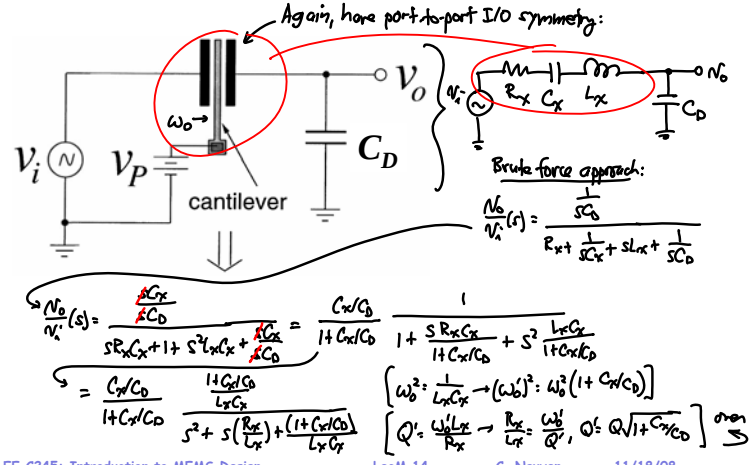
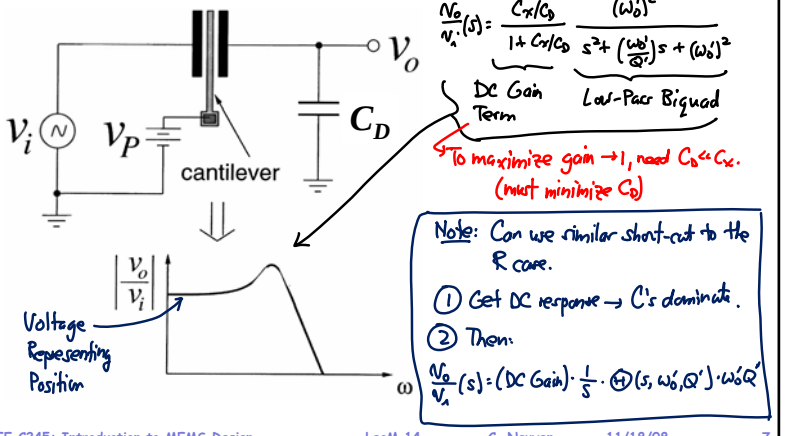
Position-to-Voltage Conversion

- To sense position (i.e., displacement), use a capacitive load



Position-to-Voltage Conversion

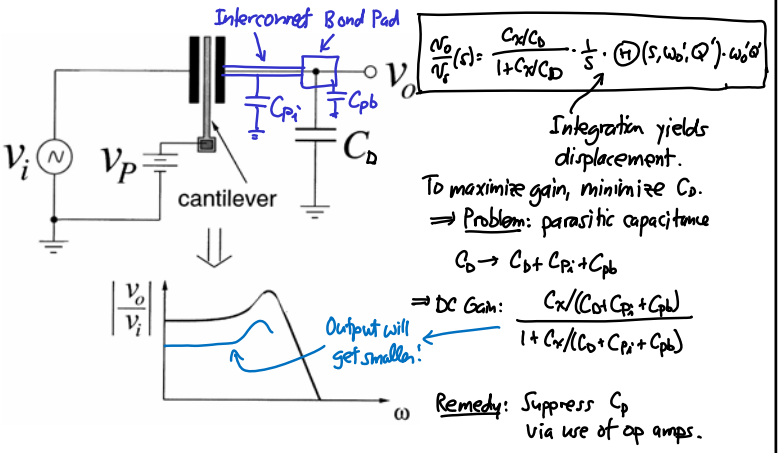
- To sense position (i.e., displacement), use a capacitive load



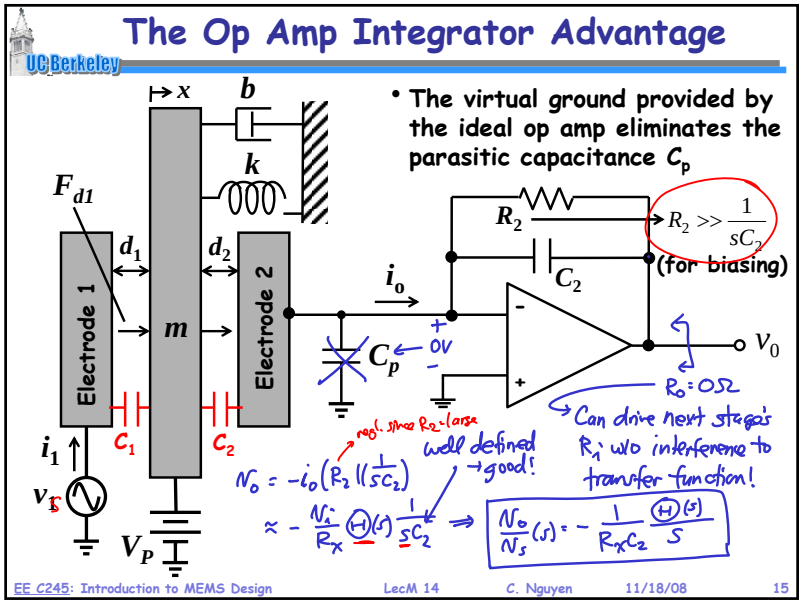
Position Sensing Circuits

Problems With Pure-C Position Sensing

- To sense position (i.e., displacement), use a capacitive load



The Op Amp Integrator Advantage

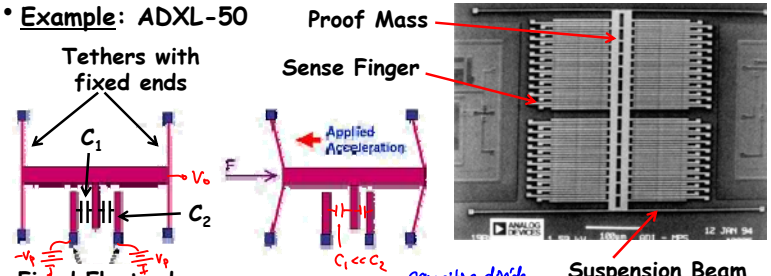


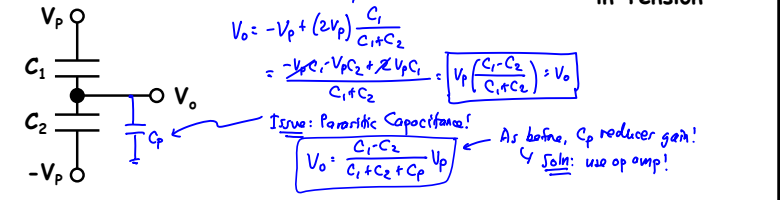
- The virtual ground provided by the ideal op amp eliminates the parasitic capacitance C_p

Differential Position Sensing

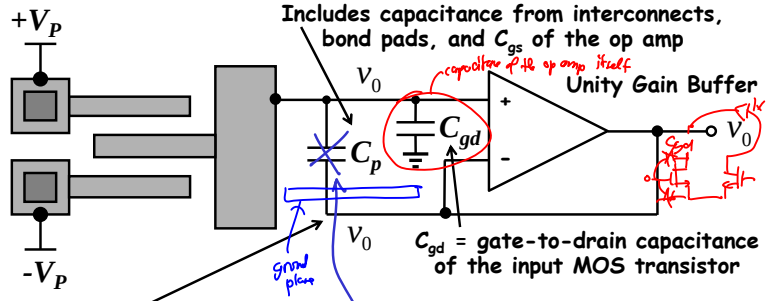
Differential Position Sensing

- Example: ADXL-50

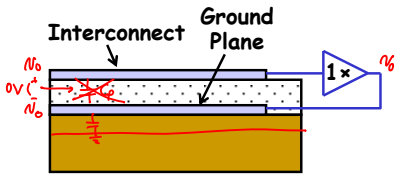




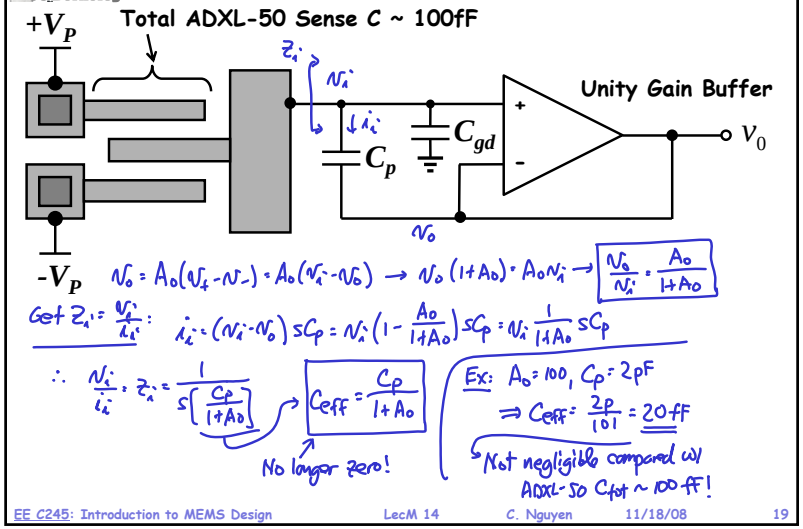
Buffer-Bootstrapped Position Sensing



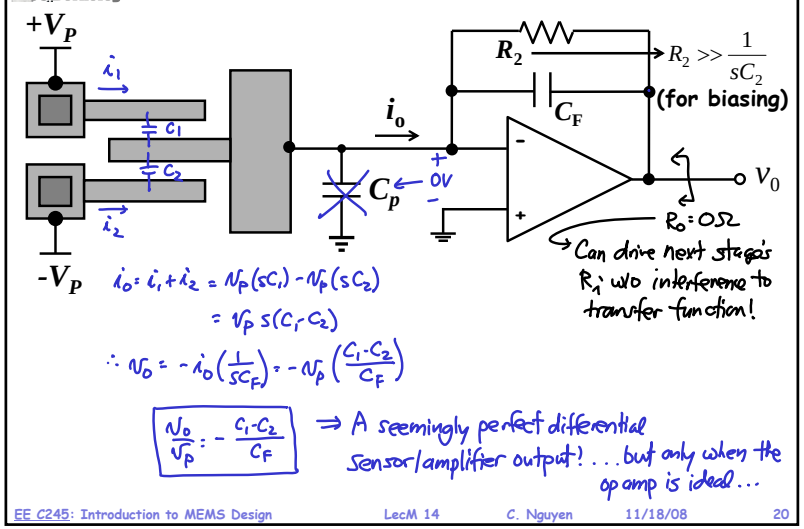
- Bootstrap the ground lines around the interconnect and bond pads
  - ↳ No voltage across C_p
  - ↳ It's effectively not there!



Effect of Finite Op Amp Gain



Integrator-Based Diff. Position Sensing



$i_o = i_1 + i_2 = V_p(sC_1) - V_p(sC_2)$

$= V_p s(C_1 - C_2)$

$\therefore V_o = -i_o\left(\frac{1}{sC_F}\right) = -V_p\left(\frac{C_1 - C_2}{C_F}\right)$

$\frac{V_o}{V_p} = -\frac{C_1 - C_2}{C_F}$ ⇒ A seemingly perfect differential sensor/amplifier output! . . . but only when the op amp is ideal . . .