

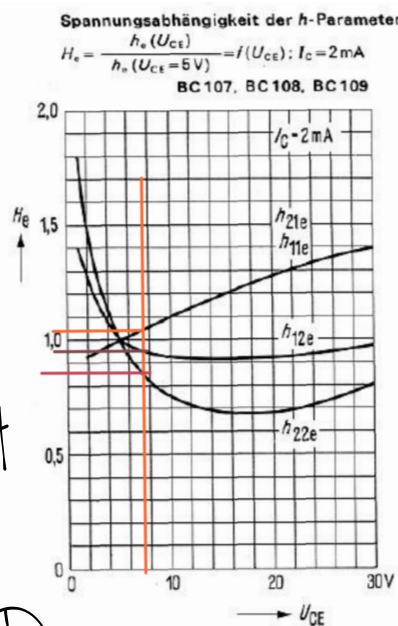
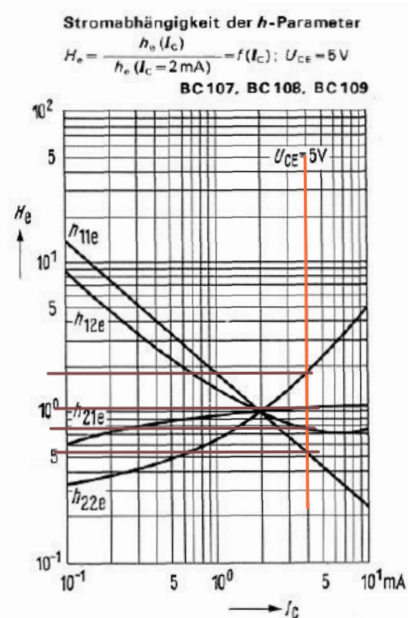
1) a) h-parameter

$$h_{11e} = 4,5 \text{ k}\Omega$$

$$h_{12e} = 2 \cdot 10^{-4}$$

$$h_{21e} = 330$$

$$h_{22e} = 30 \text{ }\mu\text{S}$$



3) Emitterwiderstand

$$U_a = (U_{r_{CE}} + U_{r_E}) \parallel U_{r_C} \parallel U_{r_L}$$

$$= \left(\frac{1}{U_{r_{CE}} + U_{r_E}} + \frac{1}{U_{r_C}} + \frac{1}{U_{r_L}} \right)^{-1}$$

$$= \left(\frac{1}{i_C r_{CE} + (i_C + i_B) r_E} + \frac{1}{i_C R_C} + \frac{1}{i_C R_L} \right)^{-1}$$

$$i_C + i_B \approx i_C \text{ da } i_C \gg i_B$$

$$= i_C \frac{1}{\frac{1}{r_{CE} + R_E} + \frac{1}{R_C} + \frac{1}{R_L}}$$

$$= \beta i_B \frac{1}{\frac{1}{r_{CE} + R_E} + \frac{1}{R_C} + \frac{1}{R_L}}$$

$$U_e = U_{r_{BE}} + U_{r_E}$$

$$= i_B r_{BE} + (i_B + i_C) r_E$$

$$i_C + i_B \approx i_C \text{ da } i_C \gg i_B$$

$$\approx i_B r_{BE} + i_C r_E$$

$$Z = i_B (r_{BE} + \beta r_E)$$

$$0 = U'_u = \frac{U_a}{U_b} = \frac{\beta i_B}{i_B (r_{BE} + \beta r_E)} \frac{1}{\frac{1}{r_{CE} + R_E} + \frac{1}{R_C} + \frac{1}{R_L}}$$

$$r_{CE} + R_E \gg R_C \vee R_L$$

$$\Rightarrow \frac{1}{r_{CE} + R_E} \ll \frac{1}{R_C} \vee \frac{1}{R_L}$$

$$\approx \frac{\beta R_C R_L}{(r_{BE} + \beta r_E)(R_C + R_L)}$$

$$\Rightarrow R_E \approx \frac{1}{\beta} \left(\frac{\beta R_C R_L}{U_u (R_C + R_L)} - r_{BE} \right) = \frac{R_C R_L}{U_u (R_C + R_L)} - \frac{r_{BE}}{\beta}$$

$$R_C = 1,9 \text{ k}\Omega \quad R_{BE} = 2,4 \text{ k}\Omega$$

$$R_L = 2,2 \text{ k}\Omega \quad \beta = 350 \quad U_u = 20$$

$$R_E \approx 44 \text{ }\Omega \quad \Rightarrow \underline{\underline{47 \text{ }\Omega}}$$

b) Anpassung zum Arbeitspunkt

$$H_{11e}^V H_{11e}^C h_{11e}(2 \text{ mA}, 5 \text{ V}) = h_{11e}(4 \text{ mA}, 7,5 \text{ V})$$

$$1,05 \cdot 0,95 \cdot 4,5 \text{ k}\Omega \approx 2,4 \text{ k}\Omega = r_{BE}$$

Ablesungsunsicherheit

$$H_{12e}^V H_{12e}^C h_{12e}$$

$$0,78 \cdot 0,95 \cdot 2 \cdot 10^{-4} \approx 1,48 \cdot 10^{-4} = D$$

$$H_{21e}^V H_{21e}^C h_{21e}(2 \text{ mA}, 5 \text{ V}) = h_{21e}$$

$$1,05 \cdot 1,01 \cdot 330 \approx 350 = \beta$$

$$H_{22e}^V H_{22e}^C h_{22e}$$

$$0,85 \cdot 1,9 \cdot 30 \text{ }\mu\text{S} = 48 \text{ }\mu\text{S} \Rightarrow r_{CE} = \frac{1}{48 \text{ }\mu\text{S}}$$

2) Kollektorwiderstand

$$U_{GA} = U_{CE}$$

$$U_{CE} = \frac{1}{2} U_B$$

$$R_C = \frac{U_B - U_{GA}}{I_{CA}} = \frac{7,5}{4 \cdot 10^{-3}} \text{ }\Omega = 1,9 \text{ k}\Omega$$

$\Rightarrow 2,2 \text{ k}\Omega$