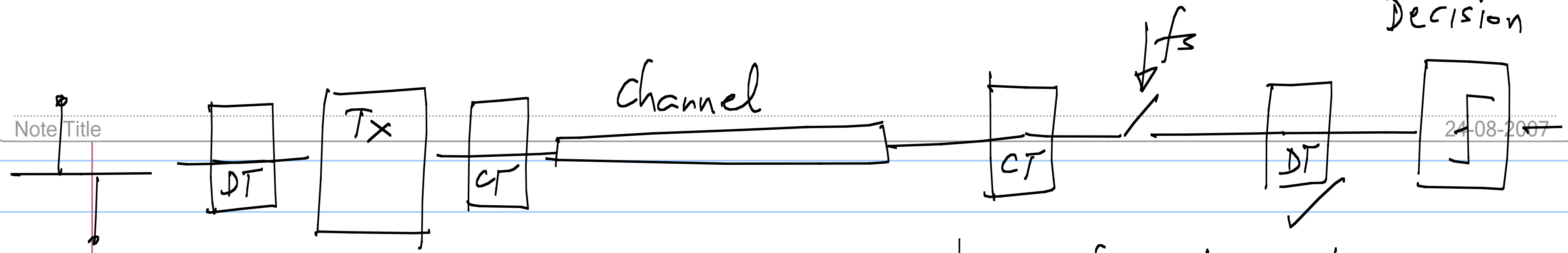
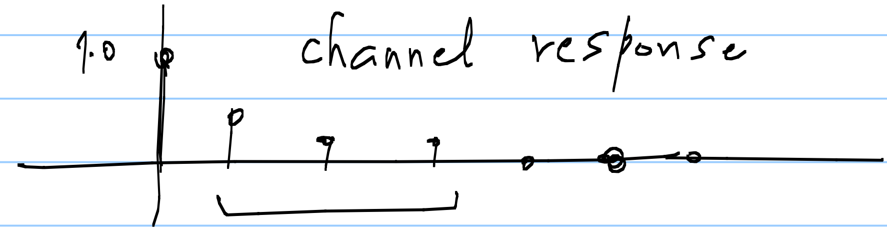


Digital input

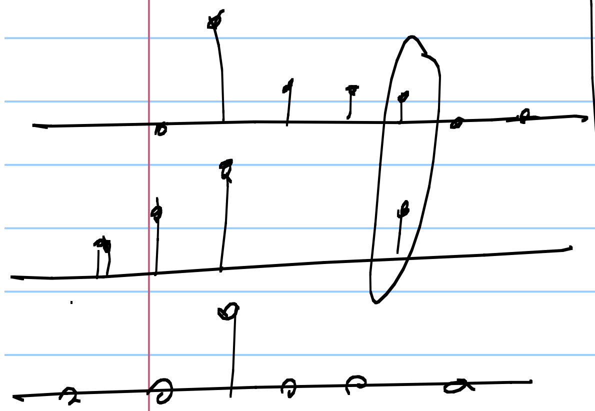
$$\left\{\begin{matrix} Rx \\ Tx \end{matrix}\right\} \times \left\{\begin{matrix} CT \\ DT \end{matrix}\right\}$$



$$h[0] + h[1]z^{-1} + h[2]z^{-2} + h[3]z^{-3}$$

Discrete time filter

FIR ? / IIR ?

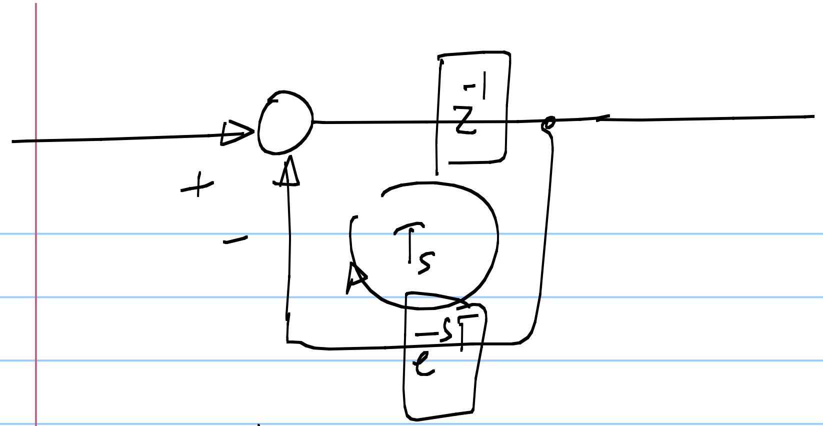


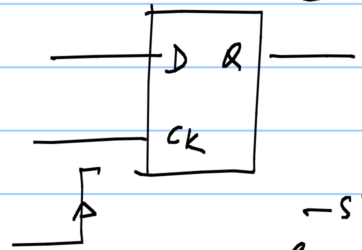
For exact cancellation $\left[H_{ch}(z) \cdot H_{eq}(z) = 1 \right]$

$H_{ch}(z)$ FIR, $H_{eq}(z)$ must be IIR

$H_{ch}(z)$ IIR, $H_{eq}(z)$ must be IIR, in general

$$\frac{\sum_{n=0}^{M} b_n z^{-n}}{\sum_{n=0}^{N} a_n z^{-n}}$$





$$\frac{e^{-sT_s}}{1 + \alpha e^{-sT_s} \cdot e^{-sT_D}}$$

IIR filters: * Feedback loop has excess delay
$\Rightarrow$ Instability

* Adaptation is more difficult with IIR filters

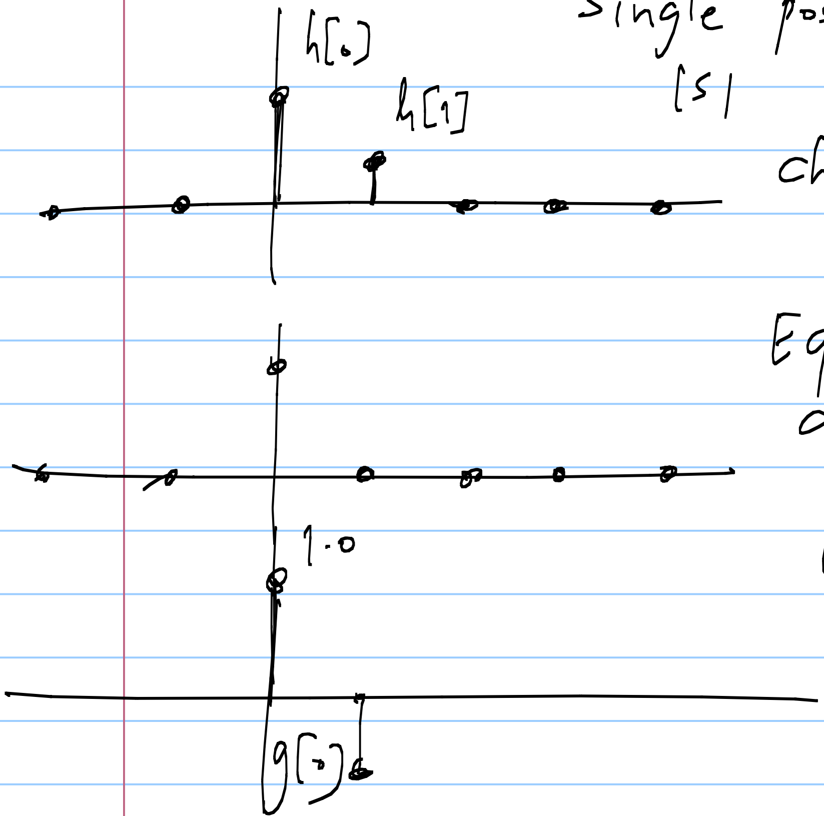
Adaptation:

* Unknown channel
* Environmental changes
    - channel
    - Equalizer

FIR equalizer :

single post cursor

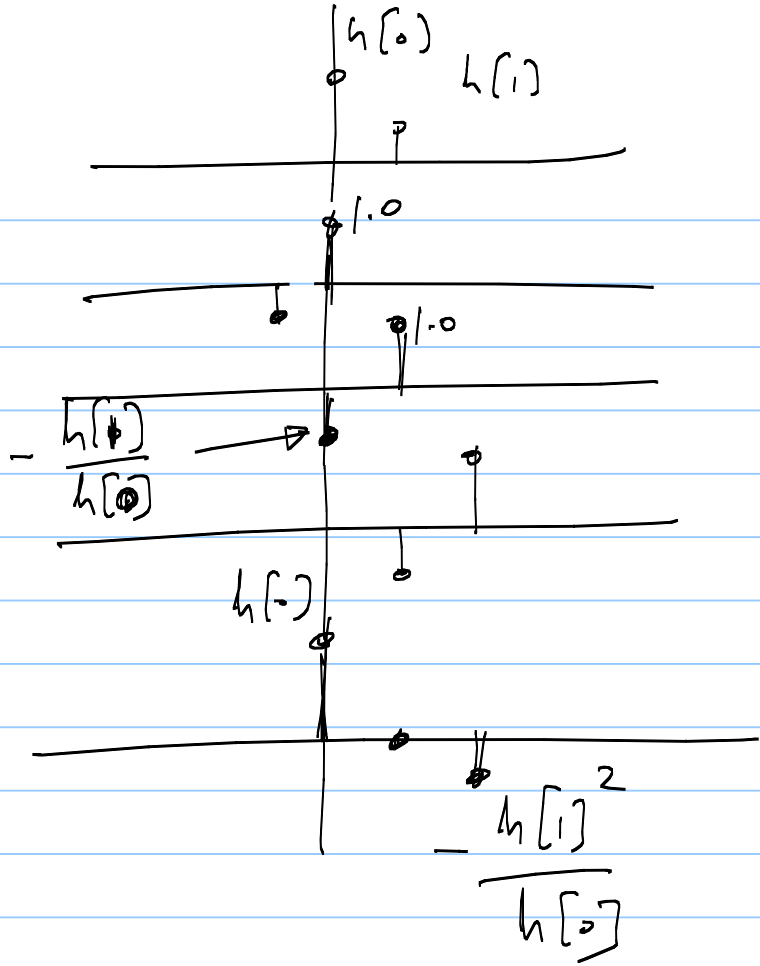
[s]



channel

Equalized channel

Equalizer response



$$\underline{1}\ \left(\underline{\underline{h[0]}},\ h[1]\right) * \left(\underset{1}{\underline{g[0]}},\ \underline{g[1]},\ \underline{g[2]}\right)$$

$$g[0]\cdot h[0]$$

$$g[1]\,h[0] + g[0]\,h[1] = 0$$

$$g[2]\,h[0] + g[1]\,h[1] = 0$$

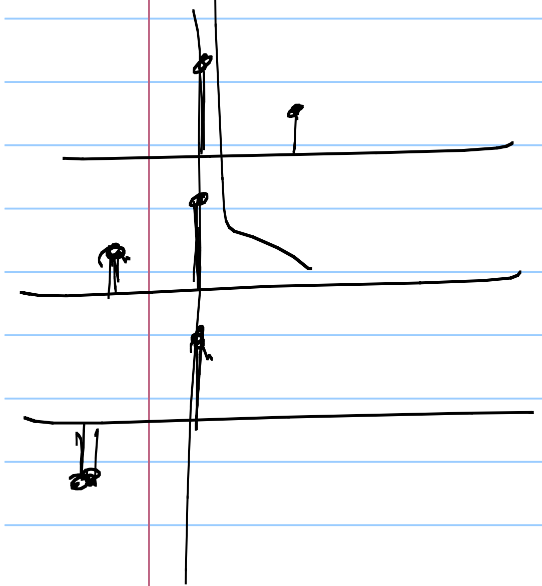
$$g[2]\,h[1] \neq 0$$

$$\frac{h[1]^3}{h[0]^2}$$

$$g[0] = 1$$

$$g[1] = -\frac{h[1]}{h[0]}$$

$$g[2] = +\frac{h[1]^2}{h[0]^2}$$



$$\frac{h[1]\left(\frac{h[1]}{h[0]}\right)^{N-1}}{\text{Residual } |s|}$$

$$N = 4$$

$$\frac{h[1]}{h[0]} = 0.5$$

$$\left(h[1]\right)^N$$

$$0.5^4 = \underline{0.0625}$$

FIR equalizer:

* \# taps. depends on \# taps in the channel impulse response & the magnitude of |s|

* $$\frac{g[1]}{g[0]} = -\frac{h[1]}{h[0]}$$

* Pre cursor / post cursor taps in the equalizer depending on if the channel has pre cursor / post cursor |s|

* Typical channel: More post cursor taps than pre cursor taps

* First post/pre cursor taps of channel response − +ve

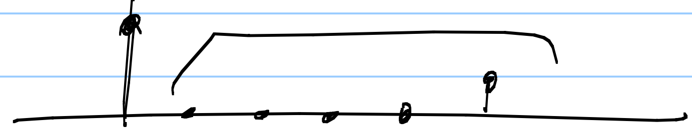
  ⇒ First post/pre cursor taps of the equalizer: −ve

Given $h[n]$ 2 taps

Choose $g[n]$ 5 taps

$h[n] * g[n]$

Result:



$\ast$