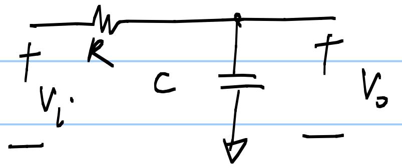
Receiver equalizer

Note Title 19-09-2007

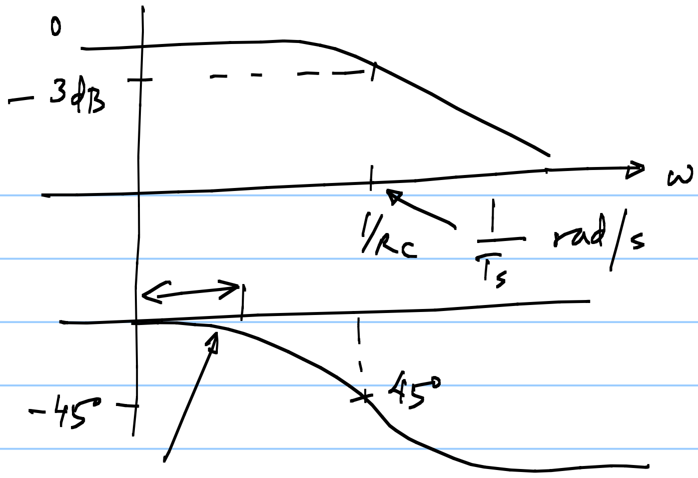
FIR equalizer

- Transmission line / L·C transmission line (lumped approximation)
- Sample & Holds to implement delays
- A/D conversion + Digital filter implementation

Delay using RC



$$\frac{V_o}{V_i} = \frac{1}{1 + sCR}$$

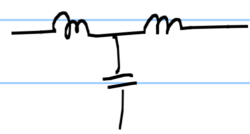


$$\phi = -\tan^{-1}(\omega CR)$$

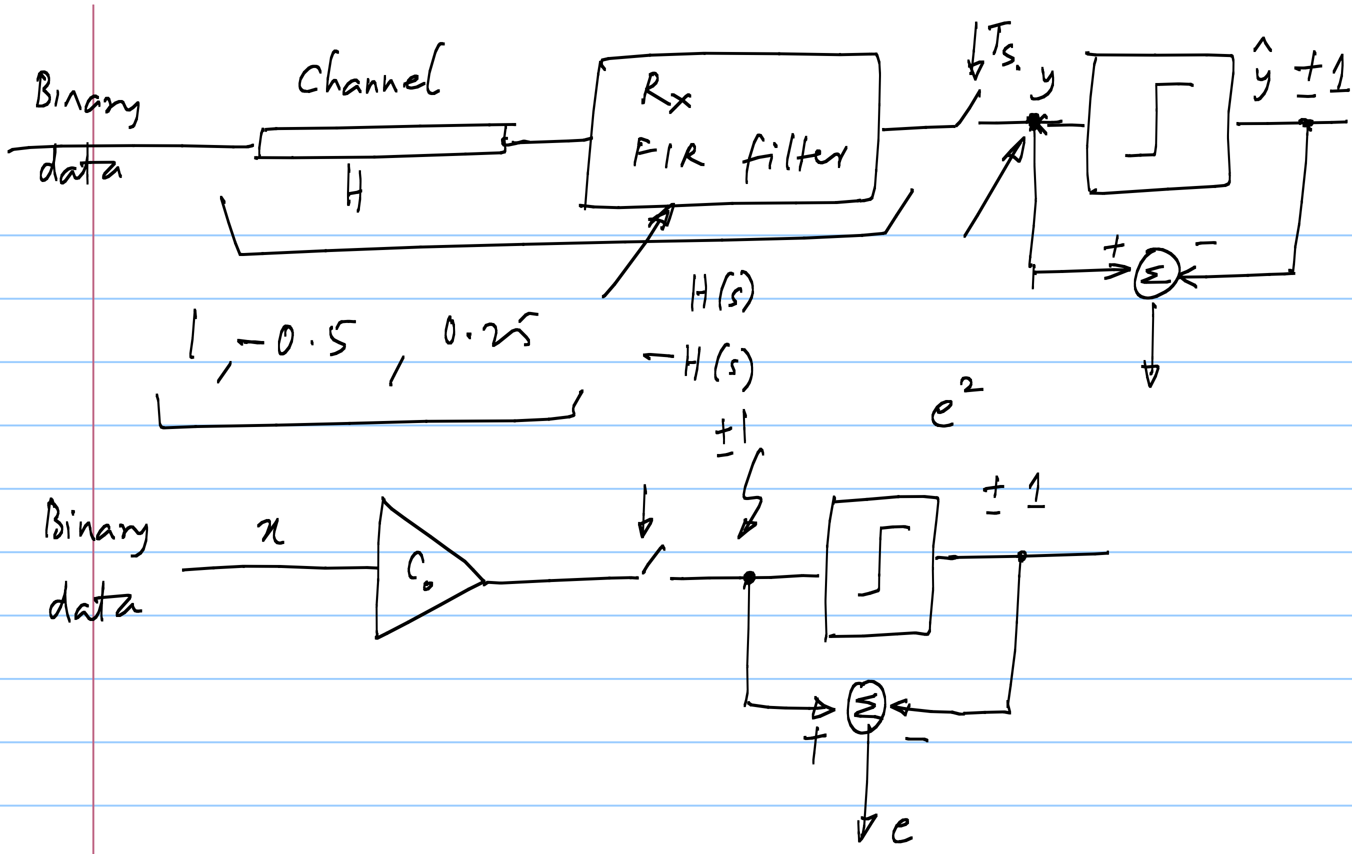
1GHz

$$\frac{1}{2\pi \cdot 1ns} = 159\ MHz$$

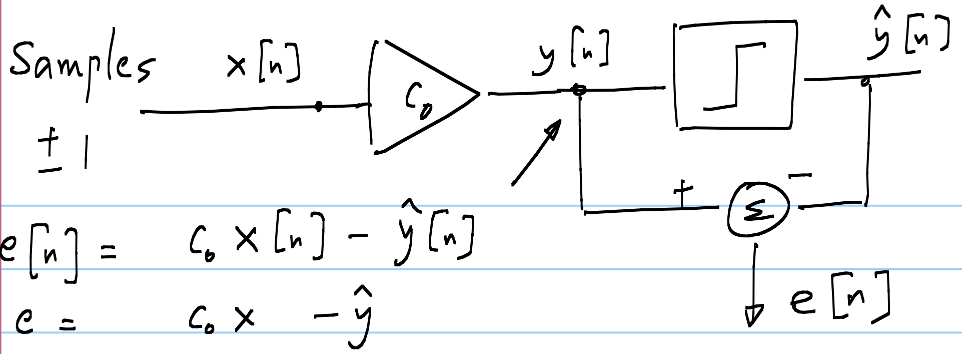
$$-\frac{\partial \phi}{\partial \omega} = \frac{CR}{1 + (\omega CR)^2}$$

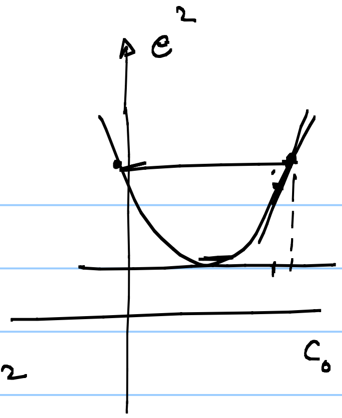


$$\text{Delay} = CR = T_s = 1\ ns$$



Binary data
Channel
H
Rx
FIR filter
Ts.
y
ŷ
±1
+
−
Σ
H(s)
1, −0.5, 0.25
−H(s)
e²
±1
Binary data
x
C₀
±1
+
−
Σ
e





$$e[n] = c_0 x[n] - \hat{y}[n]$$

$$e = c_0 x - \hat{y}$$

$$e^2 = (c_0 x - \hat{y})^2 = c_0^2 x^2 - 2c_0 x \hat{y} + (\hat{y})^2$$

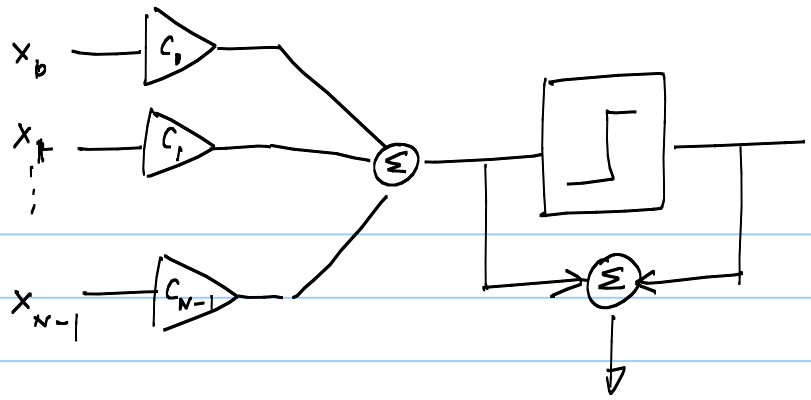
$$\frac{d}{dc_0} \cdot e^2$$

$$= 2 \cdot e \cdot \left(\frac{de}{dc_0}\right)$$

$$= 2 \cdot e \cdot x$$

$$c_0[k] = c_0[k-1] - \frac{\mu}{2} \frac{d}{dc_0}(e^2)$$

$$c_0[k] = c_0[k-1] - \mu \cdot e[k-1] \cdot x[k-1]$$



x_0
x_1
x_{N-1}
c_0
c_1
c_{N-1}
Σ
Σ