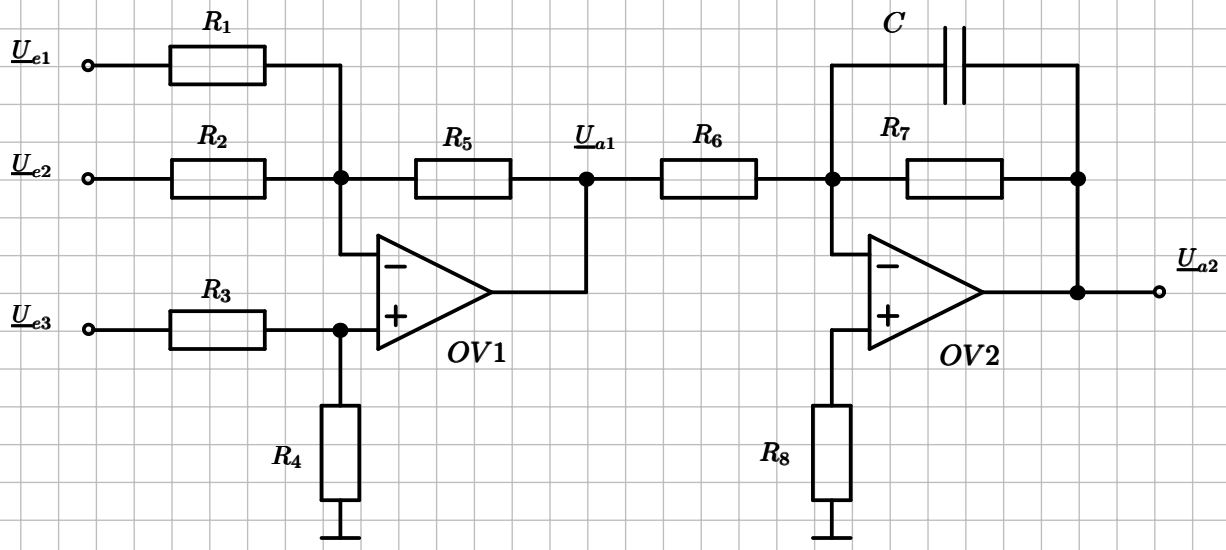
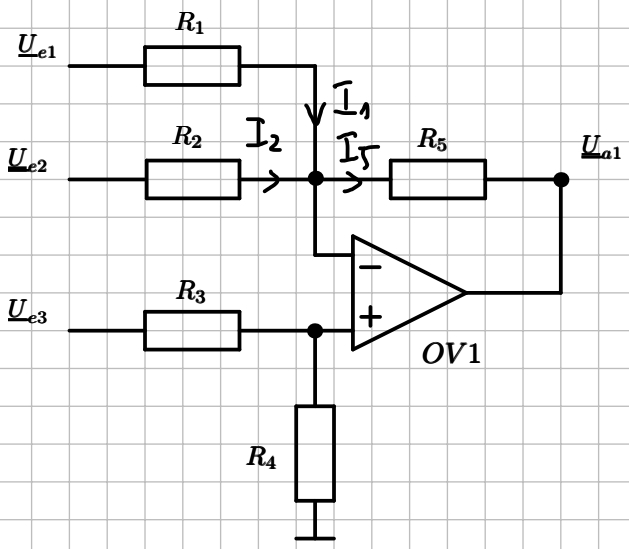


a) $A_1 = \frac{U_{a1}}{U_{e1}} = 2 \quad // \; U_{e2} = U_{e3} = 0$



$I_5 = I_1 + I_2 = \frac{U_{e1}}{R_1} + \frac{U_{e2}}{R_2} = -\frac{U_{a1}}{R_5}$

$\frac{U_{e1}}{R_1} = -\frac{U_{a1}}{R_5} \rightarrow A = \frac{U_{a1}}{U_{e1}} = -\frac{R_5}{R_1}$

$R_1 = \frac{R_5}{|A_1|} = 5k\Omega$

b) $A_2 = \frac{U_{a1}}{U_{e2}} = 1 \quad // \; U_{e1} = U_{e3} = 0 \qquad R_2 = \frac{R_5}{|A_2|} = 10k\Omega$

c) $A_3 = \frac{U_{a1}}{U_{e3}} = 1{,}333 \quad // \; U_{e1} = U_{e2} = 0$

$U_{a1} = U_5 + U_{1||2}$ $\quad U_{e3} = U_3 + U_4$ $\quad U_4 = U_{1||2}$ $\quad U_{1||2} = U_{e3} \cdot A_3 \cdot \frac{R_1 \| R_2}{R_1 \| R_2 + R_5}$

U_4

$U_{e3} = U_{e3} \cdot A_3 \cdot \underbrace{\frac{R_1 \| R_2}{R_1 \| R_2 + R_5}}_{= \frac{1}{4}} + U_3$

$U_3 = U_{e3} \cdot \frac{R_3}{R_3 + R_4}$

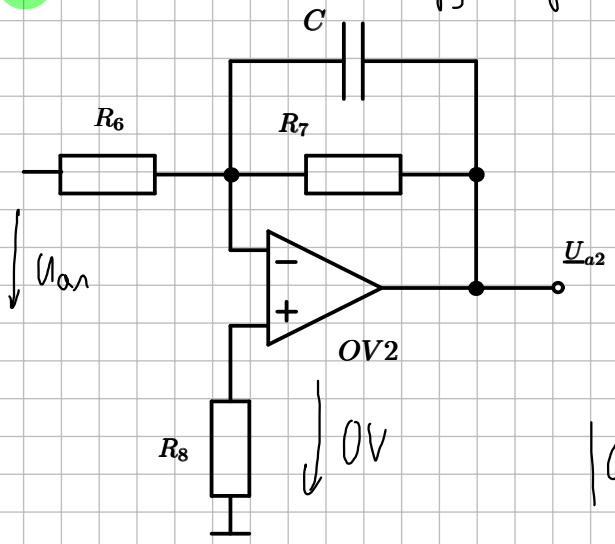
$\cancel{U_{e3}} = \cancel{U_{e3}} \cdot A_3 \cdot \frac{1}{4} + \cancel{U_{e3}} \cdot \frac{R_3}{R_3 + R_4} \rightarrow 1 = A_3 \frac{1}{4} + \frac{R_3}{R_3 + R_4}$

$R_3 - A_3 \cdot \frac{1}{4} R_3 + R_4 - A_3 \frac{1}{4} R_4 = R_3$

$$\Rightarrow R_4 - A_3 \frac{1}{4} R_4 = A_3 \frac{1}{4} R_3$$

$$\Rightarrow R_4 = \frac{A_3 \frac{1}{4} R_3}{1 - A_3 \frac{1}{4}} = \underline{1\,k\Omega}$$

d) nur OPV2 kann f_g aufweisen



$$G = \frac{U_{a2}}{U_{an}} = \frac{\frac{R_7 \frac{1}{j\omega C}}{R_7 + \frac{1}{j\omega C}}}{R_6} = \frac{\frac{R_7}{j\omega C R_7 + 1}}{R_6}$$

$$= \frac{R_7}{R_6} \cdot \frac{1}{1 + j\omega (C R_7)}$$

$$\omega_g = \frac{1}{R_7 C}$$

$$|G(50\,kHz)| = \left| \frac{R_7}{R_6} \cdot \frac{1}{1 + j\,50k \cdot 2\pi \cdot (C R_7)} \right|$$

$$|G(50\,MHz)| = \frac{|G(50\,kHz)|}{100}$$

$$|G(50\,kHz)| = 100\,|G(50\,MHz)|$$

$$\left| \frac{1}{1 + j\,\omega_{sens} \frac{1}{\omega_g}} \right| = 100 \left| \frac{1}{1 + j\,\omega_{stör} \frac{1}{\omega_g}} \right|$$

$$\frac{|1|}{\sqrt{1 + \omega_{sens}^2 \frac{1}{\omega_g^2}}} = 100 \frac{|1|}{\sqrt{1 + \omega_{stör}^2 \frac{1}{\omega_g^2}}} \rightarrow 1 + \omega_{stör}^2 \frac{1}{\omega_g^2} = 100^2 \cdot \left(1 + \omega_{sens}^2 \frac{1}{\omega_g^2}\right)$$

$$\omega_{stör}^2 \frac{1}{\omega_g^2} = 100^2 + 100^2 \omega_{sens}^2 \frac{1}{\omega_g^2} - 1$$

$$\omega_{stör}^2 \frac{1}{\omega_g^2} - 100^2 \omega_{sens}^2 \frac{1}{\omega_g^2} = 100^2 - 1$$

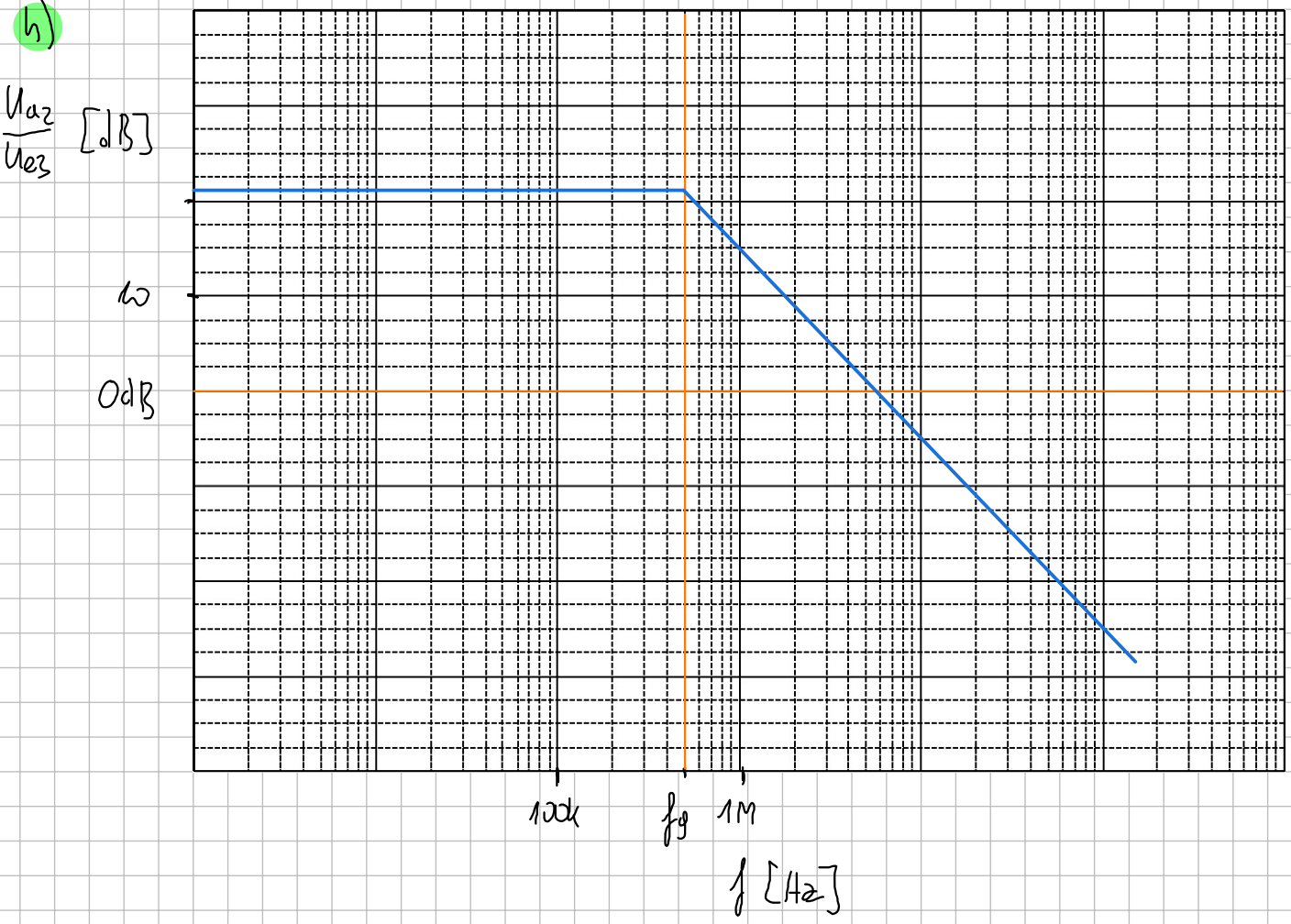
$$\frac{1}{\omega_g^2} \left(\omega_{stör}^2 - 100^2 \omega_{sens}^2 \right) = 100^2 - 1$$

$$\omega_g = \sqrt{\frac{\omega_{stör}^2 - 100^2 \omega_{sens}^2}{100^2 - 1}} \rightarrow f_g = \sqrt{\frac{50^2 M - 100^2 50k^2}{100^2 - 1}} = \underline{\underline{49{,}524\,Hz}}$$

e) $A_{OPV2}(\approx 0) = 100 = \frac{R_7}{R_6} \rightarrow R_7 = \underline{\underline{100\,k\Omega}}$

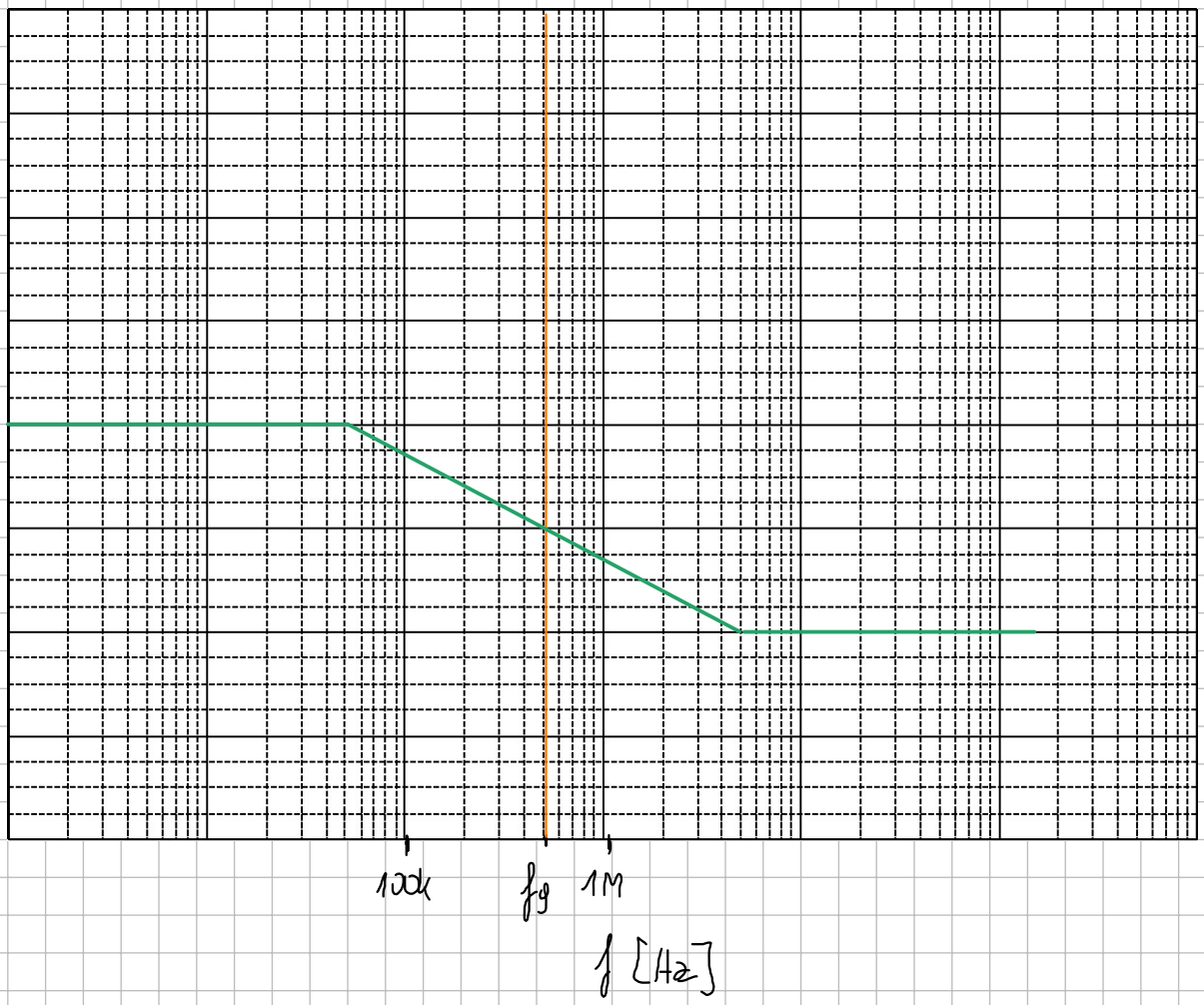
f) $\omega_g = \frac{1}{R_7 C} \rightarrow C = \frac{1}{R_7 \cdot \omega_g} = \frac{1}{10k \cdot 2\pi \cdot 497{,}52} = \underline{31{,}99\,pF}$

h)



$$\frac{U_{a2}}{U_{e2}} = A_3 \cdot G = 1{,}333 \cdot \omega \cdot \frac{1}{j\omega\left(\frac{1}{2\pi} \cdot 497{,}52\right) + 1}$$

$A_0 = 13{,}33 \rightarrow A_{0dB} = 20 \cdot \log(13{,}33) = \underline{22{,}5\,dB}$


arg(Ua2/Ue3) [°]
0°
100k
fg
1M
f [Hz]