3/26/2010

How to fix this problem?
Ans:

What is the "price" of adding some DC component?
Ans:

Section 8.3 Freq division multiplexing (FDM)
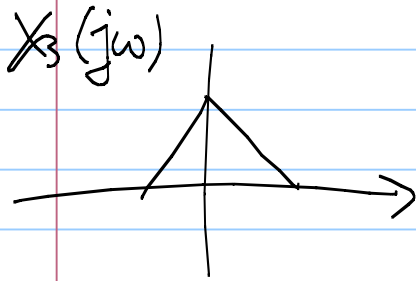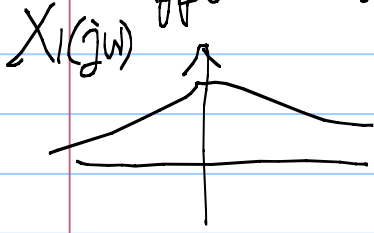
An even more practical scenario:

An antenna tower may like to broadcast several radio stations at the same time. How to achieve this goal?

Ans: Frequency-Division Multiplexing (FDM)

Multiplexing: Different users/signal sources would like to "share" the same media with minimal quality degradation.

FDM: A special type of multiplexiing such that mutlplexing is achieved by dividing the usage of the media by "frequencies."

Suppose we have three signals to transmit
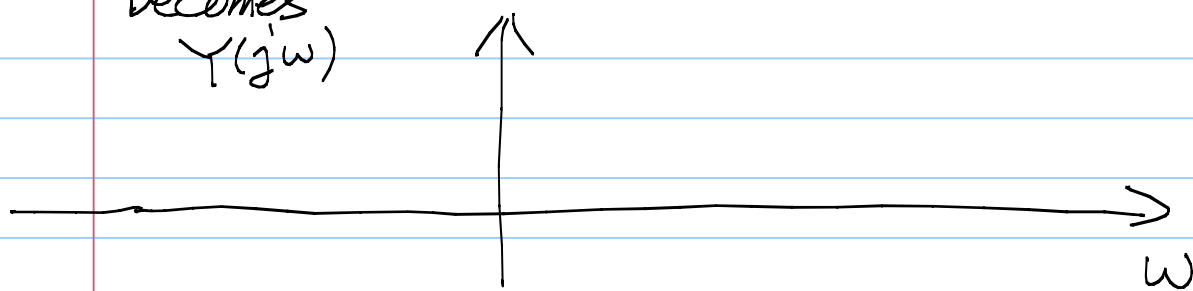
$X_1(j\omega)$

$X_2(j\omega)$

$X_3(j\omega)$

To avoid unnecessary freq overlap, $x_1(t)$ $x_2(t)$ & $x_3(t)$ have to be converted to "band-limited" signals first.
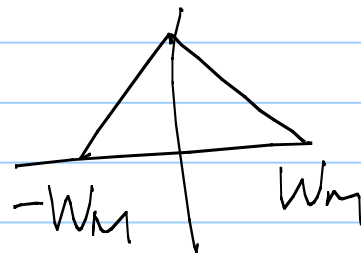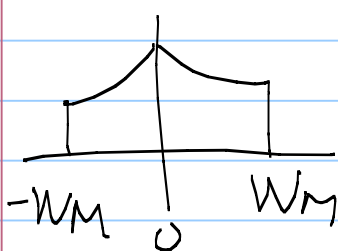
How to send all three signals simultaneously?

Ans:

The spectrum of the final transmitted signal becomes

$Y(j\omega)$

ω

How to squeeze in as many radio stations as possible? (Licensed frequency bands are outrageously expensive.)

Ans: Make w_a, w_b, w_c as close as possible, but not too close.

For example, if the original signals are bandlimitted to have freq $-W_M$ to W_M

$-W_M \quad 0 \quad W_M \qquad -W_M \quad W_M \qquad -W_M \quad W_M$
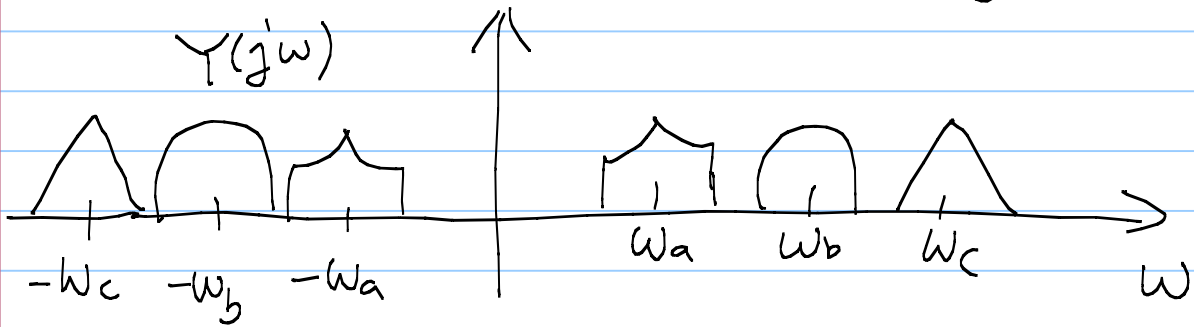
then the freq have to satisfy

Example: Using this scheme, a licensed

1 MHz bandwith can carry $\boxed{?}$ radio stations with each one carry 20 kHz band-limited signals.

* Whenever we say ?? MHz bandwith, we always refer to only the positive freq part.

Demodulation of (AM) FDM signals
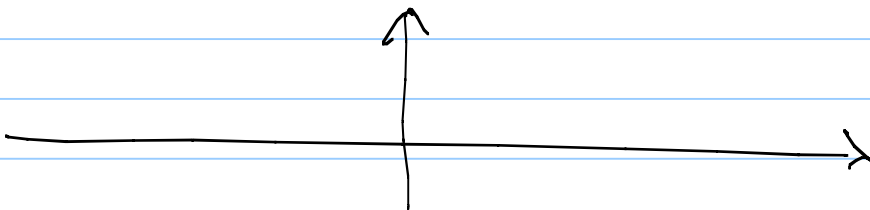
$Y(j\omega)$

Step 1:

* You need to design an LTI sys with h(t)

which will have the above BPF $H(j\omega)$

* We need to "tune the BPF" to the radio freq of your radio station

Ex: If interested in Station A
The pass band of the BPF becomes

Step 2:

Step 3:

* One thus needs to carefully choose
the parameters

in order to listen to the desired radio station.