

Multiplex Channel

✓ combiners
time

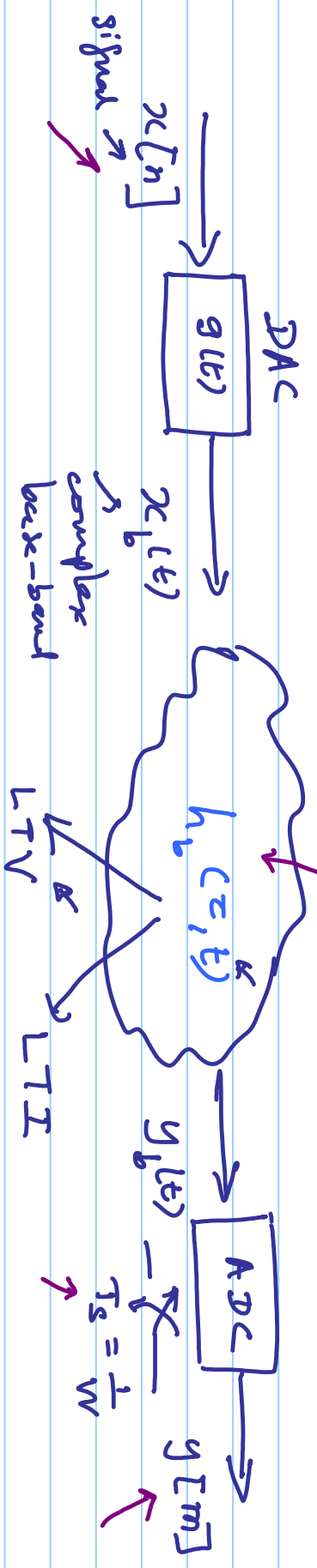
$h_c(z, t)$
paths

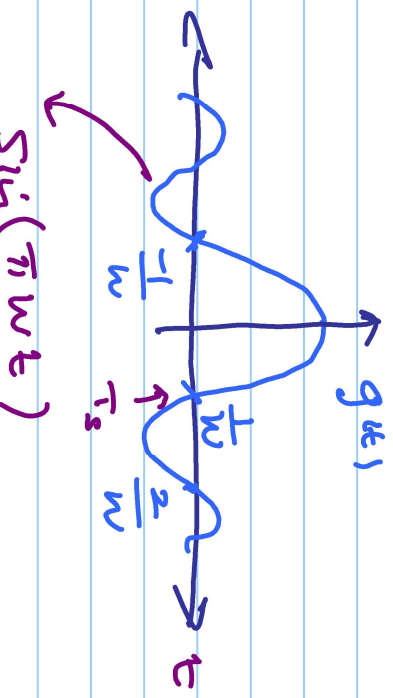
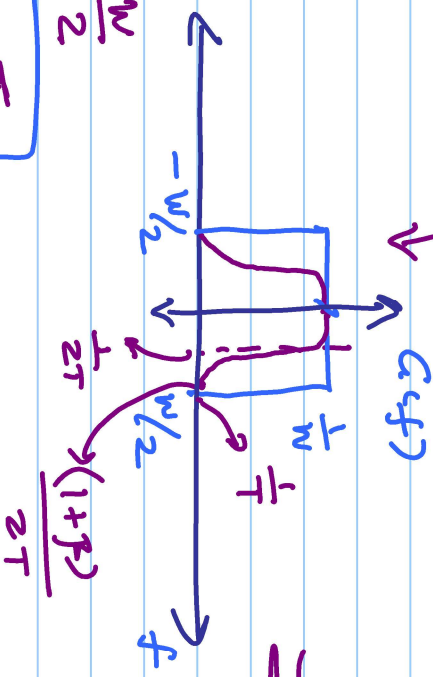
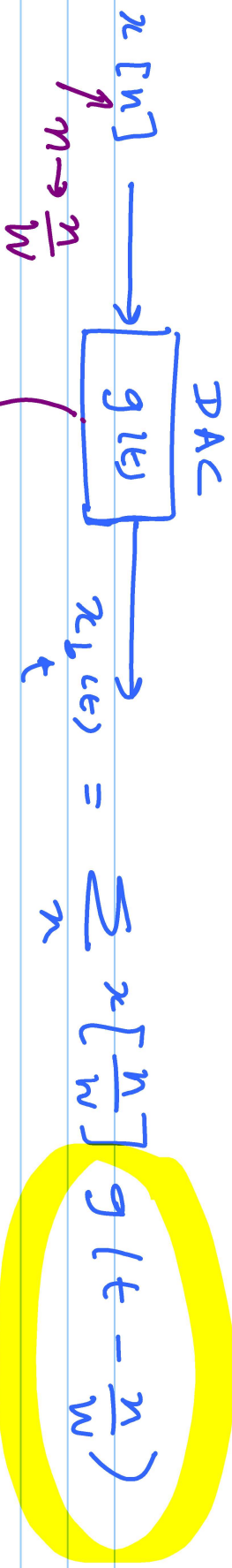
✓ Non-sample spaced channels model

Multi-tap Channel

✓ taps
 $h_c(z, t)$
discrete-time

T_s
"sample-spaced channels model"





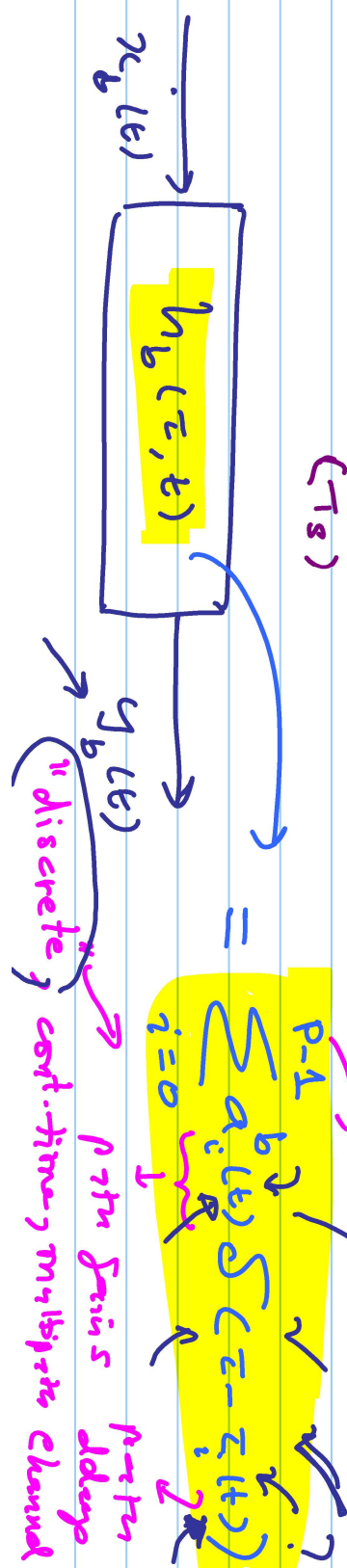
$$\frac{\text{Sinc}(\pi W t)}{\pi W t} \equiv \text{sinc}(W t)$$

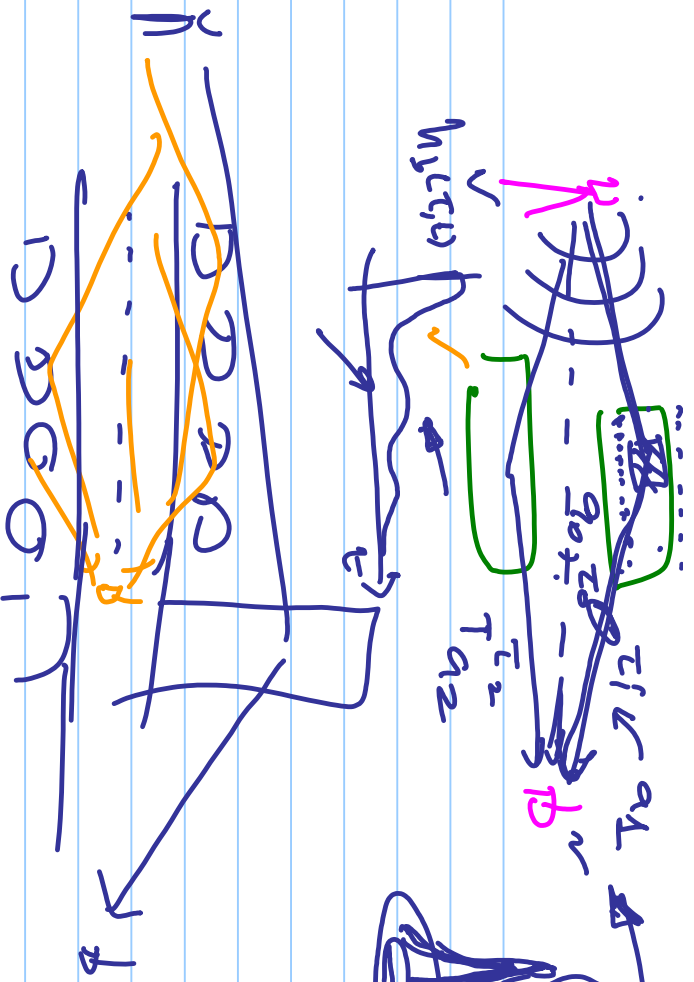
$$\frac{1}{M} = T_s = \frac{T}{2}$$

$$\frac{1}{T} = \frac{W}{2}$$

$$x_b(t) = \sum_n x\left[\frac{n}{N}\right] \text{sinc}\left(W\left(t - \frac{n}{N}\right)\right)$$

①





$$\begin{aligned}
 & \underline{p=3} \\
 & 3 \times 10^8 \text{ m} \rightarrow 1 \text{ sec} \\
 & \quad \quad \quad 1000 \text{ m} \\
 & \frac{10 \times 10^6}{3} \frac{1000}{3 \times 10^8} = \frac{10^5}{3} \\
 & = 3.3 \mu
 \end{aligned}$$

$$\begin{aligned}
 y_b(t) &= x_b(t) * h_b(z,t) \\
 &= \sum_{i=0}^{p-1} a_i(t) x_b(t - \tau_i(t))
 \end{aligned}$$

putting ① here



$$(*) \quad y(t) = \sum_n a_i(t) \sum_n x[n] \text{sinc}(w(t - \tau_i(t)) - n)$$

$$= \sum_n x[n] \sum_i a_i(t) \text{sinc}(wt - w\tau_i(t) - n)$$

(*) After sampling every m/w sec.

$$y\left[\frac{m}{w}\right] = y[n] = \sum_n x[n] \sum_{m-1} a_i\left(\frac{m}{w}\right) \text{sinc}\left(w \cdot \frac{m}{w} - w\tau_i\left(\frac{m}{w}\right)\right)$$

$\text{sinc}(m-n - w\tau_i)$

Define $L = m - n \Rightarrow n = m - L$

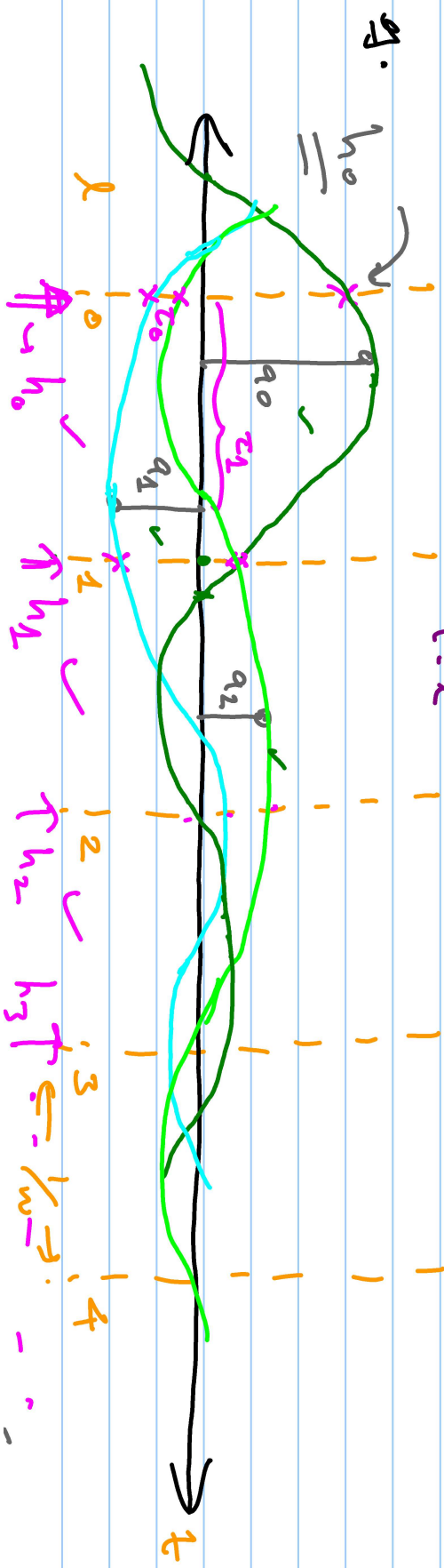
$$y[m] = \sum_{l} x_l[m-l]$$

$$\sum_{a=0}^{p-1} a_i[m] \text{Sinc}(L - \omega T_i[m])$$

$\rightarrow \text{Sinc}(\omega T_i[m] - L)$

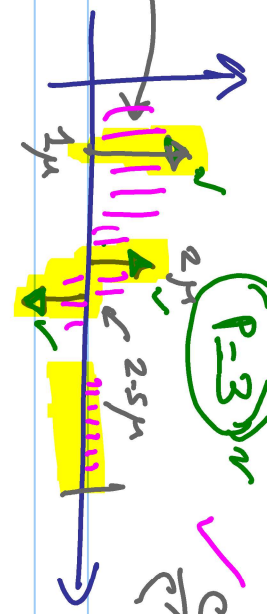
$$\triangleq h_l[m] \frac{1}{m/w}$$

$h_l[m] \rightarrow \left(\frac{L}{m}\right)$ sample of $h(L, t) * \text{Sinc}(\omega T)$



Discussion

$h(\tau)$



Cyclic prefix
 equivalent interval
 $\leq 5\mu$

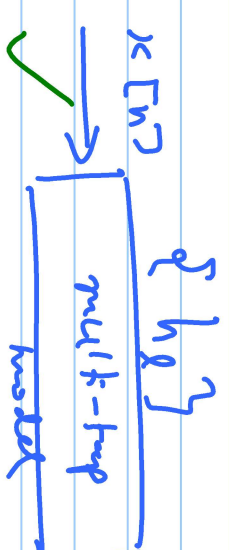
Block Modulo

$\{h_{\lambda}\} \rightarrow 90.1. (95.7), 99.7.$

$\lambda = 1 \dots 3$

$L \leftarrow \# \text{ of taps}$

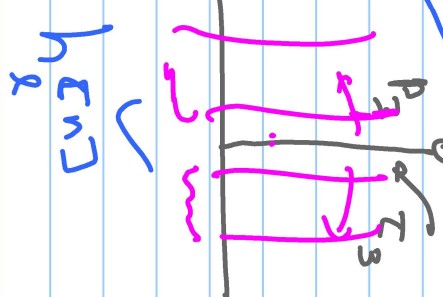
$L \gg P$



$y[n] = \sum_{\lambda=0}^{L-1} h_{\lambda} x[n-\lambda]$

$L-1$

LTI



$h(z) \cong H(f)$

$\{h_{\lambda}\} \lambda=0 \dots L-1$

2.

Why TDMA & DS-SS-CDMA don't have a
 arbitrary path in 4G/5G?
 using forms, systems

Uplink (Reverse link)

