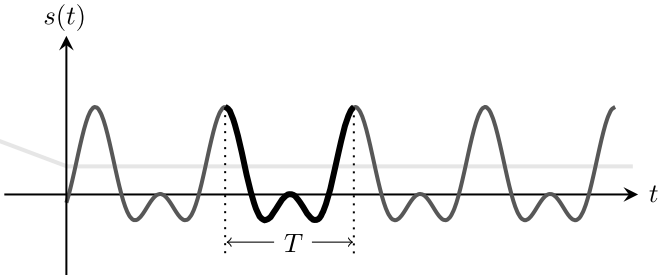
Filtrage

Signaux périodiques



Valeur moyenne

$$\langle s(t)\rangle = \frac{1}{T}\int_0^T s(t)\,dt$$

Valeur efficace

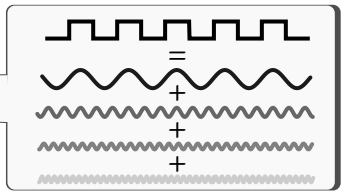
$$S = \sqrt{\frac{1}{T}\int_0^T s^2(t)\,dt}$$

- T période
- $f = \frac{1}{T}$ fréquence
- $\omega = 2\pi f$ pulsation

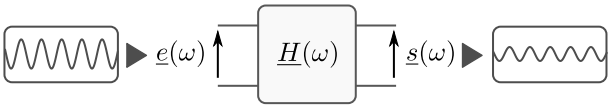
Décomposition en série de Fourier

$$s(t) = c_0 + \sum_{i=1}^{n} \underbrace{c_n \cos(n\omega t + \varphi_n)}_{\text{harmonique de rang } n}$$

c_0 : composante continue



Fonction de transfert



Fonction de transfert harmonique

$$\underline{H}(\omega) = \frac{\underline{s}(\omega)}{\underline{e}(\omega)}$$

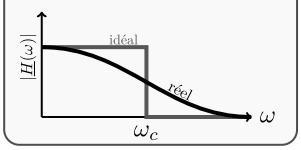
Gain $G = |\underline{H}(\omega)|$

Déphasage $\varphi = \arg(\underline{H}(\omega))$

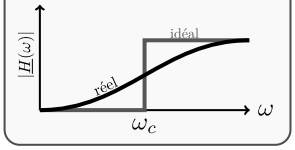
Gain en décibels $G_{dB} = 20\log(G)$

Types de filtres

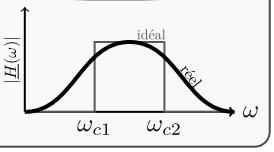
passe-bas



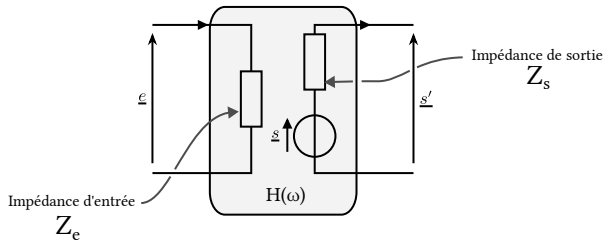
passe-haut



passe-bande



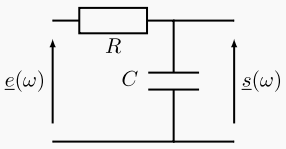
Mise en cascade



Lorsque l'on met deux filtres en cascade, si $Z_{s1} \ll Z_{e2}$, la fonction de transfert totale est le produit des fonctions de transfert des deux filtres.

Filtre passe-bas

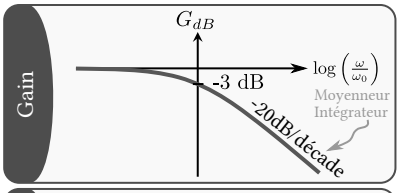
Filtre passe-bas d'ordre 1



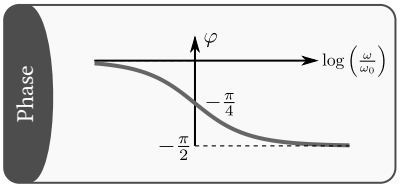
Fonction de transfert

$$\underline{H}(\omega) = \frac{1}{1+jRC\omega} = \frac{1}{1+j\frac{\omega}{\omega_0}}.$$

Gain

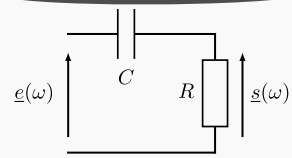


Phase



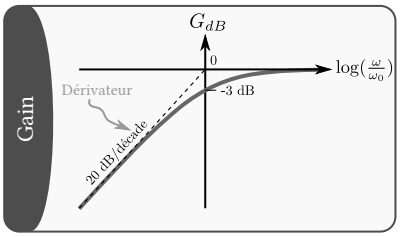
Autres filtres

Filtre pass-haut d'ordre 1

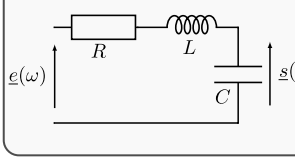


$$H(\omega) = \frac{1}{1+(jRC\omega)^{-1}} = \frac{1}{1-j\frac{\omega_0}{\omega}}$$

Gain



Filtre pass-base d'ordre 2



Gain