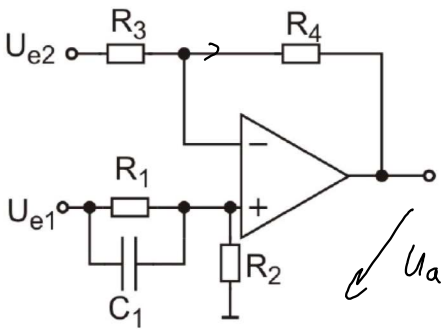
$R_2 = 1k\Omega$
$R_4 = 10k\Omega$
$C_1 = 100nF$
$U_{e1} = 5+5\cdot\sin(\omega t)$
$U_{e2} = -2+2\cdot\sin(\omega t)$

OPV ideal



a) Super pos: $U_{e1} = 0$

$$U_a = U_{R4} = -I \cdot R_4 = -\frac{U_{e2}}{R_3} \cdot R_4$$

$U_{e2} = 0$

$$\underline{Z}_1 = \frac{R_1 \cdot \frac{1}{j\omega C_1}}{R_1 + \frac{1}{j\omega C_1}} \qquad U_2 = U_3 = U_{e1} \cdot \frac{R_2}{\frac{R_1 \cdot \frac{1}{j\omega C_1}}{R_1 + \frac{1}{j\omega C_1}} + R_2}$$

$$U_3 = U_a \cdot \frac{R_3}{R_3 + R_4} \rightarrow U_a = U_3 \frac{R_3 + R_4}{R_3}$$

$$U_a = U_{e1} \cdot \frac{R_3 + R_4}{R_3} \cdot \frac{R_2}{\frac{R_1 \cdot \frac{1}{j\omega C_1}}{R_1 + \frac{1}{j\omega C_1}} + R_2} - U_{e2} \frac{R_4}{R_3}$$

b) $U_a(0) = U_{e1} - 0{,}5\,U_{e2} = U_{e1} \cdot \frac{R_3 + R_4}{R_3} \frac{R_2}{\frac{R_1}{\underbrace{R_1 j\omega C_1}_{\to 0} + 1} + R_2} - U_{e2} \frac{R_4}{R_3}$

$$= U_{e1} \cdot \underbrace{\frac{R_3 + R_4}{R_3} \frac{R_2}{R_1 + R_2}}_{=1} - U_{e2} \underbrace{\frac{R_4}{R_3}}_{=0{,}5}$$

$R_3 = \frac{R_4}{0{,}5} = \underline{20k\Omega}$

$$1 = \frac{20k + 10k}{20k} \cdot \frac{1k}{1k + R_1}$$

$$\frac{2}{3} 1k + \frac{2}{3} R_1 = 1k \rightarrow R_1 = \left(1k - \frac{2}{3} 1k\right) \frac{3}{2} = \frac{1}{2} k = \underline{500\,\Omega}$$

c) In Standard form bringen

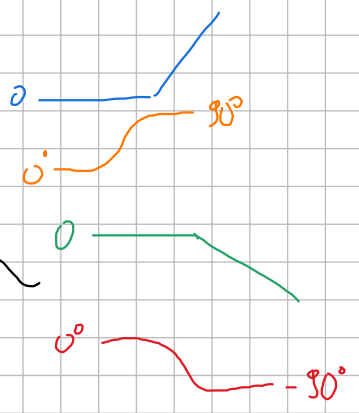
$$\omega\text{-Abh. Teil: } \frac{R_3 + R_4}{R_3} \frac{R_2}{\frac{R_1}{R_1 j\omega C_1 + 1} + R_2} = \frac{R_3 + R_4}{R_3} \cdot \frac{R_2}{\frac{R_1 + R_1 R_2 j\omega C_1 + R_2}{R_1 j\omega C_1 + 1}} =$$

$$= \frac{R_3+R_4}{R_3} \cdot \frac{R_2 \cdot R_1 j\omega C_1 + R_2}{R_1+R_1R_2 j\omega C_1 + R_2} = \frac{R_3+R_4}{R_3} \cdot \frac{R_2}{R_1+R_2} \cdot \frac{1+j\omega C_1 R_1}{1+j\omega C_1 \frac{R_1R_2}{R_1+R_2}}$$

$$\omega_{g1} = \frac{1}{C_1 R_1} \qquad \omega_{g2} = \frac{R_1+R_2}{C_1 R_1 R_2}$$

$$f_{g1} = \frac{1}{2\pi C_1 R_1} \qquad f_{g2} = \frac{R_1+R_2}{2\pi C_1 R_1 R_2}$$

d) ?



e) $V_1 = \frac{U_{aus}}{U_{ein}} = \frac{1+j\omega C_1 R_1}{1+j\omega C_1 \frac{R_1R_2}{R_1+R_2}}$

$f_{g1} = 3{,}18\,kHz < f_{g2} = 5{,}77\,kHz$