Lecture 28: Inspection Analysis & Miller Effect

• Announcements:
  • HW#9 online and due Friday via Gradescope
  • Extend Lab#5 due date by one week
    ◦ Now due Tuesday, Nov. 6, 5 p.m.
  • Hopefully, you watched Monday’s video lecture

• Lecture Topics:
  ◦ Intro. to Inspection Analysis
  ◦ C.E. Design Project Hints
  ◦ Other Amplifier Configurations
  ◦ Generally-Loaded Transistor

• Last Time:
  • Started introduction to inspection analysis
  • Now continue with this …
2nd Stage:

\[
\frac{V_D}{V_D} = \frac{V_D}{V_D} = \frac{-(g_m(R_C)R_E)}{R_C} = \frac{V_D}{V_D}
\]

from monop.

\[
R_{in}R_{out} = R_C R_E
\]

\[
\frac{V_D}{V_D} = \frac{R_C R_E}{V_D + R_C R_E}
\]

High-frequency response:

Not shielded! In feedback!

\[
C_{out} = \text{junction capacitance}
\]

\[
R_{in} = \text{shunted (easy)}
\]

\[
R_{out} = \text{shunted (easy)}
\]

Output swing:

\[
V_C = \text{set by } V_R
\]

\[
V_E = V_T - V_{BEQ}
\]

Gain:

\[
\frac{V_C}{V_T} = \frac{V_E}{V_T}
\]

Won't work: \( V_C \uparrow \rightarrow V_{CEQ} \rightarrow V_C \uparrow \rightarrow \text{isolation gain} \)

\[
\frac{V_C}{V_T} = \frac{V_E}{V_T}
\]

Gain:

\[
\frac{V_C}{V_T} = \frac{V_E}{V_T}
\]

\[
0.2V = V_{CEQ} \text{ (cut)}
\]

Nonlinear clipping.
The Miller Effect

- Useful to transform a circuit with feedback into a simpler circuit without feedback.

**Formal Derivation:**

\[
\begin{align*}
    i_1 & = \frac{Y(N_1 - N_2)}{N_1} = Y(N_1 - N_2) \\
    i_2 & = \frac{Y(N_1 - N_2)}{N_2} = Y(N_1 - N_2)
\end{align*}
\]

\(Y_1 = Y(1 - k)\)

**Find \(i_2\):** (equate for both circuits)

\(i_2 = Y(N_1 - N_2)\)

\(i_2 = Y(N_1 - N_2)\)

\(\Rightarrow\) no longer have \(R_B\) \(\Rightarrow\) easy...

\(C_m \cdot \frac{1}{1 - k} = C_m\)

**C.E. Inspection Analysis for HF Using the Miller Effect**

- **Gain:** \(g_m \cdot R_L\)

- **Miller X-form:**

- **Total:**

- All terms from previous analysis captured here!

(Same answer... no need to deal w FB)