ECE 2100 Lecture notes Fri, 1/17/03

A. Stolp
1/16/03

Homeworks

HW # 2 due today by 5:00 pm
Ch 1: 11,13, 14, 18, 19, Exercises: Ex1.4, Ex1.15
Answers: 13) 24mW 14) 0.092V 18 last part) 0.5W
19) 0.826, 0.0098, A, 75.13

Answer to prob 1.19 is wrong in textbook.

HW # 3, due W, 1/22

Change the order of problems

From: Nilsson *Electric Circuits, 6th Ed.*
Read sections 14.6 & 14.7 (p.736)
Problem 14.33 (p.768 refers to p.687)
Drill 14.12, 14.13 (p.747)
From: *Microelectronic Circuits, 4th Ed.*, prob. 1.42

HW #4, due F, 1/24 Ch 1: 34, 37, 43
Exercises: 2.1, 2.2, 2.4, 2.5
Help: 34) You may find H(ω) instead of H(s). To determine low- or high-pass, you may indicate that cap blocks low freq. or shunts high freq. to ground, etc.. 37) The buffers isolate the 4 filters & make the problem easier. Write:

$$-0.75\cdot\text{dB} + -0.75\cdot\text{dB} + -0.75\cdot\text{dB} + -0.75\cdot\text{dB} = -3\ \text{dB}$$

You are now "convinced". Then find the frequency where v_c/v_{in} is -0.75dB in terms of C & R. 43) You may find H(ω) instead of H(s).

Stuff Problem Sessions:
W, 11:50 - 12:40 am, WBB 212 (tall brick geology building)
F, 10:45 - 11:35 am, MEB 1208 (by SW entrance)

Labs started Wednesday. Bring an old video camera with power supply & audio / video connections if you want to do those parts of lab 1.

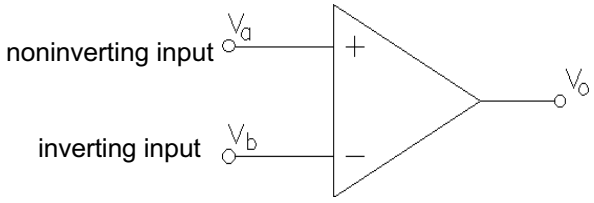
Frequency Response

Continue with **Frequency Response & Bode Plot Examples,** Start with Ex 3

Operational Amplifiers (Op amp) Chapter 2 of the textbook

An operational amplifier is basically a complete high-gain voltage amplifier in a small package. Op-amps were originally developed to perform mathematical operations in analog computers, hence the odd name. With the proper external components, the operational amplifier can perform a wide variety of "operations" on the input voltage. It can multiply the input voltage by nearly any constant factor, positive or negative, it can add the input voltage to other input voltages, and it can integrate or differentiate the input voltage. The respective circuits are called amplifiers, summers, integrators, and differentiators. Op-amps are also used to make active frequency filters, current-to-voltage converters, voltage-to-current converters, current amplifiers, voltage comparators, etc. etc.. These little parts are so versatile, useful, handy, and cheap that they're kind of like electronic Lego blocks — although somewhat drably colored.

Op-amp characteristics

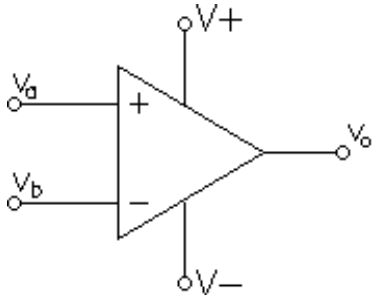


An op-amp has two inputs
Amplifies the voltage *difference* between those two inputs.

$$v_o = G\cdot(v_a - v_b)$$

G = voltage gain of the op-amp

G is usually very big, ≥ 100,000



The op-amp must be connected to external sources of power, V+ and V-.

The output voltage is limited by the power supply voltages.

$V- \le v_o \le V+$ (Usually even more limited than this)

So: $V- \le G(v_a - v_b) \le V+$

If the op amp is in its ***active*** region:

Since G is very big, $(v_a - v_b)$ must be very small, in fact the usual assumption is that

$$v_a \sim v_b$$ Active region ONLY

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