Lecture 35

• Last time:
  – More examples of cascades
  – DC coupling issues
• Today:
  – Cascode amplifiers
  – Totem pole voltage supplies
  – Start: multistage amplifier design examples

Alternative CG-CC Cascade
Use a PMOS CD Stage: DC level shifts upward
CG Cascade: DC Biasing

Two stages can have different supply currents

Extreme case:
\[ I_{\text{bias}} = 0 \text{ A} \]
CG Cascade: Sharing a Supply

First stage has no current supply of its own. Its output resistance is modified.

Two-Port Model of Common-Gate Cascade with Shared Current Supply

\[ \frac{1}{g_{m2}} \]
The Cascode Configuration

Common source/common gate cascade is one version of a cascode (all have shared supplies)

DC bias: select $V_{ bee}$

Two-port model: first stage has no current supply of its own

$V_{bias} = V_{be}$

$V_{in} = \frac{V_{dc}}{2}$, $(V_{bias} - V_{be})$

$2 \times 2$
Cascode Two-Port Model

Output resistance of first stage $R_{\text{out}} = R_{\text{down,cs}} = R_{\text{out}}$

Why is the cascode such an important configuration?

\[ R_{\text{out}} = \frac{1}{\frac{1}{R_{\text{down,cs}}} + \frac{1}{R_{\text{out}}}} \]

Fini = \infty

Fin = \text{Gain} = \frac{g_m}{g_m + \text{gm} + \text{gm}}