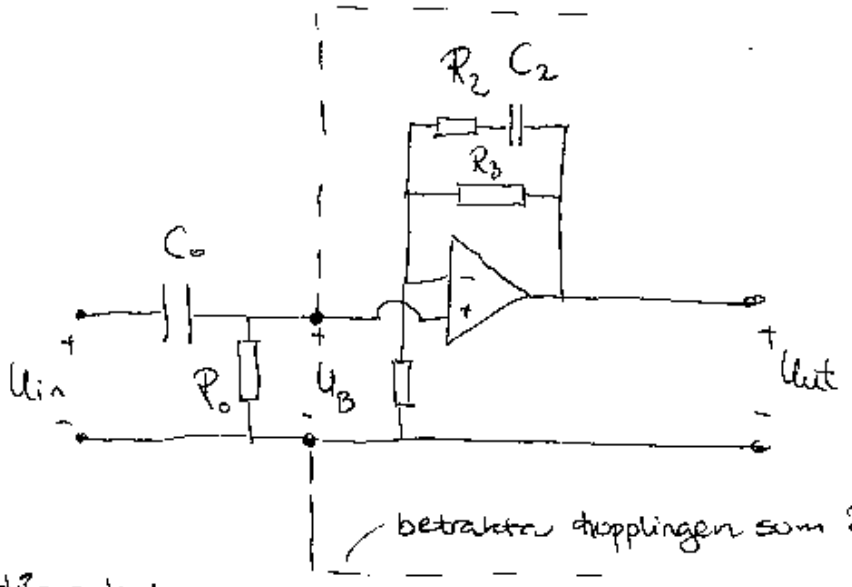
En 29 Sökes: Förstärkningen
Rita asymptotiskt Bodediagram



$R_0 = 10k\Omega$
$R_1 = 1k\Omega$
$R_2 = 10k\Omega$
$R_3 = 100k\Omega$
$C_0 = 1\mu F$
$C_2 = 10nF$

Högra halvan:

$$\bar{F} = \frac{\bar{U}_{ut}}{\bar{U}_B} = 1 + \frac{\bar{Z}_2}{\bar{Z}_1}$$

där $\bar{Z}_1 = R_1$

$$\bar{Z}_2 = \frac{\left(R_2 + \frac{1}{j\omega C_2}\right)R_3}{R_2 + \frac{1}{j\omega C_2} + R_3} = \dots = \frac{R_3\left(1 + j\omega R_2 C_2\right)}{1 + j\omega(R_2 + R_3)C_2}$$

Vänstra halvan:

$$\bar{U}_B = \frac{\bar{U}_{in}}{R_0 + \frac{1}{j\omega C_0}} \cdot R_0$$

Ohms lag:
$$\bar{U}_B = \frac{U}{Z_{serie}} \cdot R$$

dägg inop HH & VH:

$$\bar{F} = \frac{\bar{U}_{ut}}{\bar{U}_{in}} = \frac{R_0}{R_0 + \frac{1}{j\omega C_0}} \cdot \left(1 + \frac{\bar{Z}_2}{\bar{Z}_1}\right)$$

$$= \frac{j\omega R_0 C_0}{1 + j\omega R_0 C_0} \cdot \left(1 + \frac{R_3(j\omega C_2 R_2 + 1)\cdot\frac{1}{R_1}}{1 + j\omega C_2(R_2 + R_3)}\right) = \frac{j\omega R_0 C_0}{1 + j\omega R_0 C_0} \cdot \frac{1 + j\omega C_2(R_2 + R_3) + \frac{R_3}{R_1}(j\omega C_2 R_2 + 1)}{1 + j\omega C_2 R_2 + R_3} =$$

$$= \left(1 + \frac{R_3}{R_1}\right) \cdot \frac{j\omega R_0 C_0}{(1 + j\omega R_0 C_0)} \cdot \frac{\left(1 + j\omega C_2 \frac{R_2 + R_3 + \frac{R_3 \cdot R_2}{R_1}}{1 + R_3/R_1}\right)}{\left(1 + j\omega C_2(R_2 + R_3)\right)}$$

forts. Kn 29

$$\bar{F} = \left(1+\frac{R_3}{R_1}\right) \frac{j f \overbrace{2\pi R_0 C_0}^{\approx 0{,}063}}{1+j\frac{f}{f_1}} \cdot \frac{1+j\frac{f}{f_3}}{1+j\frac{f}{f_2}}$$

$$= \frac{6{,}35 \cdot j f \left(1+j\frac{f}{f_3}\right)}{\left(1+j\frac{f}{f_1}\right)\left(1+j\frac{f}{f_2}\right)}$$

$$f_1 = \frac{1}{2\pi R_0 C_0} = 16\,Hz$$

$$f_2 = \frac{1}{2\pi (R_2+R_3) C_2} = 145\,Hz$$

$$f_3 = \frac{1}{2\pi \frac{(R_1R_2+R_1R_3+R_2R_3)}{R_1+R_3} \cdot C_2} = 1450\,Hz$$

da $f = 1\,Hz$: $|\bar{F}| = 6{,}35_{ggr} \hat{=} 16\,dB$

da $f_1 < f < f_2$: $|\bar{F}| = 6{,}35 \cdot f_1 = 102_{ggr} \hat{=} 40\,dB$

da $f_3 < f$: $|\bar{F}| = 6.35 \cdot \frac{f_1 \cdot f_2}{f_3} = 10_{ggr} \hat{=} 20\,dB$

$\arg \bar{F} = \arg k + \arg j + \arctan\left(\frac{f}{f_3}\right) - \arctan\left(\frac{f}{f_1}\right) - \arctan\left(\frac{f}{f_2}\right)$

da $f < f_1$: $\arg \bar{F} = 0 + 90 + 0 - 0 - 0 = 90°$

da $f_1 < f < f_2$: $\arg \bar{F} = 0 + 90 + 0 - 90 - 0 = 0°$

da $f_2 < f < f_3$: $\arg \bar{F} = 0 + 90 + 0 - 90 - 90 = -90°$

da $f_3 < f$: $\arg \bar{F} = 0 + 90 + 90 - 90 - 90 = 0°$