Lecture 34

• Last time:
  – Improved current sources and current mirrors
  – Start multistage amplifiers

• Today:
  – More examples of cascades
  – DC coupling issues

Multistage Current Buffers

Are two cascaded common-base stages better than one?

\[ R_{\text{in}} = R_{\text{in1}} \]
Two-Port Models

\[ R_{out} = R_{out2} \cong r_{02} \left( 1 + g_{m2} r_{g2} \parallel R_{S2} \right) \parallel r_{oc2} \]

Common-Gate 2\textsuperscript{nd} Stage

\[ R_{out} = R_{out2} \cong r_{02} \left( 1 + g_{m2} R_{S2} \right) \parallel r_{oc2} \]
Summary of Cascaded Amplifiers

*General goals:*

1. Boost the gain parameter (except for buffers)
2. Optimize the input and output resistances

\[ R_{in} \quad R_{out} \]

Voltage:
Current:
Transconductance:
Transresistance:

Second Design Issue: DC Coupling

*Constraint:* large inductors and capacitors are not available

Output of one stage is directly connected to the input of the next stage \(\rightarrow\) must consider DC levels \(\ldots\) why?
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: $I_{BIAS2} = 0$ A
CG Cascade: Sharing a Supply

First stage has no current supply of its own \(\rightarrow\) its output resistance is modified.

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

\[ CG_1^* \quad CG_2 \]