Lecture 22: Sense Circuit Non-Ideality & Integration

- Announcements:
- Modules 16 online
- HW#6 online and due this coming Friday morning
- Project slide #3 due Friday, May 1
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- Reading: Senturia Chpt. 14, 15
- Lecture Topics:
  - Ideal Op Amps
  - Op Amp Non-Idealities
  - MEMS-Transistor Integration
    - Mixed
    - MEMS-First
    - MEMS-Last
  - Op Amp Non-Idealities (cont.)
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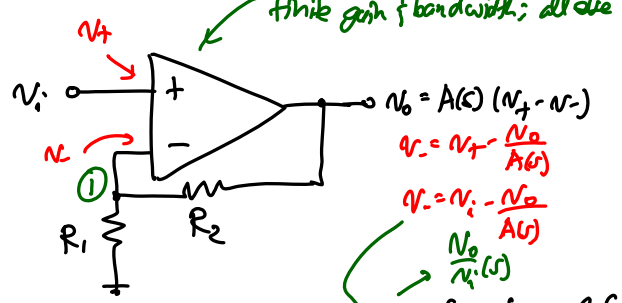
- Last Time:
- Discussed sensing circuits; ended up in Module 15
- Interrupt this a bit and go to Module 16 on Sense Circuit Non-Ideality & Integration

Effect of Finite Gain & BW

Example: Non Inverting Amplifier



Find an expression for gain as a function of frequency.

KCL①: $\frac{V_o - V_-}{R_2} = \frac{V_-}{R_1} \rightarrow \frac{V_o}{R_2} = V_-\left(\frac{1}{R_1} + \frac{1}{R_2}\right)$

$\frac{V_o}{R_2} = \left(V_i - \frac{V_o}{A(s)}\right)\left(\frac{1}{R_1} + \frac{1}{R_2}\right) \rightarrow \frac{V_o}{V_i}(s) = \frac{1 + \frac{R_2}{R_1}}{1 + \frac{1}{A(s)}\left(1 + \frac{R_2}{R_1}\right)}$

$\left[A(s) = \frac{A_0}{1 + \frac{s}{\omega_b}}\right] \Rightarrow \frac{V_o}{V_i}(s) = \left(1 + \frac{R_2}{R_1}\right)\frac{1}{1 + \frac{s}{A_0\omega_b\left(\frac{R_1}{R_1+R_2}\right)}}$ ($j\omega$)

Gain Term; Freq. Shaping Term

New $\omega_{-3dB} = A_0\omega_b\left(\frac{R_1}{R_1+R_2}\right) > \omega_b$

New Gain: $\left(1 + \frac{R_2}{R_1}\right) < A_0$

In fact, $A_0\omega_b$ = constant