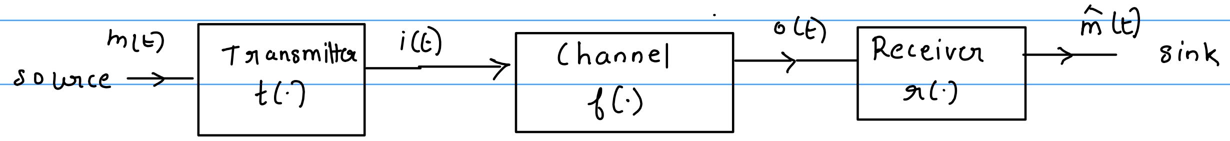
Lecture 6 05/08/2019

Review



Design $t(\cdot)$ and $r(\cdot)$

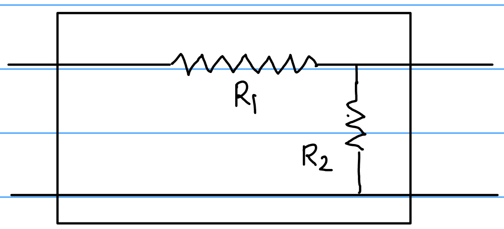
such that $e(m(t), \hat{m}(t)) \le \varepsilon$,

given $f(\cdot)$

* real-world Channels are well modelled as LTI systems or LTI filters.

e.g. can you model a wire as a LTI filter?

a model



an important idea here is that $t(\cdot)$ and $r(\cdot)$ are used to nullify the effect of the channel (at least in our current understanding).

Important points to take away from this class:

a) Channels can be modelled as LTI filters.

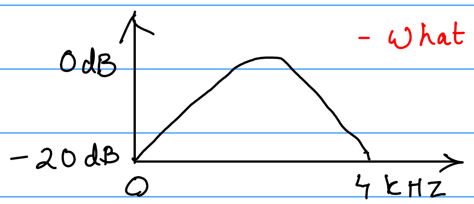
b) There are model fitting procedures to find out LTI filter models ($h(t)$ or $H(f)$) for a channel.

c) The $t(\cdot)$ and $r(\cdot)$ functions are used to nullify the effect of the channel so that $e(m(t), \hat{m}(t)) \le \varepsilon$.

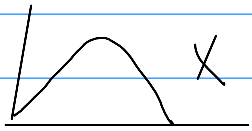
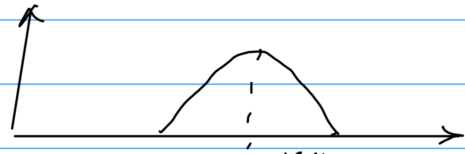
d) Wired channels are modelled as low pass filters, wireless channels as bandpass filters.

e.g. Telephone channel $|H(f)|$?

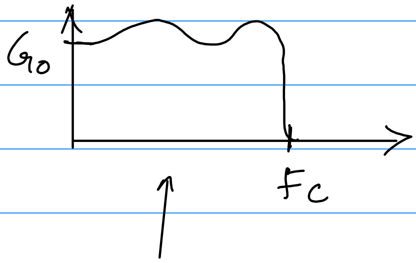
- What is dB?



another example DSL line model. there are bandpass wired channels too.

not like  but 

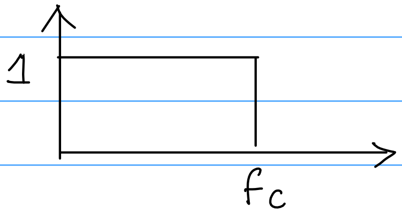
Usually wired channels are modelled as low pass filters



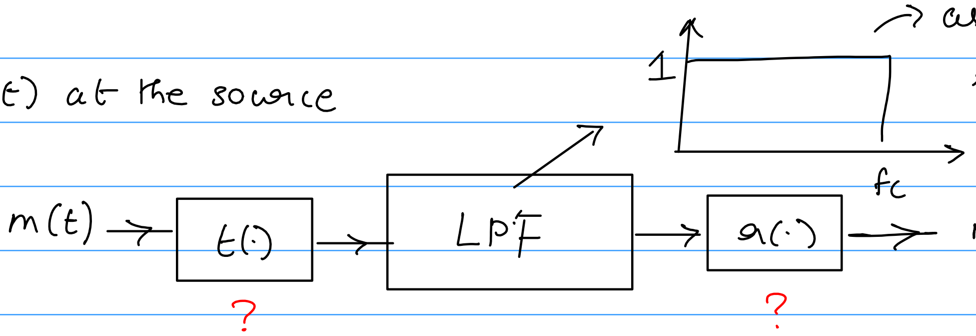
- other ways in which a LPF is characterized.
- $H(f)$ of the LPF

actual low pass filters

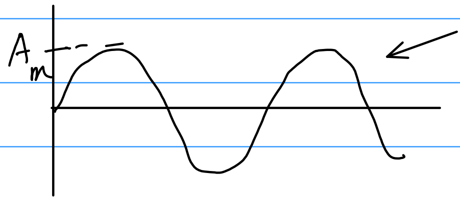
We replace this by an ideal filter to study how to design $t(\cdot)$ and $r(\cdot)$



$m(t)$ at the source

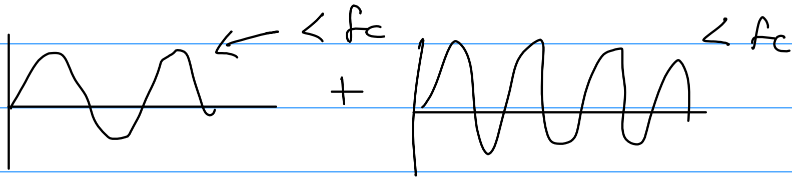


→ assume phase response is linear

e.g. $m(t)$ is 

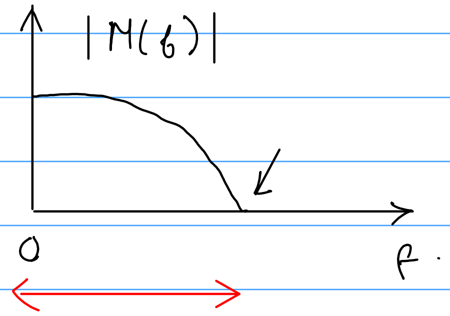
$< f_c$

so $t(\cdot)$ and $r(\cdot)$ are identity functions

e.g. $m(t)$ is 

$m(t)$ will have some characteristics which are important for designing $t(\cdot)$ and $r(\cdot)$

$$m(t), \quad E_m = \int_{-\infty}^{\infty} |m(t)|^2 \, dt < \infty, \quad m(t) \xrightarrow{\mathcal{F}} \underline{M(f)} \checkmark$$

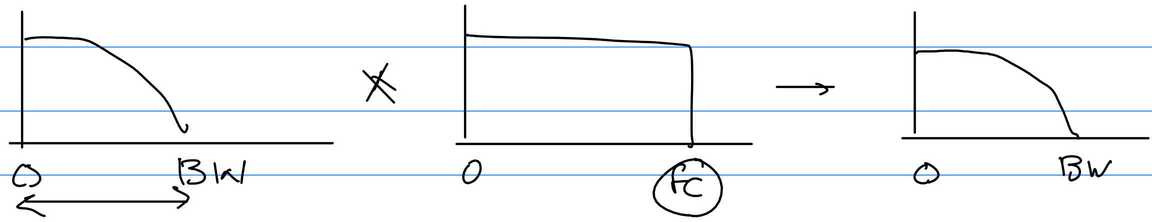


Bandwidth

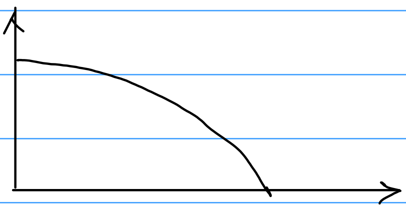
$m(t)$ will a low pass signal

baseband

What is $t(\cdot)$ and $r(\cdot)$ if $f_c >$ Bandwidth?



e.g. suppose $m(t)$ baseband?



BW $> f_c$

a) try and get another channel

b) how to reduce BW?

$$x(t) \xrightarrow{\mathcal{F}} X(f)$$
$$x(at) \xrightarrow{\mathcal{F}} X(f/a)$$

exercise: