Discussion on Licensed / Unlicensed Freq. Bands

LTI Impairments

LTI model of wired coaxial cable (slide 12-3?)

* but the wired connection is NOT LTI !

⇒ what to do?

we have to constantly update our LTI model (an FIR filter) to better reflect the non-LTI cable

the cable performance can be modeled using RLC circuit

LTI Impairments in Wireless Model (slide 12-6)

→ reflection (LOS vs. bounce paths ... aka Multipath)

→ absorption

→ scattering

we can model these LTI impairments using FIR filters!

we can model various different channel models for wireless communication

→ all using FIR filters (we find the coefficients of the filter) (aka. we find the impulse response of the filter)

@ 11:00 AM, discussion of HW 5

1) examining detection of a marker/header sequence in the presence of noise

⇒ HW 5 Q2

2) examining detection of a marker/header sequence in the presence of various impairments...

≠ noise

⇒ wireless channel impairments (the filter $h = [1\ 0\ 0\ a\ 0\ 0\ 0\ b]$)

⇒ HW 5 Q3

(break @ 11:13AM)

(return @ 11:21 AM)

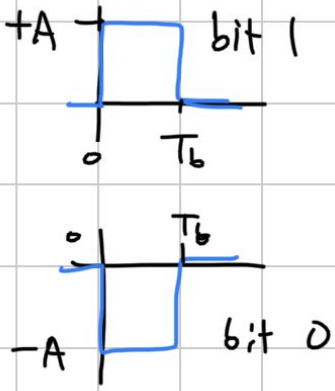
LTI Effects

⇒ distortion in frequency
⇒ spreading in time (slide 12-7)

modelling the model of the communication channel!

⇒ switching the **Matched Filtering** slides (slides 14)

Transmitting 1 Bit ⇒ how does Rx determine what bit was sent?



① averaging the response

⇒ avg = + positive # ⇒ bit 1
avg = − negative # ⇒ bit 0
avg = 0 ⇒ flip a coin (randomly 1 or 0)

why do we average? let's examine freq. domain...

noise ⇒ covers all frequencies

our desired signal ⇒ low frequencies.

↳ implies a baseband signal

there is still noise @ low freq. we can use a notch filter to remove low freq. noise (similar to previous HW) ⇐

how to get rid of out of band noise?

⇒ implement a Low Pass Filter

to keep desired signal (low frequency)

✡ to remove noise @ high frequencies

what is a low pass filter? ⇒ Averaging!!

✡ turns out, the Averaging filter is the OPTIMAL low pass filter to use!! ✡

for Rxer to get back BPSK bit,

Optimal filter = Averaging Filter.

Averaging Filter = rectangular shaped

★ this matches the pulse shape of the transmitted bit! (also rectangular).

thus, this filter to recover the transmitted bit is Matched!

Transmitting 2 Bits (slide 14-5)

intersymbol interference (ISI) occurs! (bad)

How to prevent ISI?

1) ⇒ we can implement on the Receiver
a channel equalizer

2) Rxer communicates to Txer
the necessary guard time / delay
to prevent ISI
↳ what's the down side to method ②?
⇒ gain in reliability (less ISI)
⇒ loss in data rate