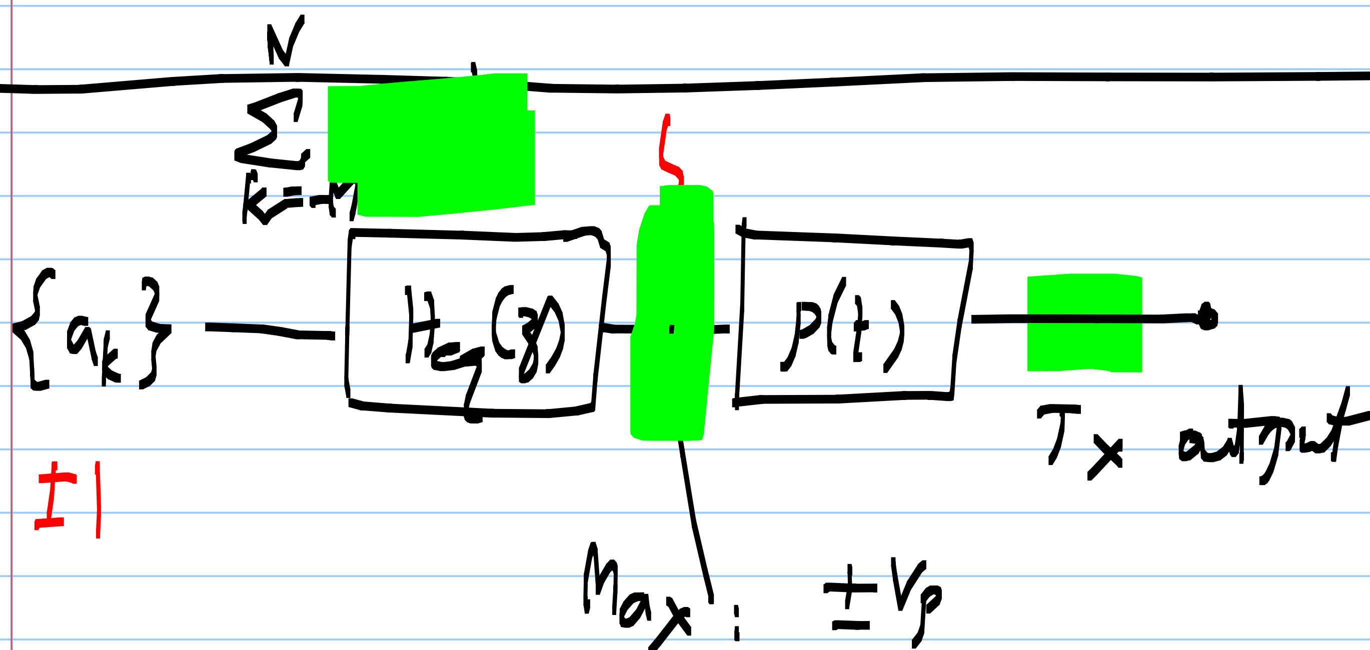
$$\boxed{b_1 = -a_1}$$

Equalization









$$H_{eq} = \left\{ 1 + \sum_{k \neq 0} c_k \right\}^{-1}$$

Max. value $= \left[1 + \sum_{k \neq 0} |c_k| \right]$

(for some input bit pattern)

$$\frac{1 - }{1 + }$$

$\boxed{1/3}$

$$H_{eq} = \frac{\left\{ 1 + \sum_{k=0} c_k \right\}^{-1}}{\underbrace{1 + \sum_{k \neq 0} |c_k|}}$$

Max value of the o/p (for a ±1 input)

$= 1$

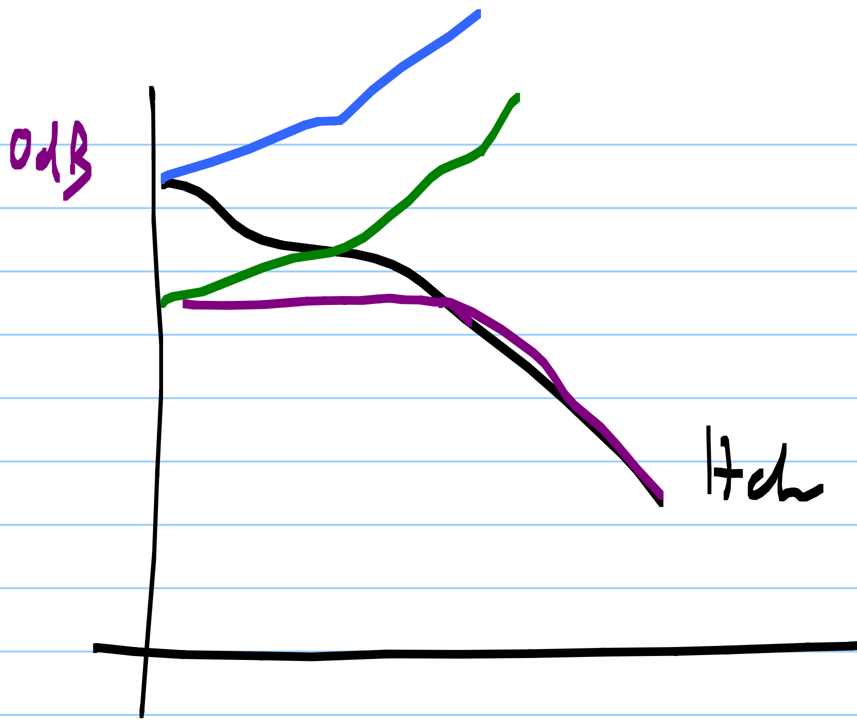
Equalizer gain has to be reduced so that max. boosted value remains within bounds

$$H_{eq}(z) = \frac{1 + \sum_{k \neq 0} c_k z^{-1}}{1 + \sum_{k \neq 0} |c_k|}$$

In an equalizer some c_k will be -ve

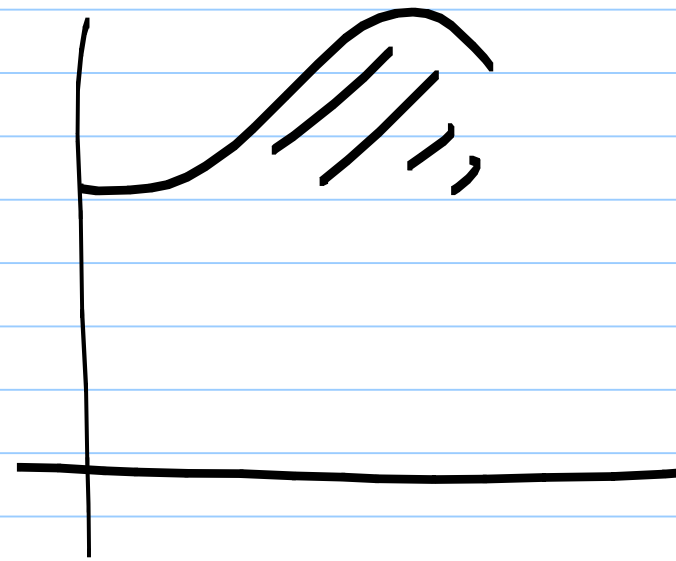
dc gain:

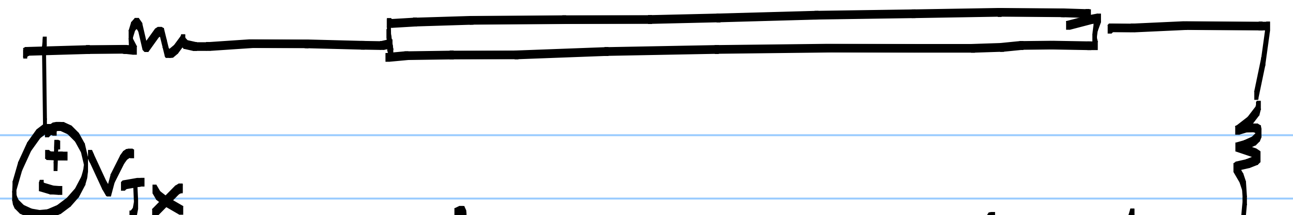
$$\frac{1 + \sum_{k \neq 0} c_k}{1 + \sum_{k \neq 0} |c_k|}$$



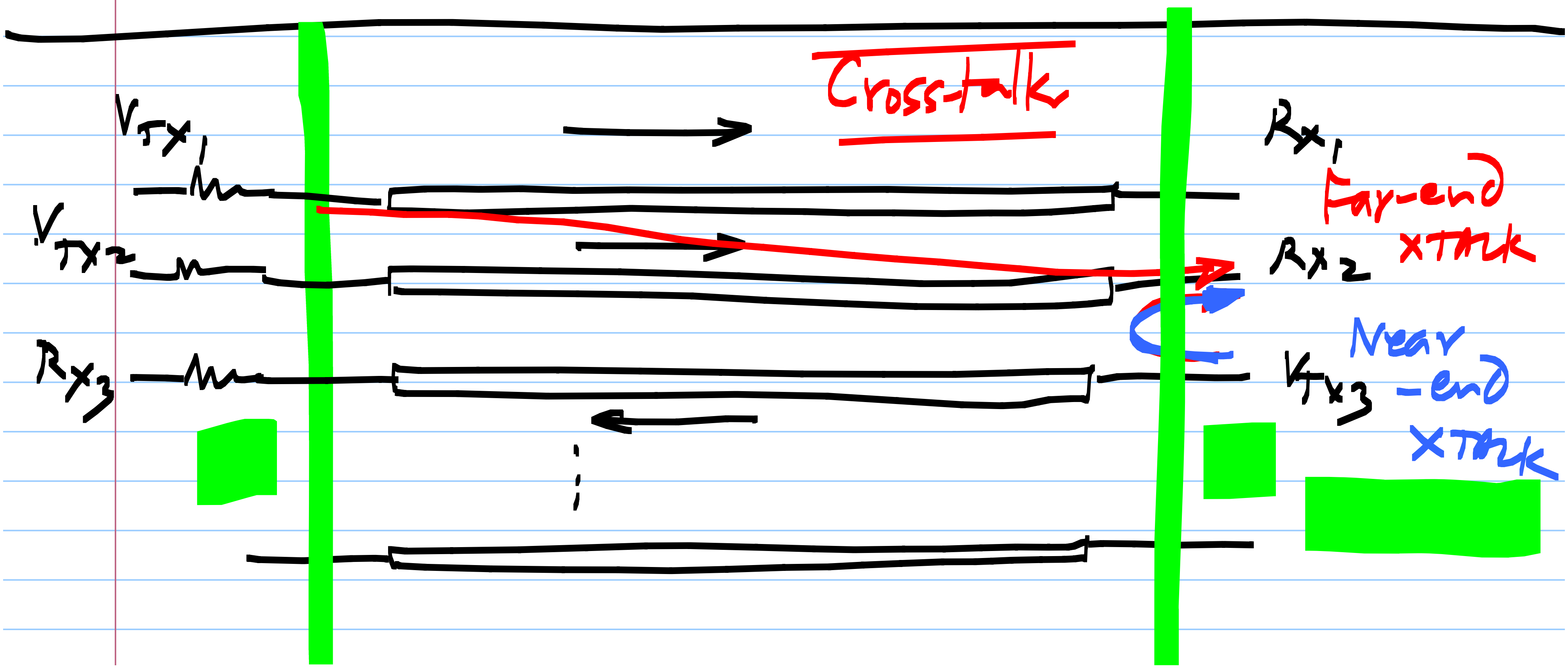
CTLE in Rx

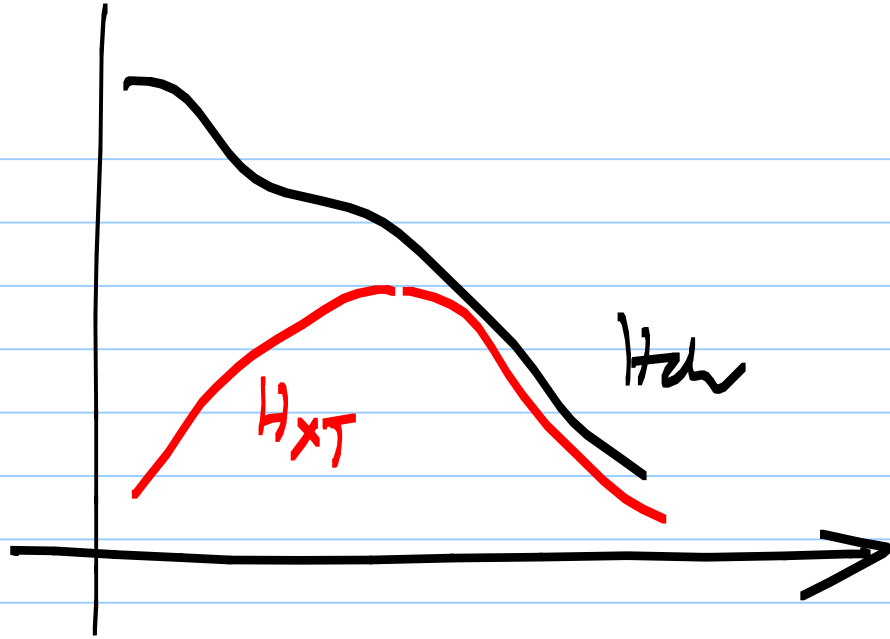
DT eq in Rx



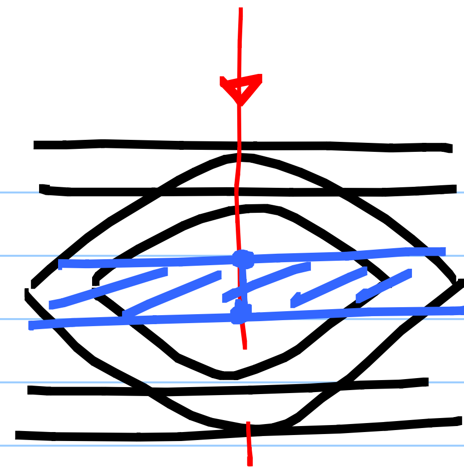


Single-transmission channel




Hch
HXT

Desired signal



XTALK

Crosstalk can reduce the signal (SNR) at the sampling instant

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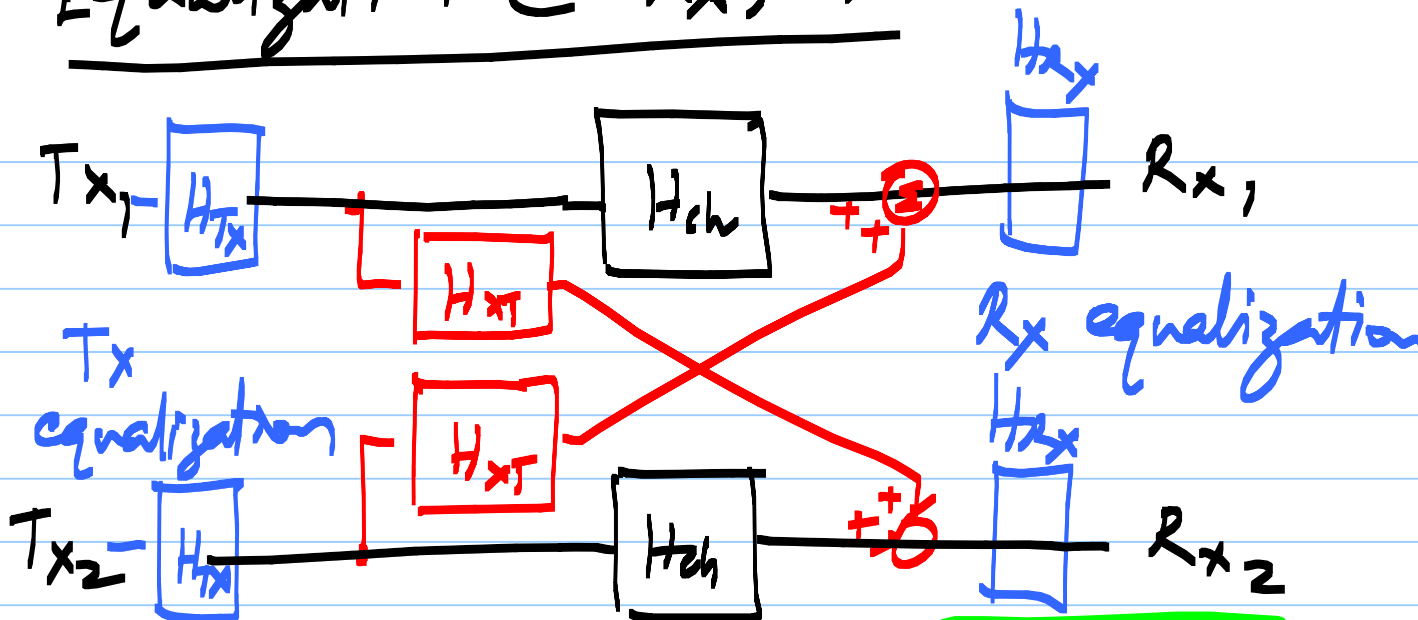
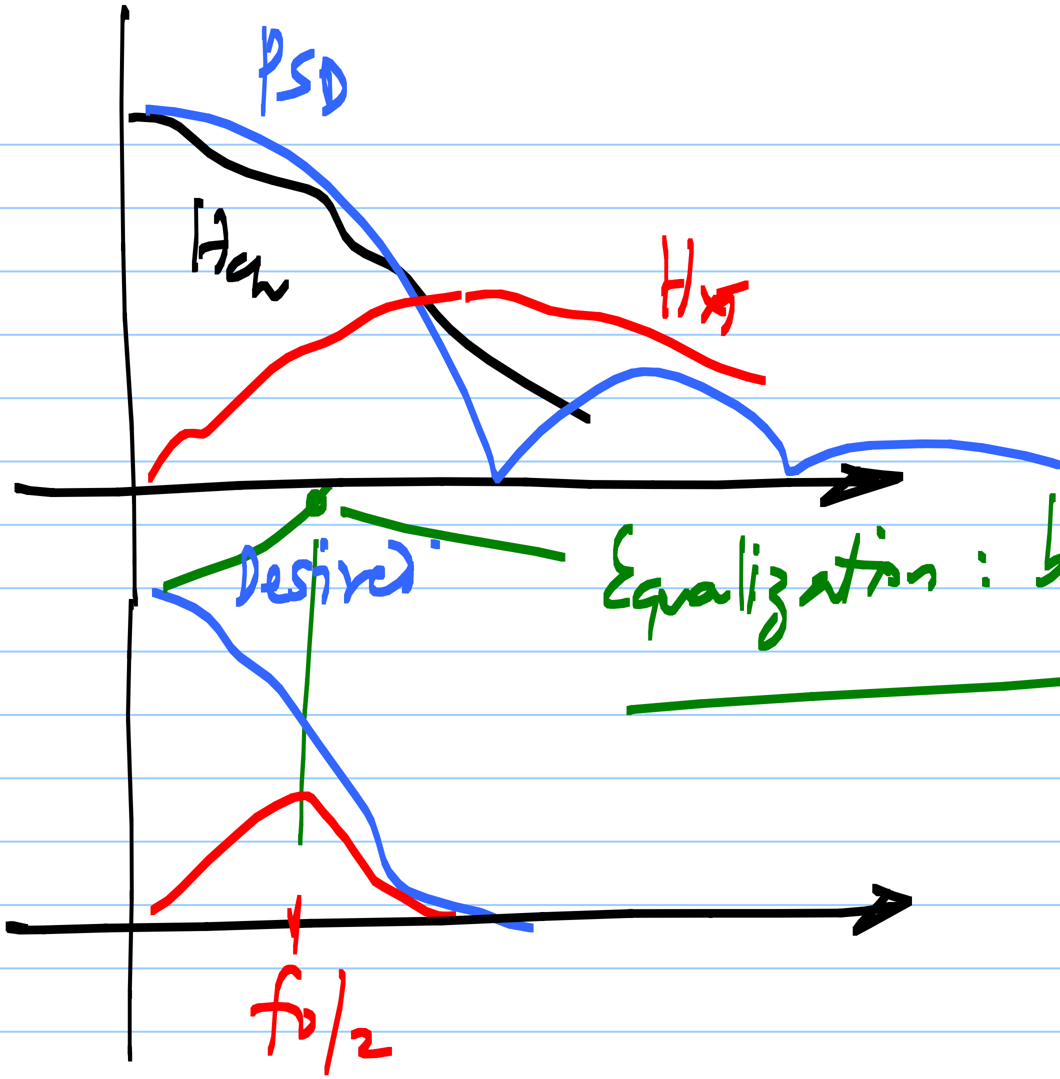
Equalization @ Rx, Tx



Tx_1 to Rx_1: (Tx_2 to Rx_2) $\quad H_{ch} \cdot \underbrace{(H_{Tx} \cdot H_{Rx})}_{H_{eq}}$

Tx_1 to Rx_2: (Tx_2 to Rx_1) $\quad H_{xT} \cdot (H_{Tx} \cdot H_{Rx})$



Equalization : boost @ $f_0/2$

* Desired signal energy : lowpass
* Cross talk energy: highpass
* Total Tx + Rx equalization $H_{eq} = H_{Tx} \cdot H_{Rx}$ boosts both the desired & crosstalk signals
* H_{eq} boost @ $f_0/2$ emphasizes cross talk
* Distribution of H_{eq} between Tx & Rx doesn't matter