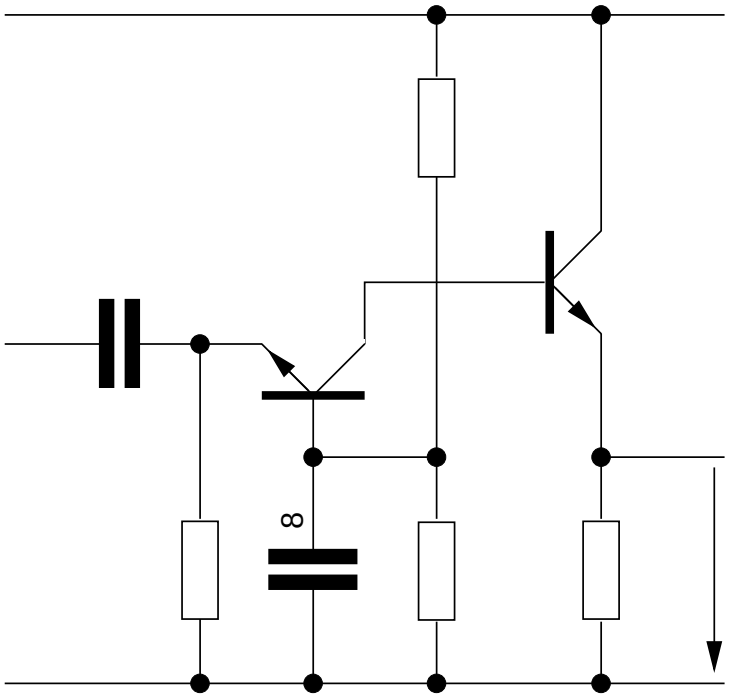
Aufgabe A)

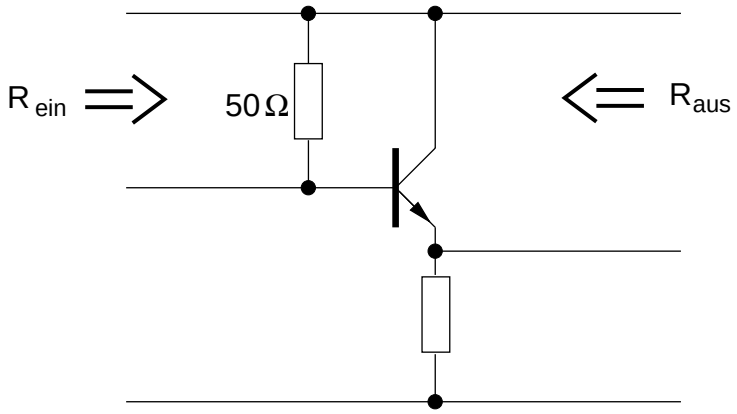
	EGS	KGS	BGS
R_{ein}	$\beta r_e + r_b$ mittel	$\beta(R_L + r_e) + r_e$ gross	$r_e + \frac{r_b}{\beta}$ klein
R_{aus}	$\frac{1}{g_0}$ gross	$\frac{R_G + r_b}{\beta} + r_e$ klein	$\gg \frac{1}{g_0}$ sehr gross

- kleiner Eingangswiderstand $\Rightarrow$ BGS
- kleiner Ausgangswiderstand $\Rightarrow$ KGS
- kleiner Ein- und Ausgangswiderstand

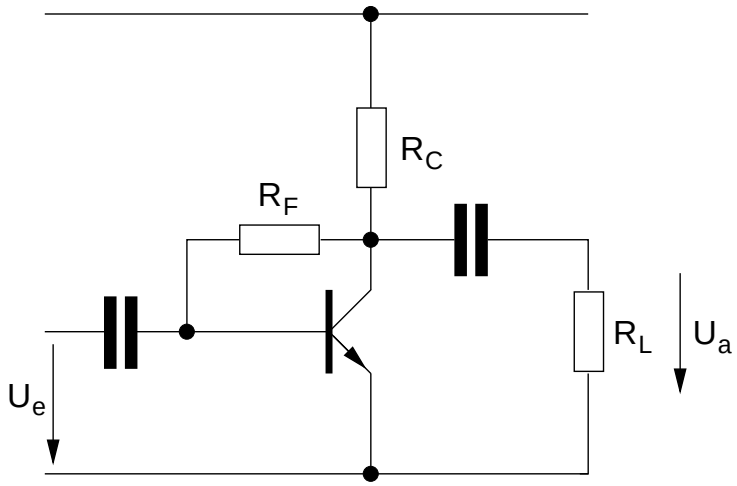
a.) Kombination von BGS + KGS, ...

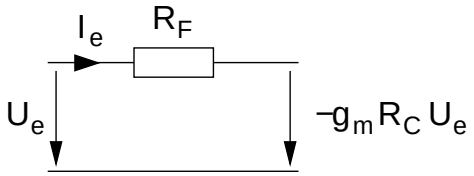


b.) ... als Schaltung mit einem Transistor ...



c.) ... oder als rückgekoppelte Schaltung:

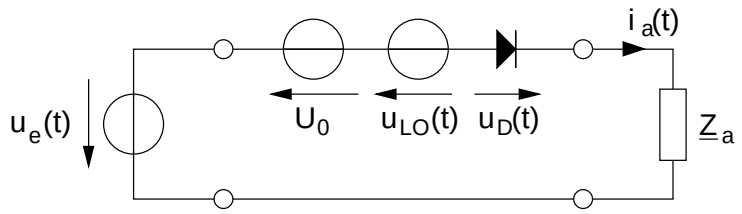




$$I_e = \frac{U_e + g_m R_C U_e}{R_F}$$

$$\Rightarrow R_{ein} = \frac{U_e}{I_e} = \frac{U_e R_F}{U_e(1 + g_m R_C)} = \frac{R_F}{1 + g_m R_C}$$

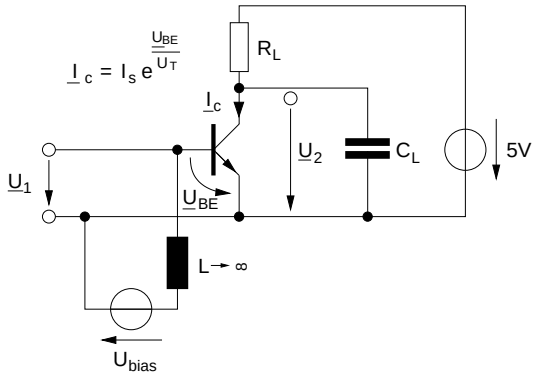
Aufgabe B)

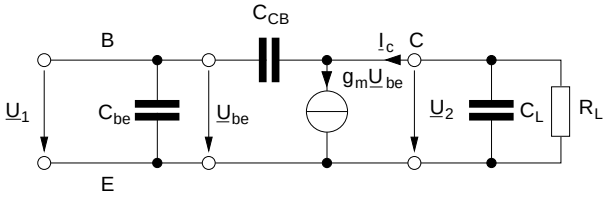


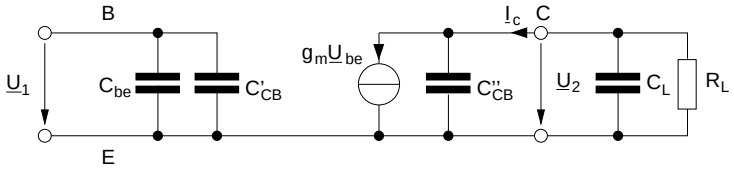
Maschenumlauf für $\underline{Z}_a = 0$:

$$
\begin{aligned}
u_D(t) &= U_0 + u_e(t) + u_{LO}(t) \\
&= U_0 + \underbrace{u \cdot \cos(\omega_u t) + v \cdot \cos(\omega_v t)}_{\Delta u} \\
i_a(t) &= i_D(t) \approx a_0 + a_1 \Delta u + a_2 \Delta u^2 + a_3 \Delta u^3 \\
&\Rightarrow \text{siehe Skript S. 87ff}
\end{aligned}
$$

Aufgabe C)
1)







$$C_L \gg C_{CB}$$

$$\Rightarrow \underline{I}_C = g_m \underline{U}_1 = -\frac{1}{\underline{Z}_L}\underline{U}_2$$

$$\Leftrightarrow \underline{V}_U = \frac{\underline{U}_2}{\underline{U}_1} = -g_m \underline{Z}_L$$

$$Z_L = R_L \parallel C_L = \frac{R_L \frac{1}{j\omega C_L}}{R_L + \frac{1}{j\omega C_L}} = \frac{R_L}{1 + j\omega C_L R_L}$$

$$\Rightarrow \underline{V}_U = -\frac{g_m R_L}{1 + j\frac{\omega}{\omega_0}}, \qquad \text{mit } \omega_0 = \frac{1}{R_L C_L}$$

2)3)

$$g_m = \frac{I_C}{U_T} = \frac{I_S e^{\frac{U_{be}}{U_T}}}{U_T}$$
$$= \frac{10^{-16}\ \text{A}\ e^{\frac{800\ \text{mV}}{26\ \text{mV}}}}{26\ \text{mV}} = 0,0887\ \text{S}$$

$$f_0 = \frac{\omega_0}{2\pi} = \frac{1}{2\pi R_L C_L}$$

$f_0(R_L = 10\ \Omega) = 160\ \text{MHz}$
$f_0(R_L = 100\ \Omega) = 16\ \text{MHz}$
$f_0(R_L = 1000\ \Omega) = 1,6\ \text{MHz}$

$|\underline{V}_{U0}(R_L = 10\ \Omega)| = 20log(g_m 10\ \Omega) = -1\ \text{dB}$
$|\underline{V}_{U0}(R_L = 100\ \Omega)| = 20log(g_m 100\ \Omega) = 18,9\ \text{dB}$
$|\underline{V}_{U0}(R_L = 1000\ \Omega)| = 20log(g_m 1000\ \Omega) = 39\ \text{dB}$