Useful Inspection Formulas

The General Case (Midband)

\[ R_b = (r_x + R_E)(\beta + 1) = r_x + (\beta + 1)R_E \]
\[ R_e = \frac{r_x + R_E}{\beta + 1} = \frac{1}{g_m} \frac{R_E}{\beta + 1} \]
\[ R_c = r_o \left[ 1 + \frac{g_m R_E}{1 + (R_E/r_o)} \right] \]

Base-to-Collector Gain:

\[ \frac{v_c}{v_b} = -G_m R_C \quad G_m = \frac{g_m}{1 + g_m R_E} \]

Emitter-to-Collector Gain:

\[ \frac{v_c}{v_e} = -G_m R_E \quad G_m = \frac{r_n}{r_x + R_E} g_m \]

Base-to-Emitter Gain:

\[ \frac{v_b}{v_e} = \frac{R_E}{R_E + r_c + r_e} \]

High Frequency Analysis

\[ \omega_H = \frac{1}{\tau_{\mu} + \tau_{\pi} + \tau_{\mu_0} + \tau_{\pi_0}} \]
\[ \tau_{\mu} = C_{\pi} R_C \quad \tau_{\pi} = C_{\mu} R_E \]
\[ \tau_{\mu_0} = C_{\pi_0} R_C \quad \tau_{\pi_0} = C_{\mu_0} R_E \]

\[ R_{x0} = \frac{R_B + R_E}{1 + g_m R_E} \]
\[ R_{\mu_0} = R_B + C_m R_E \]