$x(t) \rightarrow \boxed{h(t)} \rightarrow y(t) = \int_{-\infty}^{+\infty} h(\tau)\, x(t-\tau)\, d\tau$

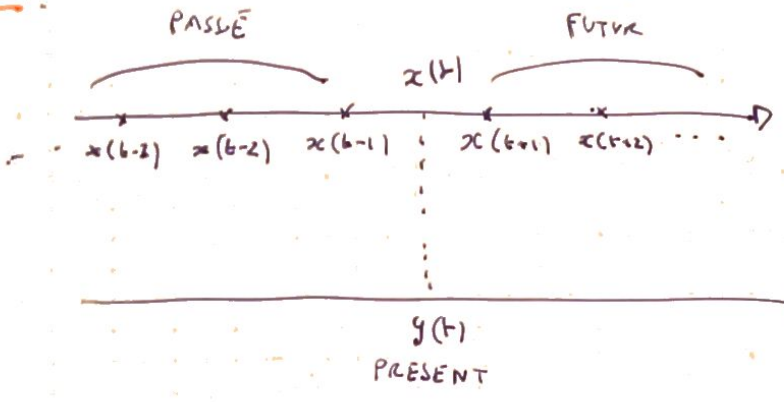
Un FL est réalisable physiquement si il est **stable** et **causal**

Stable : entrée bornée
sortie bornée

$|x(t)| < M$

$|y(t)| \leq \int |h(z)|\,|x(t-z)|\, dz \leq M \underbrace{\int |h(z)|\, dz}_{< \infty}$

Causal :

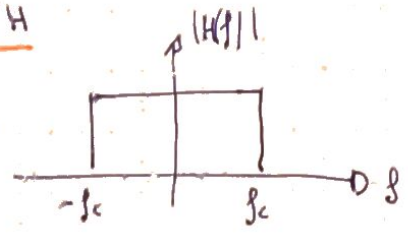


$y(t)$ dépend de $x(t)$ au présent et au passé.

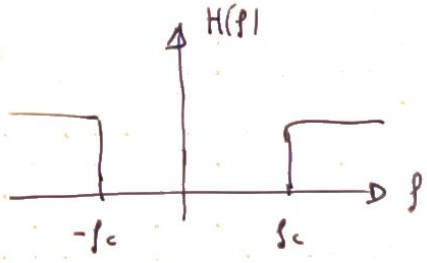
$$y(t) = \int_0^{\infty} h(z)\, x(t-z)\, dz$$

Filtre Passe-bas, Passe-haut, passe-bande, coupe-bande

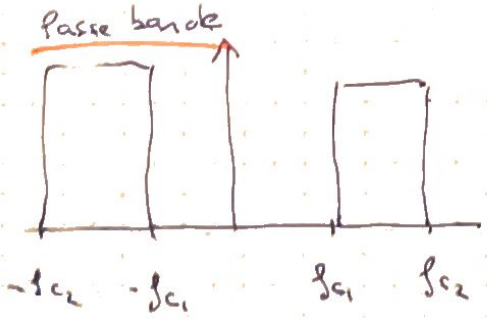
PH



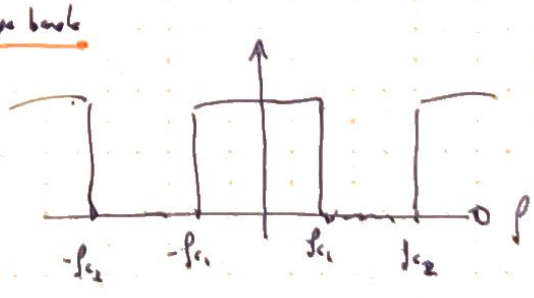
PB



Passe bande



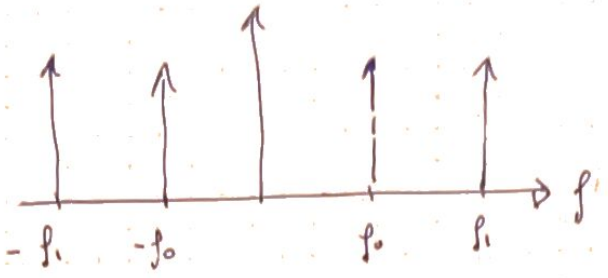
Coupe bande



Exemple

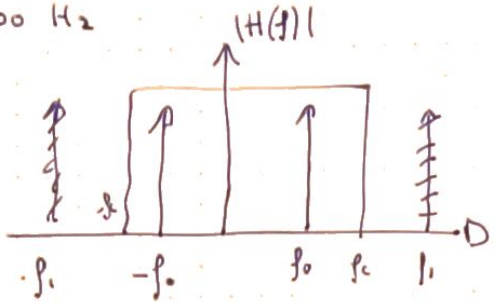
$x(t) = \cos(2\pi f_0 t) + \cos(2\pi f_1 t)$

$\xrightarrow{TF} X(f) = \frac{1}{2}[\delta(f-f_0) - \delta(f+f_0)] + \frac{1}{2}[\delta(f-f_1) + \delta(f+f_1)]$



$f_0 = 2000$ Hz $f_1 = 5000$ Hz

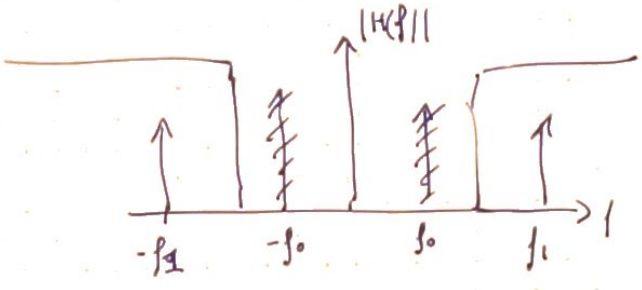
filtre PH à 2500 Hz



$y(t) = \cos(2\pi f_0 t)$

si $f_c = 4000$ Hz alors $y(t) = \cos(2\pi f_0 t) + \cos(8\pi f_1 t)$

filtre basse bas à 2500 Hz



filtre coupe bande $f_{c_1} = 2500$ Hz $f_{c_2} = 6000$ Hz