Lecture 23: Sensing Circuits II & Integration

- Announcements:
- Project Slide Set #3 due Friday, April 24
- HW#6 online and due Friday, 5/1, at 8 a.m.
- Module 14 on "Sensing Circuits" online
- Module 16 on "Sensing Circuit Non-Idealities & Integration" online
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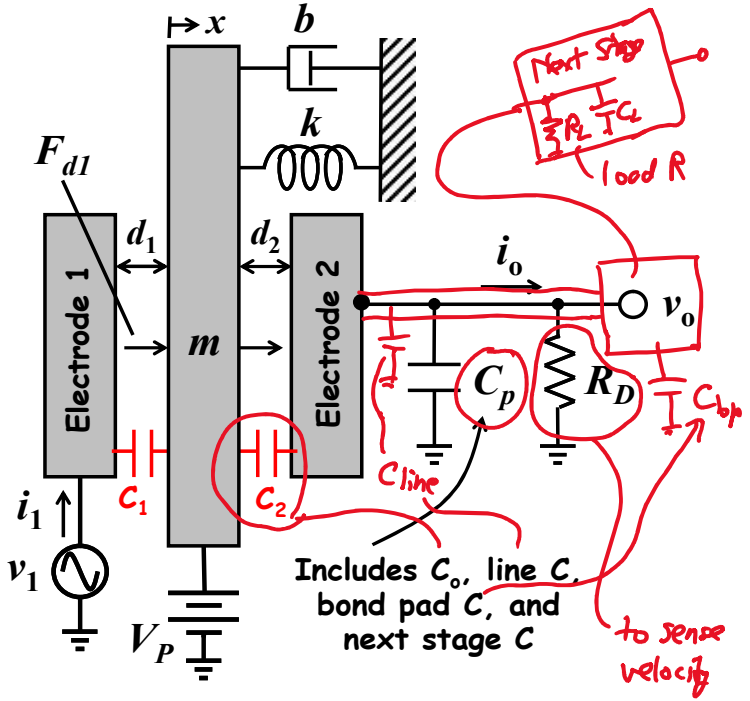
- Reading: Senturia, Chpt. 14
- Lecture Topics:
  - Detection Circuits
    - —Velocity Sensing
    - —Position Sensing
- Reading: Senturia Chpt. 14, 15
- Lecture Topics:
  - Ideal Op Amps
  - Op Amp Non-Idealities
  - MEMS-Transistor Integration
    - —Mixed
    - —MEMS-First
    - —MEMS-Last
- ----------
- Last Time:
- Working through velocity sensing
- Now, continue with this …

1

↳* The Problem is actually much bigger!



Now, we get:

$$\frac{N_o}{N_i}(s) \sim \frac{R_D \| R_L}{R_x + R_D \| R_L} \cdot \frac{1}{1 + \frac{s}{\omega_p}} \cdot H(s, \omega_o', Q')$$

$$\omega_p = \frac{1}{(R_x \| R_D \| R_L) C_p}$$

↑ from mechanical device

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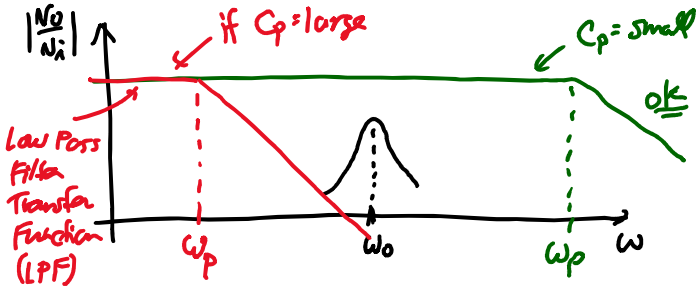
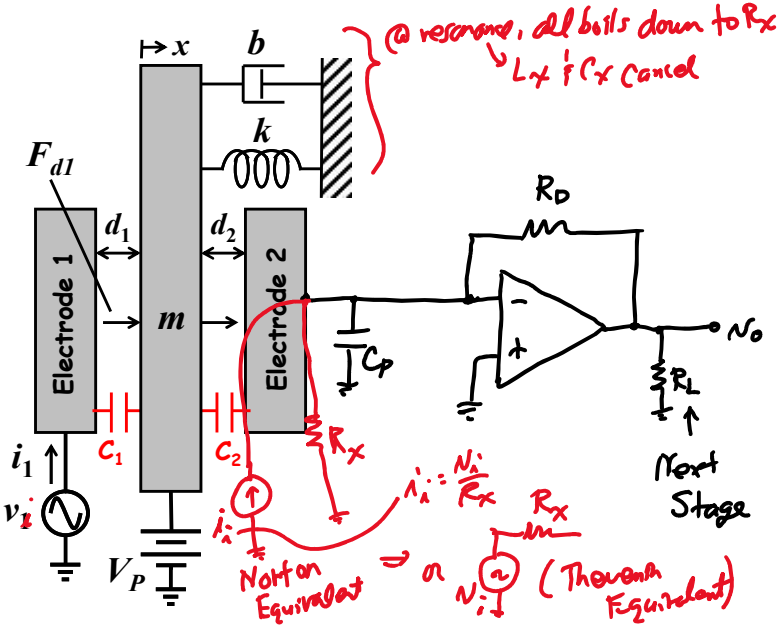


Problems w/ Purely Resistive Detection

1. Need large R_D for large gain... but...
2. $R_D \uparrow \rightarrow Q \downarrow$
3. $R_D \uparrow \rightarrow \frac{1}{R_D C_p} \downarrow \rightarrow$ get undesirable LPF cut-off freq.
4. Load $R_L \rightarrow$ affects gain! $\rightarrow$ lose control of gain!



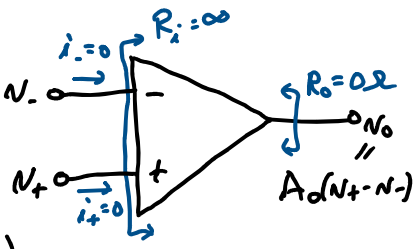
3

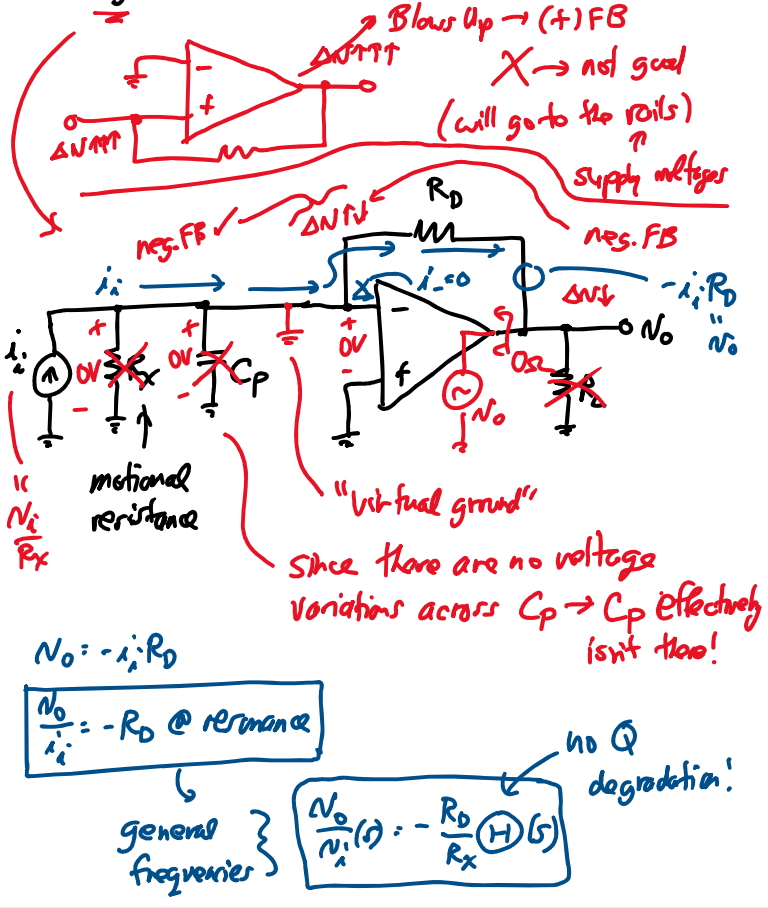
Ideal Op Amp Laws:

1. $R_i = \infty \rightarrow i_- = i_+ = 0$
2. $R_o = 0$
3. Gain $= A_o = \infty$

N_o = finite $= A_o(N_+ - N_-)$

need neg. FB $\rightarrow$ $= \infty(N_+ - N_-) \rightarrow N_+ = N_-$ ($N_+ - N_- = 0$)





4