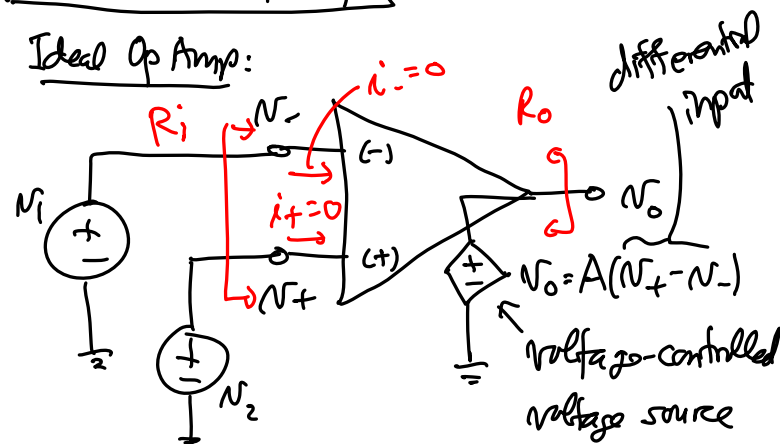


Lecture 1w: Admin & OverviewLecture 1: Admin & Overview

- Announcements:
- EE 140: Analog Integrated Circuits
- Instructor: Prof. Clark T.-C. Nguyen
- Webcast: wireless mic
- [http://webcast.berkeley.edu/course\\_details\\_new.php?seriesid=2011-B-25461&semesterid=2011-B](http://webcast.berkeley.edu/course_details_new.php?seriesid=2011-B-25461&semesterid=2011-B)
- 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 though
  - ↳ Course information sheet
  - ↳ Syllabus
  - ↳ Grading Information and Policy
- Class account sheets handed out in class

Review of Op AmpsIdeal Op Amp:Properties of Ideal Op Amps

- ①  $R_o = 0 \rightarrow$  can drive any load w/ no problems
  - ② Infinite freq. response
  - ③  $A = \infty \rightarrow N_+ = N_-$ , assuming that  $N_0$  is finite.
  - ④  $R_i = \infty \rightarrow i_+ = i_- = 0$
- ↑  
neg. FB must insure this!

**Inverting Amplifier**

① Verify that we have neg. FB. ✓

Pos. FB Example.

(+) FB  
↑  
If we have this, then the ideal op amp rules don't hold!

②  $\therefore v_o = \text{finite} \rightarrow v_+ = v_-$

③  $i_- = 0 \therefore i_1 = i_2$

$$i_1 = \frac{v_i - 0}{R_1} = \frac{v_i}{R_1} = i_2$$

$$v_o = 0 - i_2 R_2 = -i_2 R_2$$

$$v_o = -\left(\frac{v_i}{R_1}\right) R_2 = -\frac{R_2}{R_1} v_i$$

$$\therefore \boxed{\frac{v_o}{v_i} = -\frac{R_2}{R_1}}$$

$\hookrightarrow$  (over)

- **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