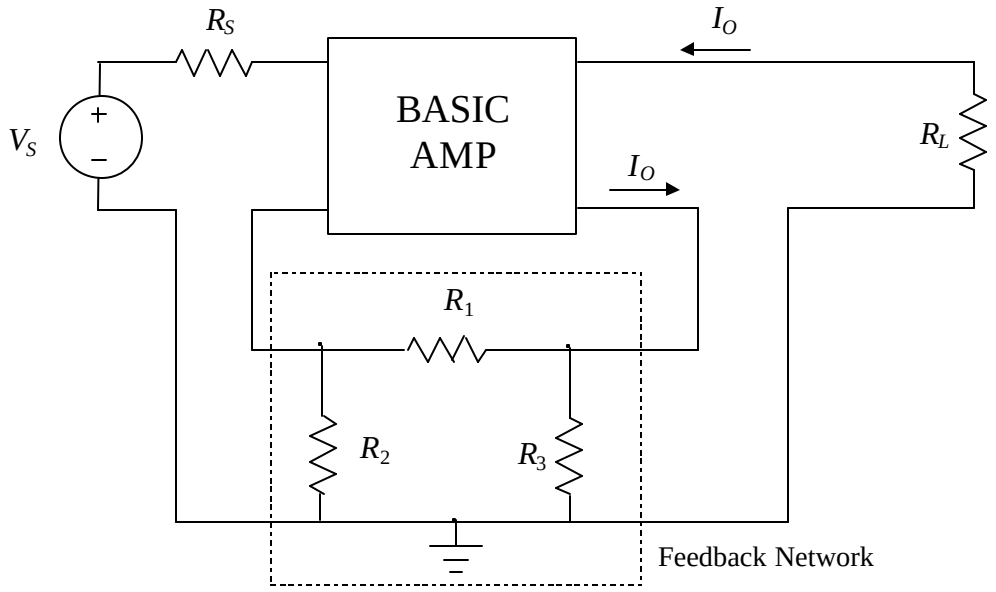
ECE3110 Homework #7 Fall 2005

(Due Oct. 19 by 6pm in homework locker)

1. What type of feedback topology is shown below (e.g., series-series, shunt-series,…)?

Draw three pictures showing the circuit configurations used for measuring b, R_{11}, and R_{22} for the feedback network shown, and derive expressions for b, R_{11}, and R_{22} as a function of circuit parameters.



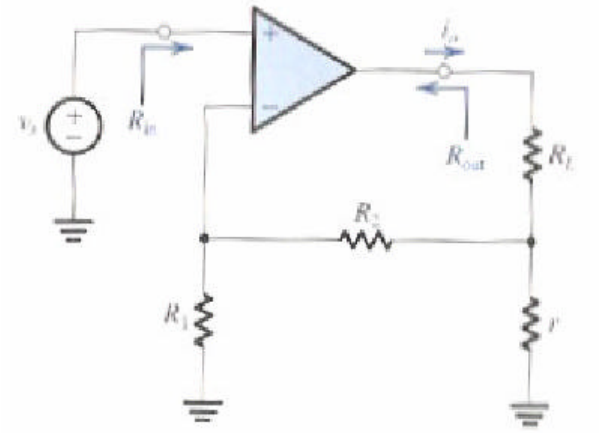
2. A voltage amplifier (voltage input, voltage output) having an open-circuit gain of 500, an input resistance of 50 kΩ, and an output resistance of 200 Ω is connected in a negative-feedback loop.

(a) Which feedback topology (e.g., series-shunt, series-series, etc.) would be used in this situation?

The feedback network has an R_{11} and R_{22} of 10 kΩ and provides a feedback factor b = 0.1. The amplifier is fed by a voltage source having R_S = 100 Ω, and a load resistance R_L = 10 kΩ is connected at the output.

(b) What is A? (Hint: It is *not* 500!)
(c) What is the closed-loop gain A_f of the feedback amplifier?
(d) What is the feedback amplifier's input resistance R_{in}?

3. Use the series-series feedback amplifier shown below. The op amp is characterized by an open-loop gain of 10,000V/V, an input differential resistance of 10kΩ, and an output resistance r_o = 1kΩ. The feedback network consists of R_1, R_2, and r. Let R_L= 5kΩ, R_1=200Ω, R_2=5kΩ, and r =200Ω. Find the closed-loop gain $A_f = i_o/v_s$, the input resistance R_{in}, and the output resistance R_{out}.



4. Negative feedback is to be used to modify the characteristics of a particular amplifier for various purposes. Identify the feedback topology to be used if:

(a) Input resistance is to be increased and output resistance lowered.
(b) Input resistance is to be lowered and output resistance is to be increased.
(c) Input and output resistance is to be lowered.

5. Use Figure P8.42 from the book. The shunt-shunt feedback amplifier shown has I=2mA and V_{GS} = 0.5V. The MOSFET has V_t=1V, V_A = 50V, R_s=1kΩ, R_1=100kΩ, and R_2=500kΩ, find the voltage gain, the input resistance R_{in}, and the output resistance R_{out}.

6. Reconsider Exercise 8.14 for the case of the op amp wired as a unity-gain buffer. At what frequency is $|A\beta| = 1$? What is the corresponding phase margin?

7. Reconsider Exercise 8.14 for the case when a manufacturing error introduces a second pole at 100,000. What is now the frequency for which $|A\beta| = 1$? What is the corresponding phase margin? For what values of β is the phase margin 45^o or more?

8. For the amplifier described by Fig. 8.47 and with independent frequency-independent feedback, what is the minimum closed-loop voltage gain that can be obtained for phase margins of 60^o and 90^o?

9. Exercises 14.1, 14.2, 14.3, 14.4