Lecture 1: Admin & Overview

- Announcements:
  - EE 140: Analog Integrated Circuits
  - Instructor: Prof. Clark T.-C. Nguyen
  - Webcast: wireless mic
  - Office Hour Changes?:
    - No changes requested
    - For the course website, just google ee140
      - The website should be up and running in a couple of days
    - I will be traveling this coming Thursday and next week on Tuesday
      - TA’s will lecture on these days; it’s review material
      - I will be out of town, so will not be able to hold office hours thru Wednesday, next week
  - Discussion sections start next week
  - Lecture Topics:
    - Review
      - Ideal Op Amps
      - Non-Ideal Op Amps
    - Op Amp Examples
    - Go through
      - Course information sheet
      - Syllabus
      - Grading Information and Policy
    - Class account sheets handed out in class

Review of Op Amps

Ideal Op Amps:

\[ V_+ = V_- \]

Properties of Ideal Op Amps:

1. \( R_o = 0 \) — can drive any load with no problems
2. Infinite freq. response
3. \( A = \infty \) \( \Rightarrow V_+ = V_- \), assuming that
4. \( R_x = \infty \) \( \Rightarrow i_+ = i_- = 0 \)

No FB must

\( V_o \) finite
① Verify that we have no FB.

For FB example.

② \[ V_o = V_i \Delta T \rightarrow V_i = R_1 \Delta T \]

③ \[ i_2 = 0 \quad \therefore i_1 = i_2 \]

\[ i_1 = \frac{V_o - 0}{R_1} = \frac{V_i}{R_1} \]

\[ V_o = 0 - 1 \times i_2 R_2 = -i_1 R_2 \]

\[ V_o = -\left(\frac{V_i}{R_1}\right) R_2 = -\frac{R_2}{R_1} N_i \]

\[ \therefore \frac{V_o}{N_i} = \frac{-R_2}{R_1} \]
Non-Ideal Op Amps:
- Actual op amps, of course, are not ideal; rather, they ...
  - Have finite gain, $A_o$
  - Have finite bandwidth, $BW$
  - Have finite input resistance, $R_i$
  - Have finite input capacitance, $C_i$
  - Have finite output resistance, $R_o$
  - Generates noise
  - Have input bias currents (because $R_i$ is not infinite)
  - Have input offset currents and voltages
  - Have finite slew rate
  - Have finite output swing
- All of the above can be temperature dependent!
- A major objective of this class is understand what gives rise to the above non-idealities and to teach design strategies to get around them

- Then look at op amp usage examples using prepared pages