Open Circuit Time Constant Calculations
6.301 — Spring 2002
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$C_\pi$ : Thevenin resistance from base to emitter:

$$R_{thbe} = r_\pi || \frac{R_E + R_B}{1 + g_m R_E / (1 + R_C / r_o)}$$

$C_\mu$ : Thevenin resistance from collector to base:

$$R_{thcb} = (R_{thb} || R_B) + \left(1 + \frac{\beta_o}{1 + R_{thb} / R_B}\right) R_C$$

where:

$$R_{thb} = r_\pi + (\beta_o + 1) R_E$$
Thevenin resistance from gate to source:

\[
R_{thgs} = \frac{R_S(1 + R_D/r_\circ) + R_G(1 + (g_{mb} + 1/r_\circ)R_S + R_D/r_\circ)}{1 + (g_m + g_{mb})R_S + (R_S + R_D)/r_\circ}
\]

Thevenin resistance from gate to drain:

\[
R_{thgd} = (R_D + R_G)(1 - \alpha/r_\circ) + \alpha g_m R_G, \quad \text{where } \alpha = r_\circ || \frac{R_D}{1 + (g_m + g_{mb})R_S}
\]