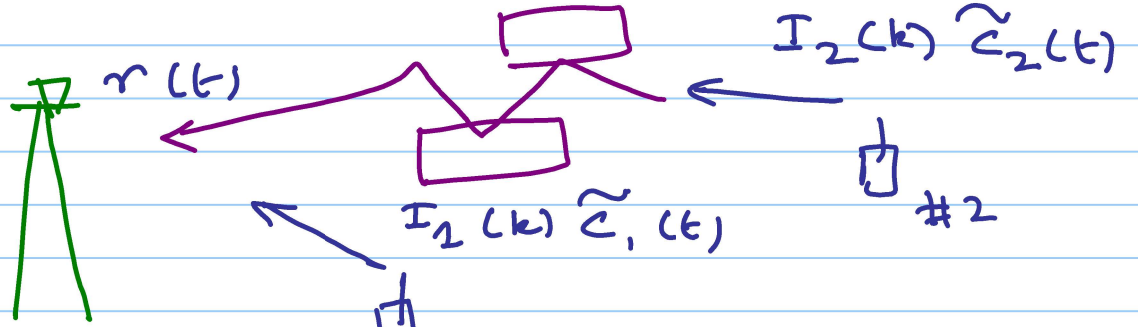
Note Title

EE 6323 - #2

Jan 31, 2020

3/27/2020



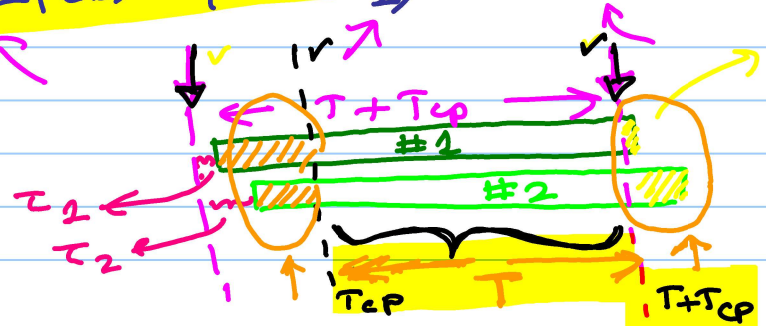
$0 \le t \le T+T_{cp}$

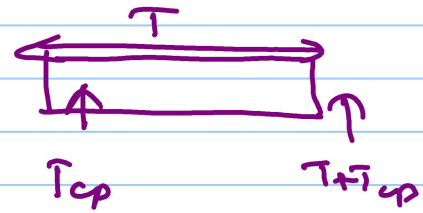
$k(T+T_{cp}) \quad (k+1)(T+T_{cp})$

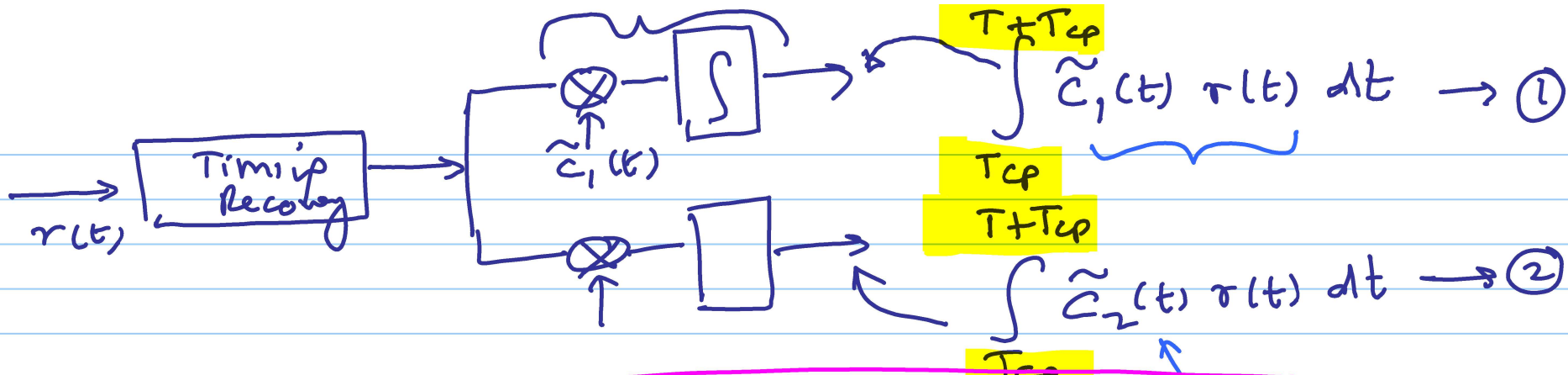
LoS

$$r(t) = \alpha_1 I_1(k)\,\tilde{c}_1(t-\tau_1) + \alpha_2 I_2(k)\,\tilde{c}_2(t-\tau_2) + n(t)$$

T out of $T+T_{cp}$



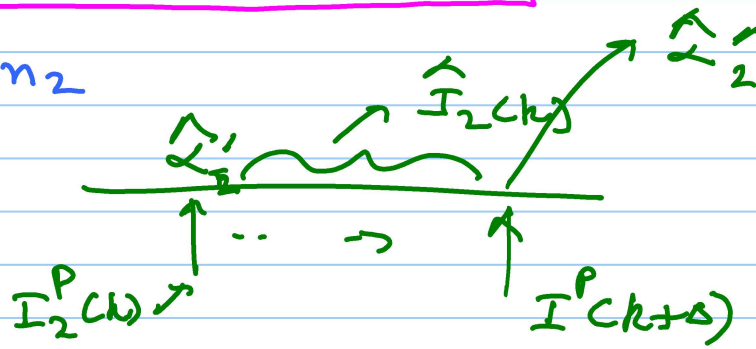




(1) $\rightarrow$ $\frac{\alpha_1 I_1(k)}{2} \cos 2\pi f_0 \tau_1 + n_1 \leftarrow \mathcal{N}(0, \sigma^2)$ ✓

(2) $\rightarrow$ $\frac{\alpha_2 I_2(k)}{2} \cos 4\pi f_0 \tau_2 + n_2$

$\alpha_2 I_2(k)$



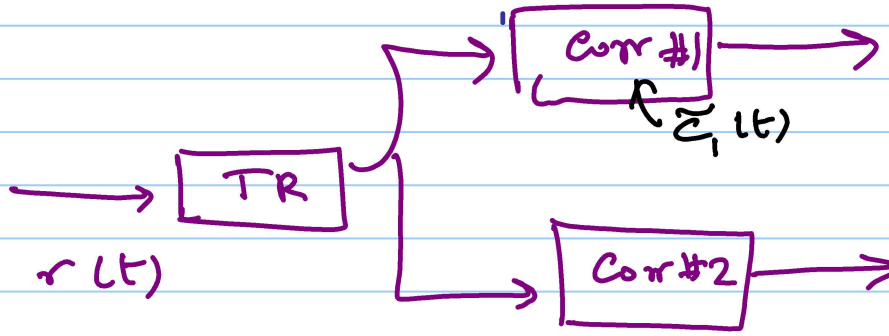
(*) Sub-band per user $\Big|\ (f_0, 2f_0, 3f_0, 4f_0) \rightarrow \#1$

$\Big|\ (\overset{5}{5f_0}, \cdots 8f_0) \rightarrow \#2$

(*) Multipath model

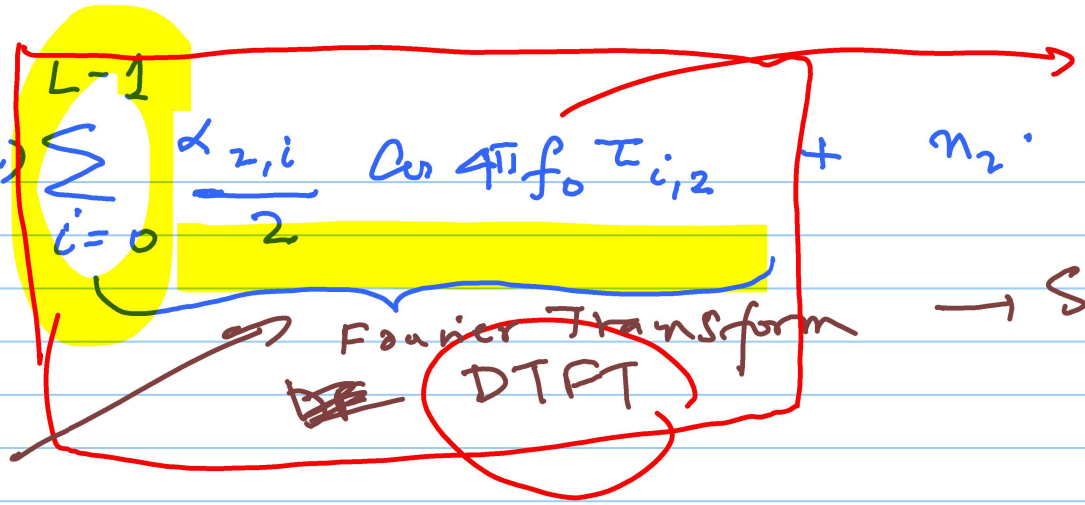
$I_2(k)\,\tilde{c}_2(t) * h_2(t)$,

$h_2(t) = \sum_{i=0}^{L-1} \alpha_{2,i}\,\delta(t-\tau_{2,i})$, $\tau_{2,i} < T_{cp}$



$$\int_{T_{cp}}^{T+T_{cp}} \tilde{c}_1(t)\left(\sum_{i=0}^{L-1} \alpha_{2,i}\,\tilde{c}_2(t-\tau_{2,i})\right) dt \;\overset{I_2(k)=0}{=}\; 0$$

$$\int_{T_{cp}}^{T+T_{cp}} \tilde{c}_2(t)\left(\sum_{i=0}^{L-1} \alpha_{2,i}\,\tilde{c}_2(t-\tau_{2,i})\right) dt$$



$\cos 10\pi f_0 \tau_{i,2}$

$\rightarrow \sin 2\pi (i f_0) t, \quad i = 1 \ldots N$

$\Downarrow i$

$e^{j 2\pi f_0 t}$

(a) Uplink user waveforms ~~remain~~ processing can be made orthogonal even with non-zero time of flight differences $0 \le \tau_1, \tau_2 \le T_{cp}$

(b) Each user can occupy 1 or more sub-carriers → subband

(c) Multipath delay spread does not affect orthogonal processing