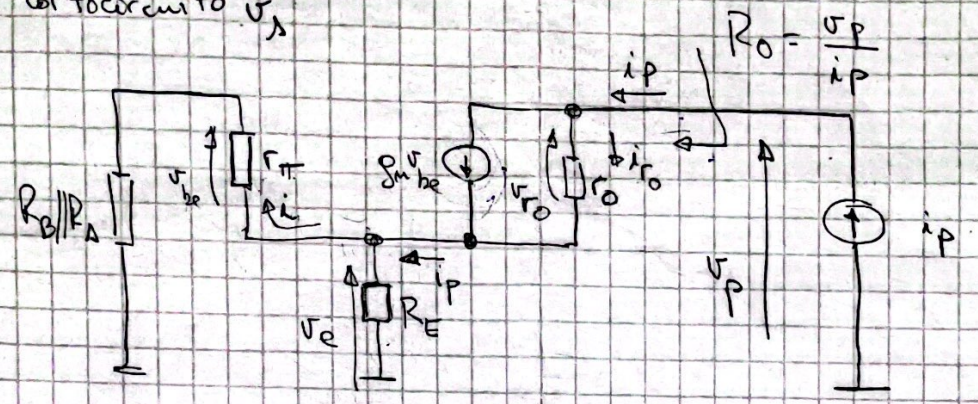
CÁLCULO R_O con realimentación en emisor.

Cortocircuito v_s

$$R_O = \frac{v_p}{i_p}$$



$$v_e = i_p \cdot \left[R_E \| (r_\pi + R_B \| R_A) \right]$$

$$v_{be} = \frac{-v_e}{r_\pi + R_B \| R_A} \cdot r_\pi = -i_p \cdot \frac{\left[R_E \| (r_\pi + R_B \| R_A) \right]}{(r_\pi + R_B \| R_A)} \cdot r_\pi$$

$$i_{r_O} = i_p - g_m v_{be}$$

$$v_p = v_e + v_{r_O} =$$

$$= i_p \left[R_E \| (r_\pi + R_B \| R_A) \right] + i_p r_O + g_m \frac{\left[R_E \| (r_\pi + R_B \| R_A) \right]}{(r_\pi + R_B \| R_A)} \cdot r_\pi \cdot i_p \cdot r_O$$

$$v_p = i_p \left[\left(R_E \| (r_\pi + R_B \| R_A) \right) + r_O + g_m r_\pi \frac{\left[R_E \| (r_\pi + R_B \| R_A) \right]}{(r_\pi + R_B \| R_A)} \cdot r_O \right]$$

$$R_O = \frac{v_p}{i_p} = R_E \| (r_\pi + R_B \| R_A) + r_O \left(1 + \frac{g_m r_\pi \left[R_E \| (r_\pi + R_B \| R_A) \right]}{(r_\pi + R_B \| R_A)} \right)$$

si $R_B \| R_A \ll r_\pi$

$$R_O = (R_E \| r_\pi) + r_O \left[\left(1 + g_m \cancel{r_\pi} \frac{(R_E \| r_\pi)}{\cancel{r_\pi}} \right) \right]$$

$$R_o = (R_E \| r_\pi) + r_o\left(1 + g_m(R_E \| r_\pi)\right)$$

$$R_o \simeq r_o\left(1 + g_m(R_E \| r_\pi)\right)$$

$$\frac{R_E \cdot r_\pi}{R_E + r_\pi} = R_E \| r_\pi = R_E \frac{\beta_o}{g_m} \Big/ R_E + \frac{\beta}{g_m} =$$

$$= \frac{\frac{R_E \beta_o}{g_m}}{\frac{g_m R_E + \beta}{g_m}} = \frac{\beta_o R_E}{\beta_o + g_m R_E}$$

$$g_m(R_E \| r_\pi) = g_m \frac{\beta_o R_E}{\beta_o + g_m R_E} \qquad \text{se } g_m R_E \ll \beta_o$$

$$\simeq g_m R_E$$

$$R_o \simeq r_o\left(1 + g_m R_E\right)$$

$$\frac{\Delta v_{ce}}{\Delta i_b \cdot \beta} = r_o \qquad \frac{\Delta v_{ce}}{\Delta i_c} = r_o$$

$$\frac{\Delta i_c}{\Delta i_b} = r_o \cdot \beta$$