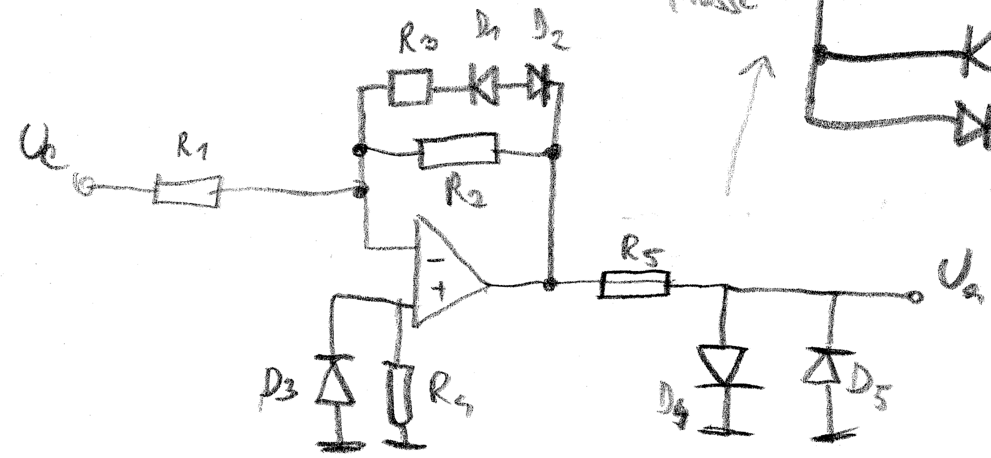
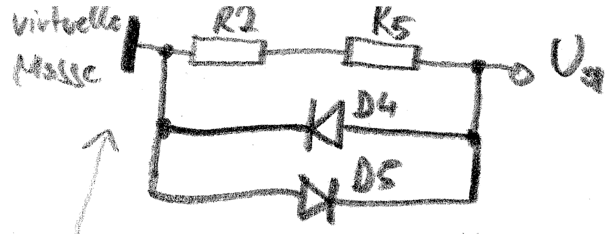
Knickkennlinie





1. Knick: $U_{a_{max}} = U_D$

2. Knick: $U_{a_{min}} = -U_D$

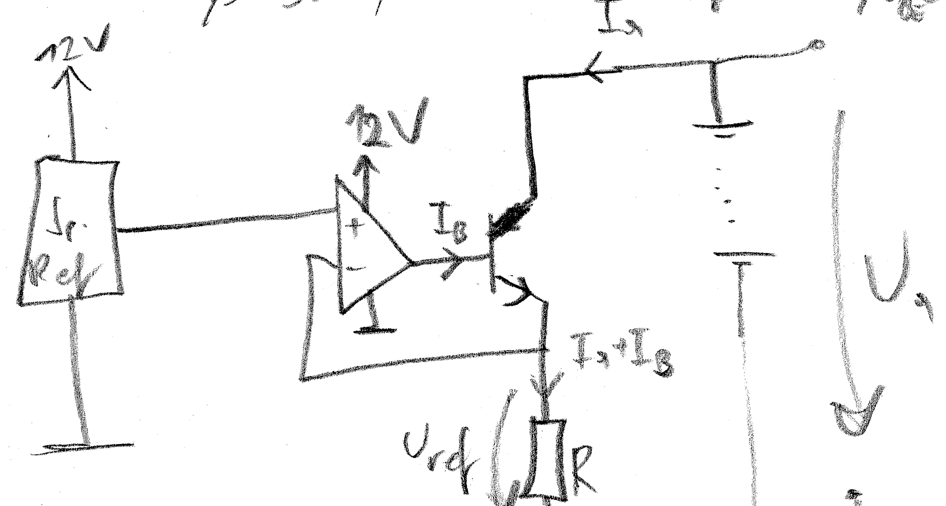
$U_e = -\frac{R1}{R2+R5} \cdot U_a$

1.) Welche Knicke und wo? Bei welchen Ue?

2.) Rauschen von D_3 und R_4 auf Schaltung wirkend? → JA

3.) Welche Verstärkungen wo? $U_a = -U_D$, $\frac{U_a}{U_e} = -\frac{R2+R5}{R1}$, $U_a = U_D$

$\beta = 30$; $I_a = 0{,}5A$; $U_{ref} = 1{,}2V$; $U_{BE} = 0{,}6V$; $U_a = 2 \dots 12V$



$I_B = \frac{I_a}{30+1}$

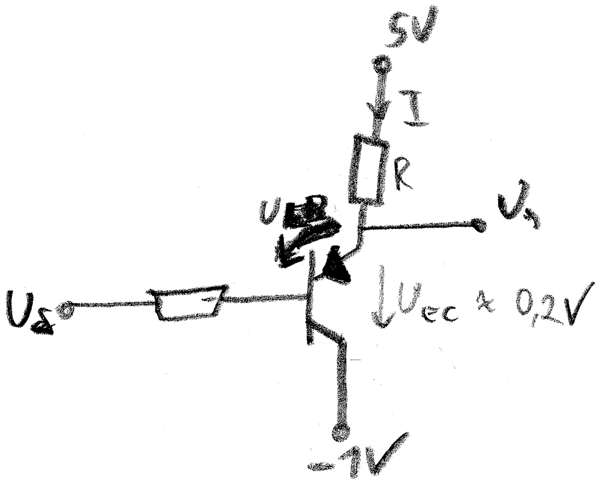
ges.: a) $R = ? = \frac{U_{ref}}{I_a + I_B}$

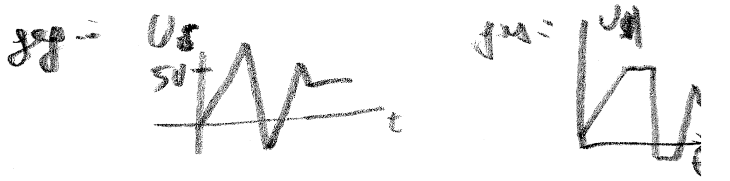
b) $P_R = ?$ $U_{ref} \cdot (I_a + I_B)$

c) $P_{Transistor} = ?$ $(\underbrace{U_{a_{max}}}_{12V} - U_{ref}) \cdot I_a + I_B \cdot U_{BE}$

d) Ändert sich I_a wenn U_{BE} von 0,6V auf 0,8V geändert wird? NEIN

e) Ändert sich $P_{Transistor}$ ——— ? JA



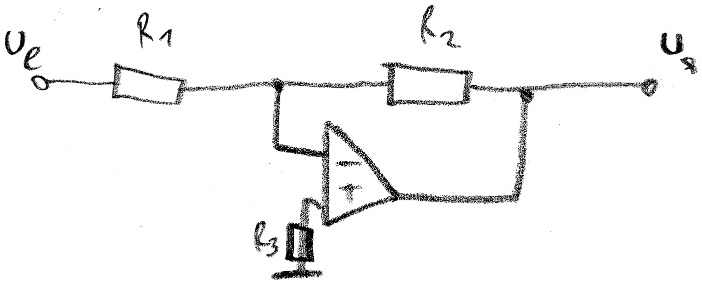


$\to \underline{U_a = U_s + U_{EB} \approx U_s + 0{,}5\,V}$

Was ist das für eine Schaltung? Emitterfolger!

Maximales U_a? 5V $\to U_a = 5V - I \cdot R$

Minimales U_a? $-0{,}8V \to U_a = 0{,}2V - 1V = -0{,}8V$



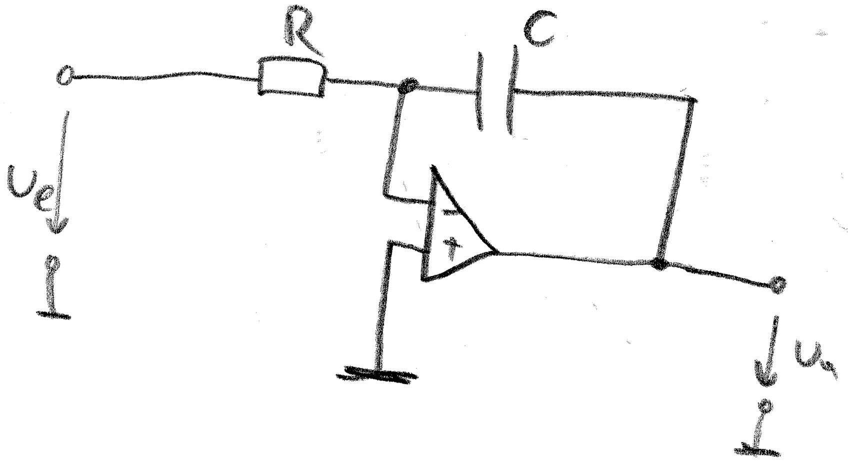
$V_r = ?$ $\quad V_g =$ endlich

$V_r = V_{r\infty} \cdot F = V_{r\infty} \cdot \frac{1}{1+\frac{1}{V_s}} = \frac{1}{1+\frac{1}{V_g \cdot \beta}} \qquad V_{r\infty} = -\frac{R_2}{R_1}$

$\beta = \frac{-U_{ed}}{U_a} = \frac{R_1}{R_1+R_2}$

$\underline{V_r = -\frac{R_2}{R_1} \cdot \frac{1}{1+\frac{R_1+R_2}{R_1 \cdot V_g}}}$

Zeichnen Sie einen Integrator der auch für kleine Frequenzen geeignet ist:



Dimensionieren auf $\frac{du_a}{dt} = \frac{10\,V}{ms}$:

$$I = C \cdot \dot{U}$$

$$I \cdot \frac{1}{C} = \frac{du_a}{dt}$$

$$\downarrow$$

$$\frac{U_e}{R} \cdot \frac{1}{C} = -\frac{du_a}{dt}$$

$$-\frac{U_e}{R \cdot C} = \frac{du_a}{dt} = \frac{10\,V}{10^{-3}\,s}$$

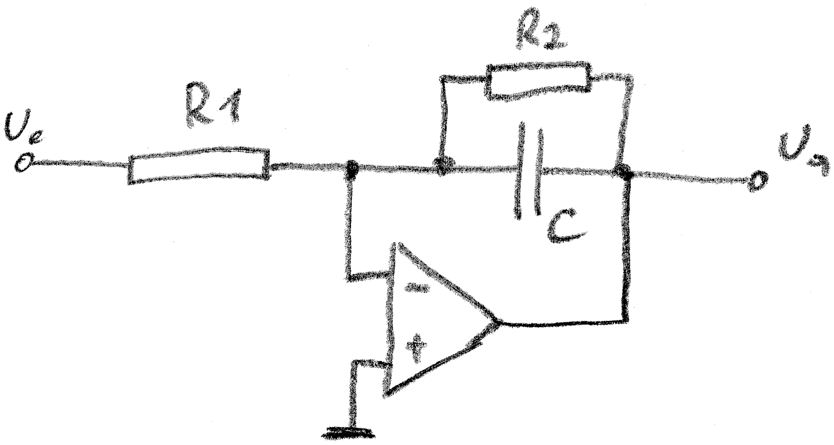
$$\underbrace{10000\,\frac{V}{s} = -\frac{U_e}{R \cdot C}}$$

wir wählen $\underline{U_e = -5\,V}$

$\underline{C = 100\,nF}$

solve(↓ , R) → $\underline{R = 5\,k\Omega}$

Zeichnen sie einen invertierenden Tiefpass mit OPV:



Dimensionieren auf $V_g = \dfrac{-10}{1 + \dfrac{jf}{1\,kHz\, 2\pi}}$

$$V_g = \frac{U_a}{U_e} = -\frac{\dfrac{R_2 \cdot \dfrac{1}{j\omega C}}{R_2 + \dfrac{1}{j\omega C}}}{R_1} = -\frac{R_2 \cdot \dfrac{1}{j\omega C}}{R_1 \cdot \left(R_2 + \dfrac{1}{j\omega C}\right)} =$$

$$= -\frac{R_2 \cdot \dfrac{1}{j\omega C}}{R_1 \cdot R_2 + \dfrac{R_1}{j\omega C}} = -\frac{R_2}{\left(R_1 \cdot R_2 + \dfrac{R_1}{j\omega C}\right) \cdot j\omega C} =$$

$$= -\frac{R_2}{R_1 \cdot R_2 \cdot j\omega C + R_1} = -\frac{R_2}{R_1 + R_1 \cdot R_2 \cdot j\omega C}$$

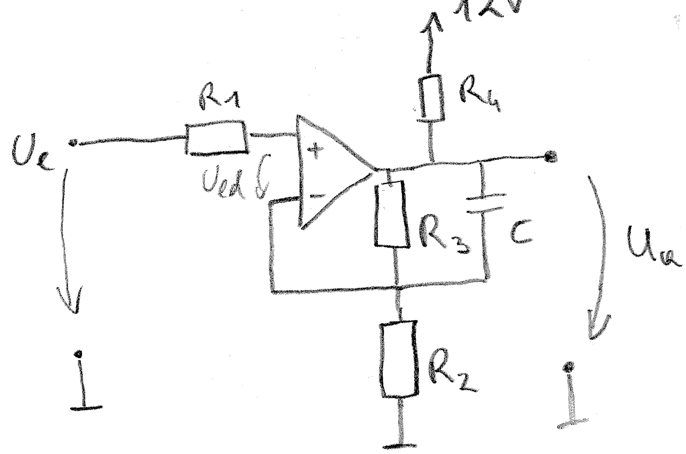
Koeffizienten-Vergleich:

$R_1 = 1\,\Omega$

$R_2 = 10\,\Omega$

$$j \cdot f \cdot 1 \cdot 10 \cdot 2\pi \cdot C = j \cdot f \cdot \frac{1}{1000 \cdot 2\pi} \rightarrow C = 2{,}533\,\mu F$$

B 6)



© AHS- Noobs 9/6/08

a.) Wie ist β definiert?

b.) β symbolisch anschreiben

c.) $V_{OPV} = 10^4$, $f_{OPV,1} = 100\,Hz$, $f_{OPV2} = 1\,MHz$

$|V_S|$ aufzeichnen

d.) OPV wie in c.)

$\varphi(V_S)$ aufzeichnen

e.) Phasenreserve einzeichnen

f.) stabil?

a.) $\beta = \frac{V_s}{V_g} = \frac{U_{ed}}{U_a}$

b.) $\beta = \frac{U_{ed}}{U_a} = \frac{R_2}{R_2 + R_3 \| \frac{1}{j\omega C}}$

$$= \frac{R_2}{R_2 + \frac{1}{\frac{1}{R_3} + j\omega C}} =$$

$$= \frac{R_2}{R_2 + \frac{R_3}{1 + j\omega C R_3}} = \frac{R_2 + j\omega C R_2 R_3}{R_2 + R_3 + j\omega C R_2 R_3} =$$

$$= \frac{R_2}{R_2+R_3} \cdot \frac{1 + j\omega C R_3}{1 + j\omega C \frac{R_2 R_3}{R_2+R_3}} =$$

$$= \frac{R_2}{R_2+R_3} \cdot \frac{1 + j\frac{f}{f_{g1}}}{1 + j\frac{f}{f_{g2}}}$$

$$f_{g1} = \frac{1}{2\pi C \cdot R_3} = 35{,}7\,Hz$$

$$f_{g2} = \frac{R_2+R_3}{2\pi C R_2 R_3} = 357\,Hz$$

$f \ll f_{g1}, f_{g2}$

$$\beta(f) = \frac{R_2}{R_2+R_3} \cdot \frac{1+0}{1+0} = \frac{R_2}{R_2+R_3}, \quad \varphi(\beta) = 0°$$

$f_{g1} \ll f \ll f_{g2}$

$$\beta(f) = \frac{R_2}{R_2+R_3}\, j\frac{f}{f_{g1}}, \quad \varphi(\beta) = 90°$$

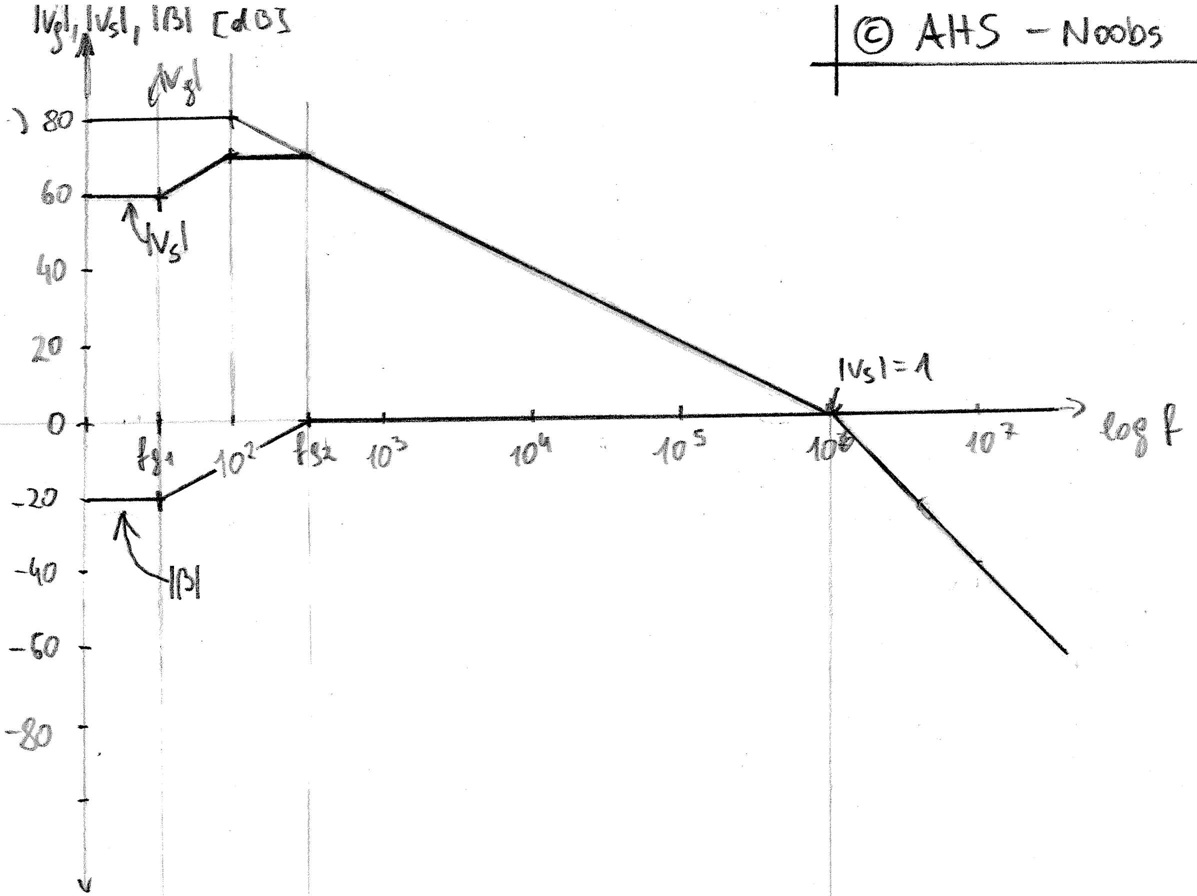
$f_{g1}, f_{g2} \ll f$

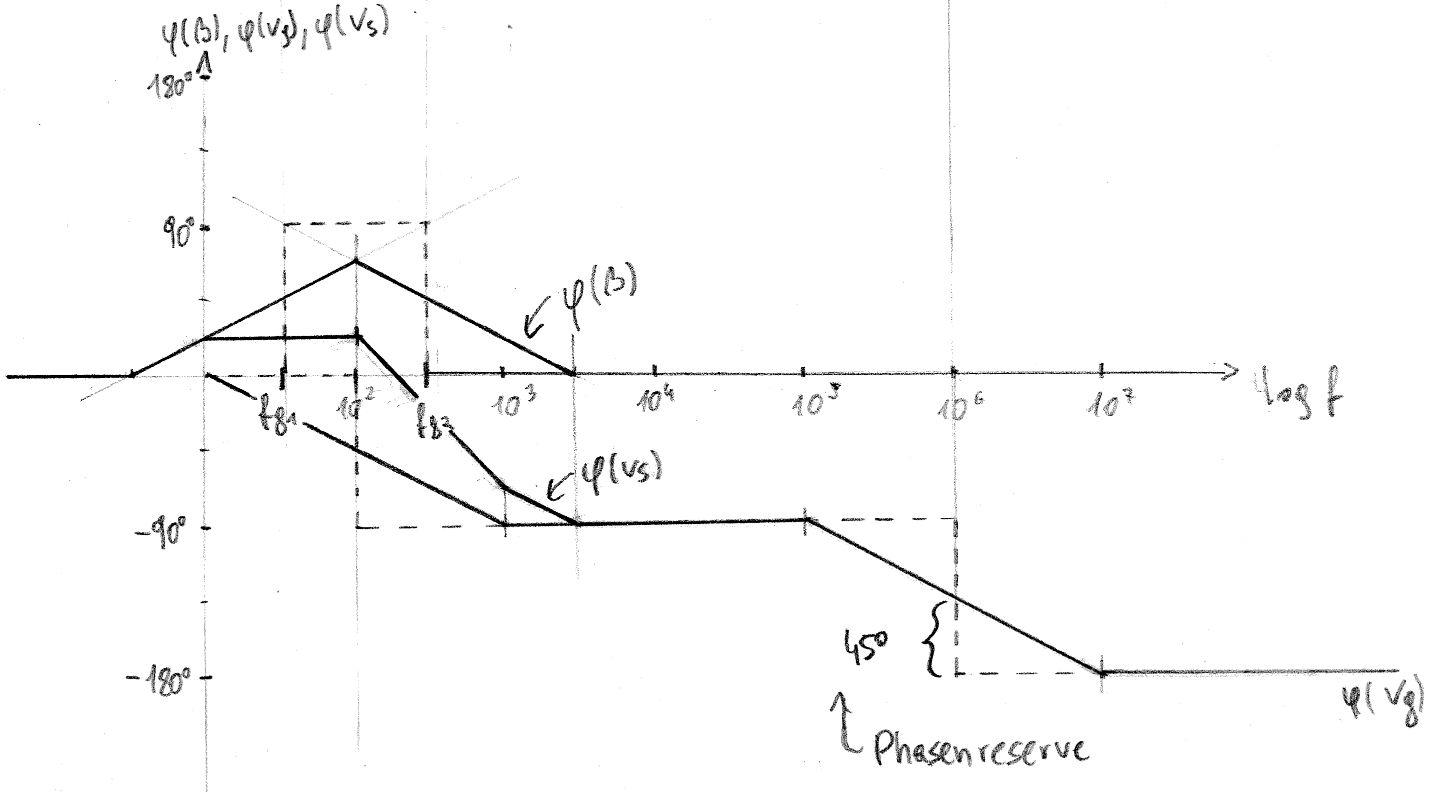
$$\beta(f) = \frac{R_2}{R_2+R_3} \cdot \frac{j\frac{1}{f_{g1}}}{j\frac{1}{f_{g2}}} = \frac{R_2}{R_2+R_3} \cdot \frac{f_{g2}}{f_{g1}}$$

$\varphi(f) = 0°$

© AHS - Noobs 9/6/08

c.) - e.)





f.) ist stabil da Phasenreserve > 0 (45°)

Have Fun - euer Dominic