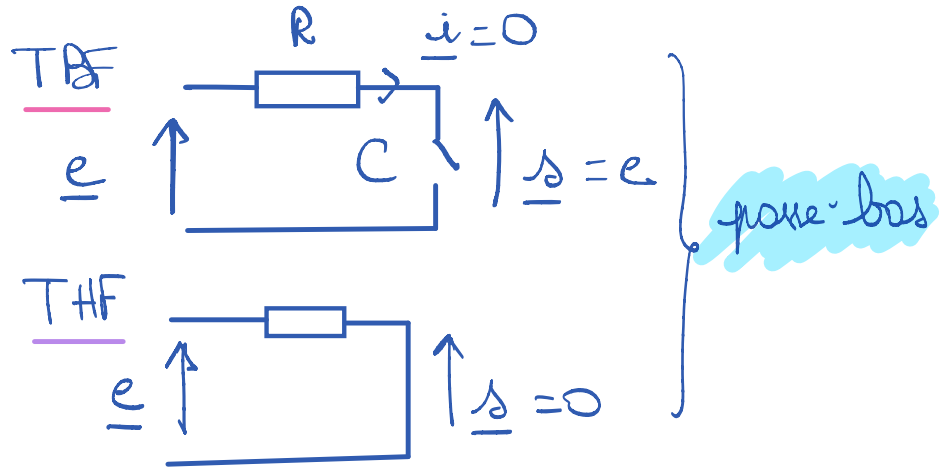


# Chapitre 8

## Filtre RC

• Nature du filtre :



• Fonction de transfert :

$$\underline{s} = \underline{e} \frac{\underline{Z}_C}{\underline{Z}_C + \underline{Z}_R} \Rightarrow \underline{H} = \frac{1}{1 + \frac{\underline{Z}_R}{\underline{Z}_C}} \quad \underline{H} = \frac{1}{1 + jRC\omega}$$

• Pulsation de coupure :

$$|\underline{H}(\omega_c)| = \frac{|\underline{H}(0)|}{\sqrt{2}} \leftarrow \text{Valeur maximale pour 1 pass-bas}$$

ici : 1 (TBF :  $\underline{s} = \underline{e}$ )

$$\Leftrightarrow \sqrt{1 + R^2 C^2 \omega_c^2} = \sqrt{2}$$

$$\omega_c = \frac{1}{RC}$$

• Diagramme de Bode

$$G_{dB} = 20 \log \frac{1}{\sqrt{1 + R^2 C^2 \omega^2}}$$

$$\varphi = -\arctan(RC\omega)$$

## Equations des asymptotes:

\*  $\omega \rightarrow 0$      $H \rightarrow 1$

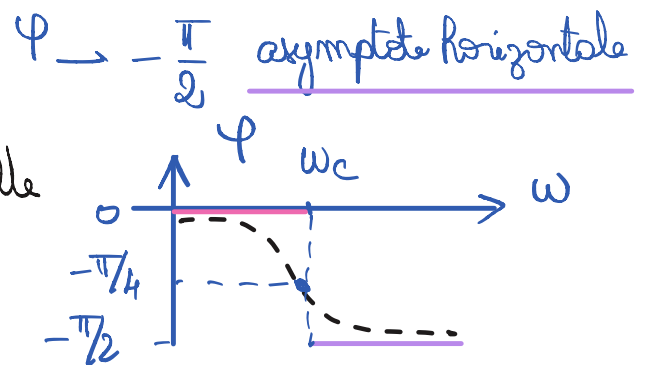
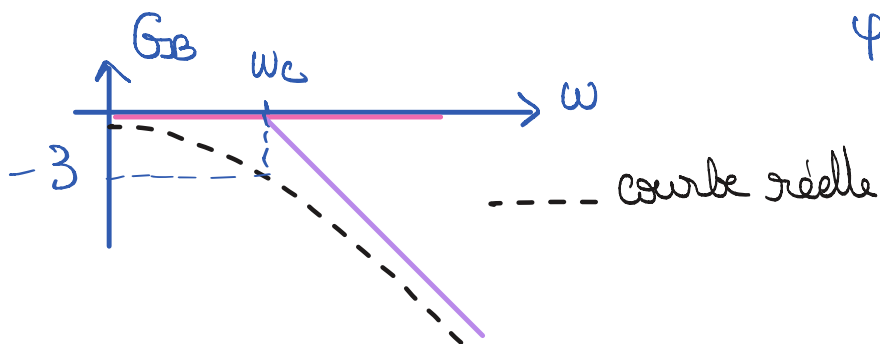
$G_B \rightarrow 0$  asymptote horizontale

$\varphi \rightarrow 0$  asymptote horizontale

\*  $\omega \rightarrow \infty$      $H \rightarrow \frac{1}{jRC\omega}$

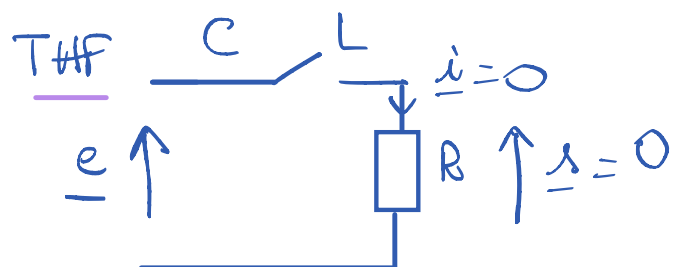
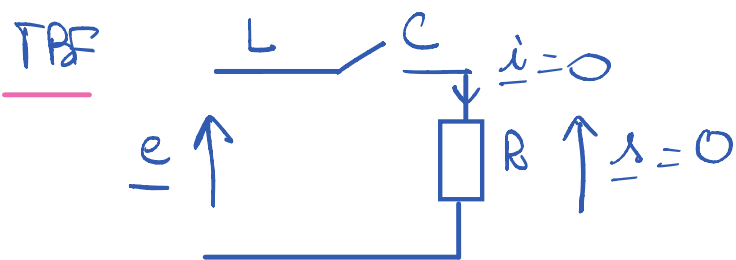
$G_B \rightarrow -20 \log(RC) - 20 \log \omega$

pente de  $-20 \text{ dB/}$   
décade



## Etude du filtre RLC aux bornes de R

### Nature du filtre



→ filtre **pass-bas**

## Fonction de transfert:

$$\underline{H} = \frac{\underline{Z}_R}{\underline{Z}_R + \underline{Z}_L + \underline{Z}_C} = \frac{1}{1 + j\left(\frac{L\omega}{R} - \frac{1}{RC\omega}\right)}$$

$$\frac{Q}{\omega_0} = \frac{L}{R}$$

$$Q\omega_0 = \frac{1}{RC}$$

$$\Rightarrow \omega_0^2 = \frac{1}{LC}$$

$$\omega_0 = \frac{1}{\sqrt{LC}}$$

$$Q^2 = \frac{1}{R^2} \frac{L}{C}$$

$$Q = \frac{1}{R} \sqrt{\frac{L}{C}}$$

### • Diagramme de Bode

$$G_{dB} = 20 \log \frac{1}{\sqrt{1 + Q^2 \left( \frac{\omega}{\omega_0} - \frac{\omega_0}{\omega} \right)^2}}$$

$$\varphi = -\arctan \left( Q \left( \frac{\omega}{\omega_0} - \frac{\omega_0}{\omega} \right) \right)$$

### • Equations des asymptotes

\*  $\omega \rightarrow 0$   $\underline{H} \rightarrow \frac{1}{-j Q \frac{\omega_0}{\omega}} = j \frac{\omega}{Q \omega_0}$  ( $\times j\omega \rightarrow$  dérivateur)

$G_{dB} \rightarrow 20 \log \left( \frac{1}{Q \omega_0} \right) + 20 \log \omega$   
 ↑ pente + 20 dB/décade

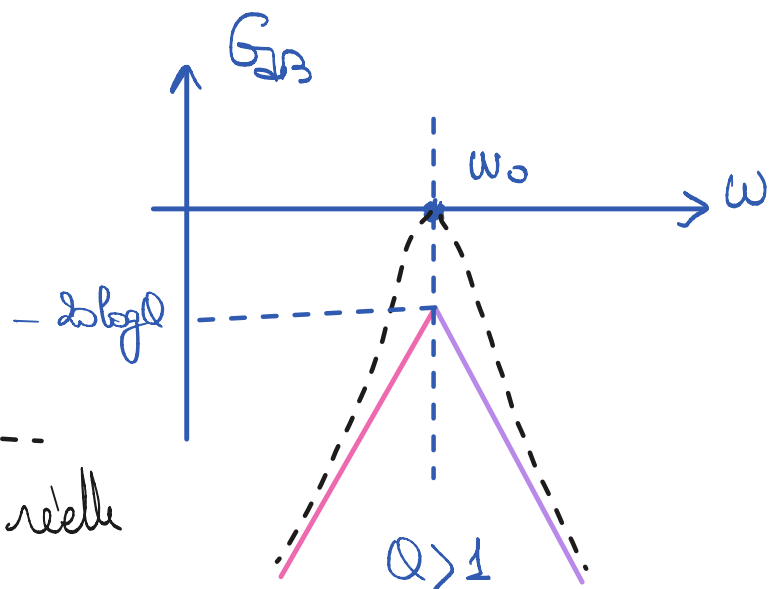
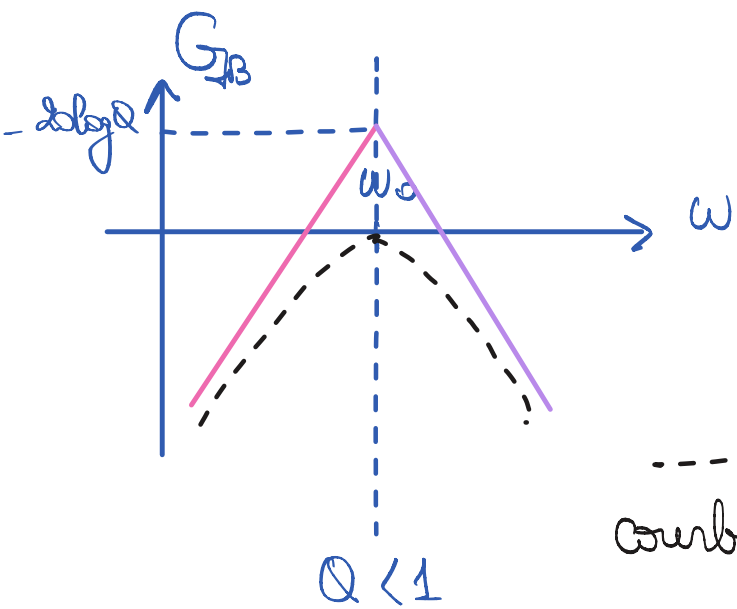
$\varphi \rightarrow +\frac{\pi}{2}$  asymptote horizontale

\*  $\omega \rightarrow \infty$   $\underline{H} \rightarrow \frac{1}{j Q \frac{\omega}{\omega_0}} = \frac{\omega_0}{j Q \omega}$  ( $\frac{1}{j\omega} \rightarrow$  intégrateur)

$G_{dB} \rightarrow 20 \log \left( \frac{\omega_0}{Q} \right) - 20 \log \omega$   
 ↑ pente - 20 dB/décade

$\varphi \rightarrow -\frac{\pi}{2}$  asymptote horizontale

• Intersection des asymptotes :  $\omega = \omega_0$  et  $G_{dB} = -20 \log Q$



Curve real

