Design Example

• What are the specs?
  • And where do they come from?

• Example: 50MS/s, ~11-bit ADC
  • Accuracy:
  • Settling time:
  • Dynamic range:
  • Closed-loop gain:
  • Power:
Design Procedure

Design Procedure Cont’d
Finding $C_L$

Settling
Device Sizing

Settling?
Slewing

Problem with Common-Mode

- What if $I_L < \frac{I_{tail}}{2}$?
  - Will capacitive feedback solve this?

- Typical solution: Common-mode feedback
  - Sense CM at output
  - Adjust some knob to alter CM
Common-Mode Sensing

- Simplest CM sensor: pair of resistors

- Resistors load the OTA (reduce gain)
  - If make R large, get slow $V_{cm}$ tracking
  - Is this a problem?

Sensing Scheme #2

- Isolated CM sensing
  - Works reasonably well
  - But hard to use with wide swing amplifier output
Capacitive Sensing

- Capacitive sensing avoids DC loading
  - (still creates AC load though)
- Needs to be reset to remove initial offset
  - Just like capacitive feedback

Adjusting Common-Mode

- Really only two knobs:
  - Knob A: adjust load current
  - Knob B: adjust tail current
Example Common-Mode Feedback

- Secondary amplifier enforces $V_{cm} = V_{cm\_ref}$
- Place dominant pole at $V_{bp}$, or $V_{cm}$?

CMRR Fix

- What if two PMOS transistors aren’t perfectly matched?
Capacitive CMFB

- How to choose $C_{cm}$?
  - “Small”: CM loop gain low
  - “Large”: Loading on diff. output high
“Continuous” CMFB