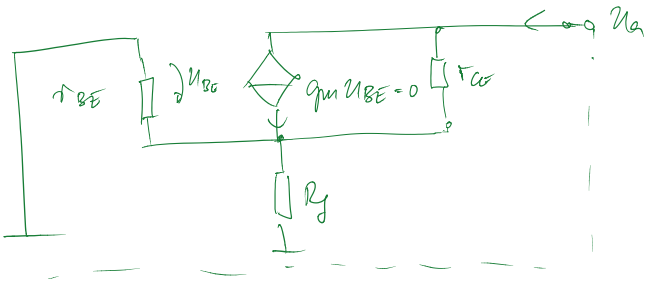

$$u_{BE} = \frac{-r_{BE} \parallel R_g}{r_{BE} \parallel R_g + r_{CE}} \cdot u_a - g_m u_{BE} \cdot r_{BE} \cdot \frac{r_{CE} \parallel R_g}{r_{CE} \parallel R_g + r_{BE}}$$

$$\frac{v_a}{u_a} = \frac{1}{u_a} \cdot \left[\frac{u_a}{r_{CE} + r_{BE} \parallel R_g} + g_m u_{BE} \cdot \frac{r_{CE}}{r_{CE} + r_{BE} \parallel R_g} \right]$$

$$= \frac{1}{u_a} \left[\frac{u_a + g_m r_{CE} u_{BE}}{r_{CE} + r_{BE} \parallel R_g} \right]$$

$$u_{BE} \left(1 + g_m r_{BE} \cdot \frac{r_{CE} \parallel R_g}{r_{CE} \parallel R_g + r_{BE}} \right) = - \frac{r_{BE} \parallel R_g}{r_{BE} \parallel R_g + r_{CE}} u_a$$

$$u_{BE} \left[\frac{r_{CE} \parallel R_g + r_{BE} + b\, r_{CE} \parallel R_g}{r_{CE} \parallel R_g + r_{be}} \right] = - \frac{r_{BE} \parallel R_g}{r_{BE} \parallel R_g + r_{CE}} u_a$$

$$u_{BE} = - \frac{r_{BE} \parallel R_g \left(r_{CE} \parallel R_g + r_{bE} \right)}{\left(r_{BE} \parallel R_g + r_{CE} \right) \left(r_{CE} \parallel R_g (b+1) + r_{bE} \right)} u_a$$

$$\Rightarrow \quad g_a = \frac{1 - g_m r_{CE} \frac{r_{BE} \parallel R_g \left(r_{CE} \parallel R_g + r_{BE} \right)}{\left(r_{BE} \parallel R_g + r_{CE} \right) \left(r_{CE} \parallel R_g (b+1) + r_{bE} \right)}}{r_{CE} + r_{BE} \parallel R_g}$$

$b \gg 1 \gg r_{BE}$

$\Rightarrow r_{CE}$

$$g_a \approx \frac{1 - g_m r_{CE} \frac{r_{BE} \parallel R_g \left(r_{CE} \parallel R_g + r_{BE} \right)}{\left(r_{BE} \parallel R_g + r_{CE} \right) \left(r_{CE} \parallel R_g \cdot b + r_{BE} \right)}}{r_{CE}}$$

$r_{CE} \gg R_g, \ldots$

mit

$$\frac{r_{BE} \parallel R_g \left(R_g + r_{BE} \right)}{r_{CE} \left(R_g \cdot b + r_{BE} \right)} \cdot g_m r_{CE}$$

$$= \frac{r_{BE} \cdot R_g}{r_{BE} + R_g \cdot b} \cdot g_m$$

$$= \frac{1}{1 + \frac{1}{R_g g_m}}$$

$$r_a = r_{CE} \left[\frac{1}{1 - \frac{1}{1 + \frac{1}{R_g g_m}}} \right]$$

$$= r_{CE} \left[\frac{1}{1 - \frac{R_g g_m}{R_g g_m + 1}} \right]$$

$$= r_{CE} \left[\frac{R_g g_m + 1}{R_g g_m + 1 - R_g g_m} \right]$$

$$= r_{CE}\left[1 + R_g g_m\right] \quad \text{mit} \quad g_m = \frac{I_{C,A}}{U_T}$$

$$= r_{CE}\left[1 + \frac{U_{Rg}}{U_T}\right]$$