Thursday, February 11, 2010
1:01 PM

Lecture 23

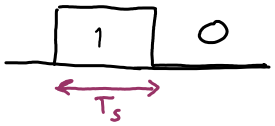
Announcement

① HW5 is posted (due next week)

② Slides for section 5.4 (CP) is available @ copy center
(You may go to buy it during the break.)

Wireless channel

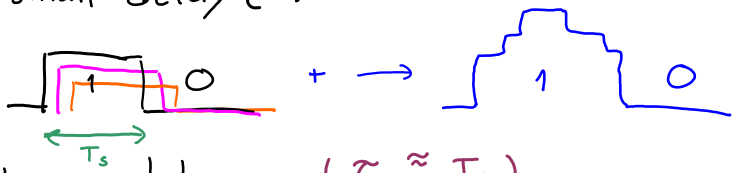
Send : $x(t)$



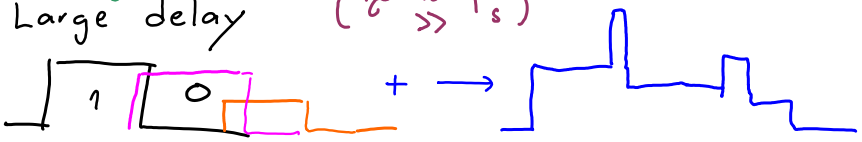
Receive : $\beta_1 x(t-\tau_1) + \beta_2 x(t-\tau_2) + \beta_3 x(t-\tau_3) + \dots$

multipath

Small delay (τ) ($\tau \ll T_s$)



Large delay ($\tau \approx\!\gg T_s$)



Inter-symbol interference (ISI)

"T_s (symbol period)" should be >> delay. ←

(if you want to easily "decode" the received signal)

Channel (with memory)
(with fading)

$$h(t) = \sum_i \beta_i \delta(t-\tau_i)$$

τ_i ↑ delay

$$H(f) = \sum_i \beta_i e^{-j2\pi f \tau_i}$$

Time-shift property

Best Channel (memoryless)

$$h(t) = \beta\delta(t-\tau)$$

$$\mathcal{F}\{x(t)\} = \beta x(t-\tau)$$

$$H(f) = \beta e^{-j2\pi f\tau}$$

β ↑ amplitude; $e^{-j2\pi f\tau}$ phase

equalization →

$\cos(2\pi f \tau_i) + j \sin(2\pi f \tau_i)$

$\cos(2\pi \tau_i f)$

τ large → high freq. variation

For OFDM, we will avoid doing equalization.

Key idea: Want to make $T_s \gg \tau$

Problem: τ is given by the environment.

T_s means data rate (datarate $\propto \frac{1}{T_s}$)

If T_s is large, then data rate will be small.

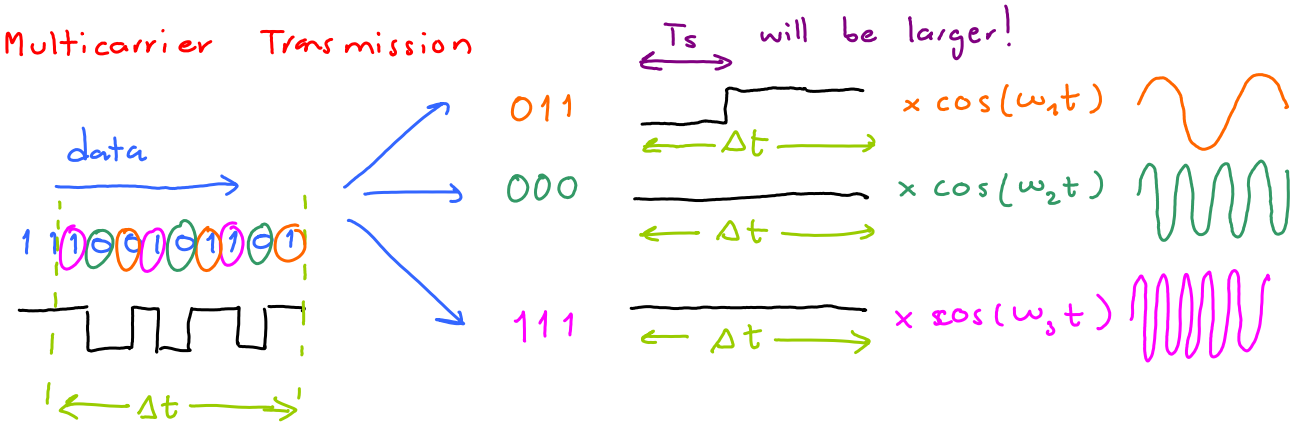
We also want the data rate to be large as well.

Solution: Use FDM (Frequency Division Multiplexing)

(5.2)

↑ Multicarrier Transmission

Multicarrier Transmission



Advantage: Reduce multipath problem

Disadvantage: Guard band → spectral inefficiency

How do we produce all the cos??