Problem with Common-Mode Feedback

- What if $I_L < I_{tail}/2$?
  - 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

Initialization
“Continuous” CMFB