BASIC ELECTRONIC CIRCUITS

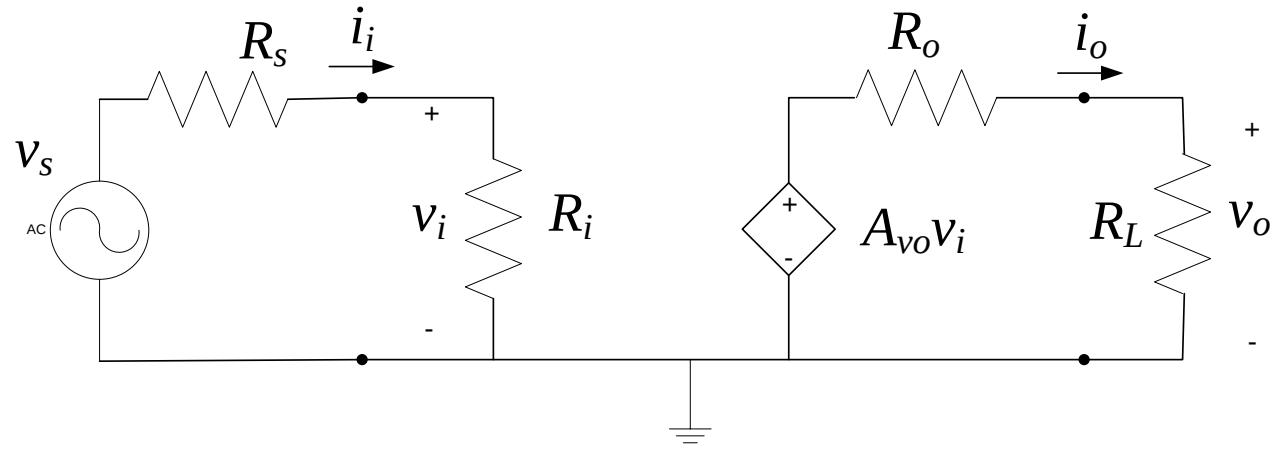
Tutorial: Amplifier and OP-amp

1. Consider the voltage amplifier circuit model, Avo = 100 V/V, under the following conditions; calculate the overall gain in each case and express in dB.

(a) $R_i = 10R_s$, $R_L = 10R_o$

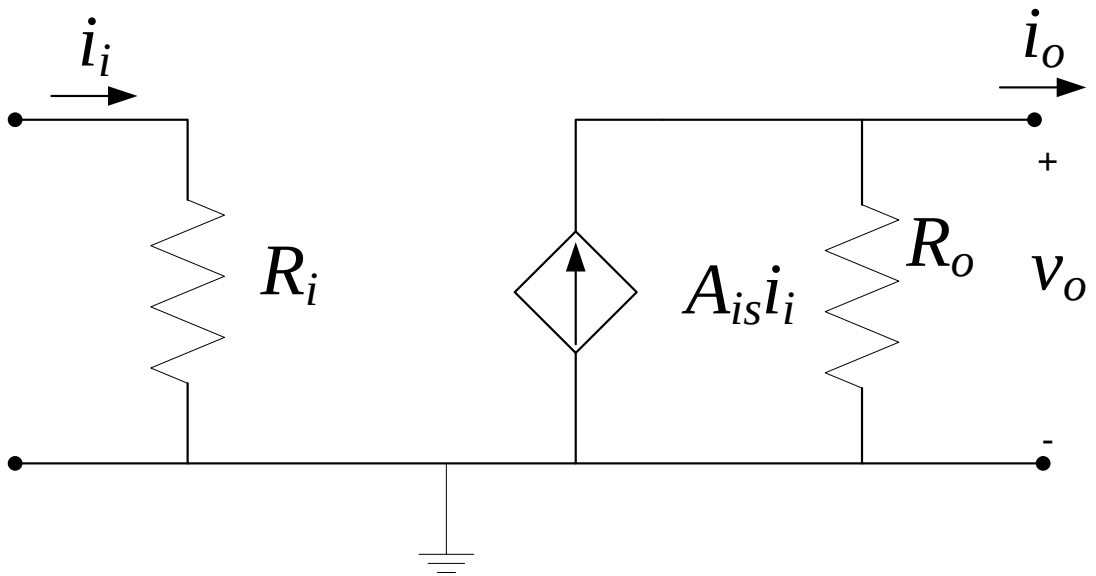
(b) $R_i = R_s$, $R_L = R_o$

(c) $R_i = R_s/10$, $R_L = R_o/10$

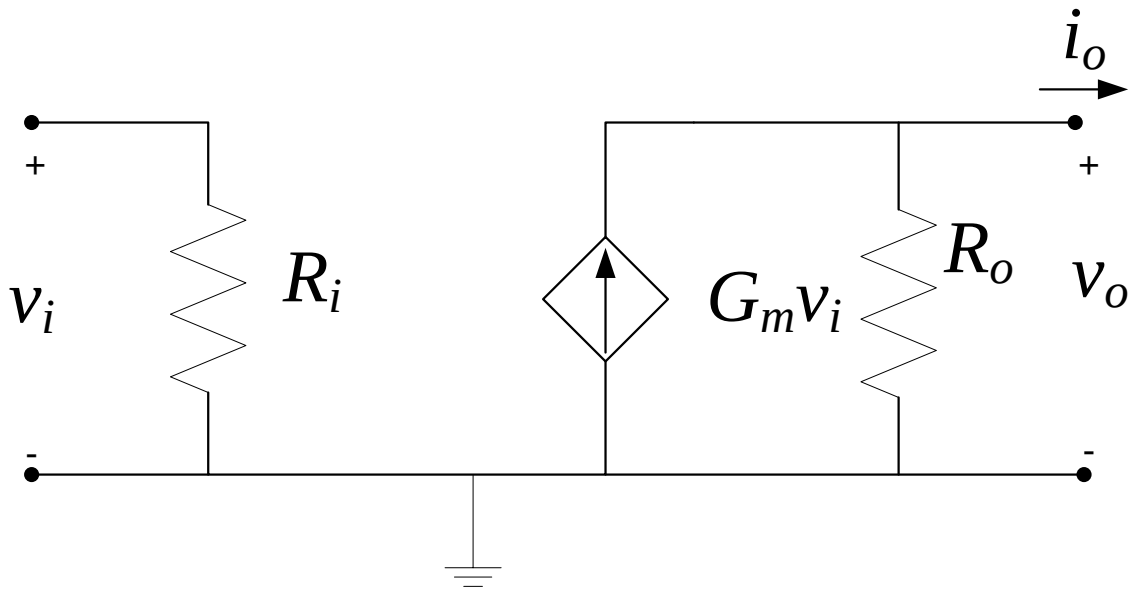


2. You are given two amplifiers, A and B, to connect in cascade between a 10-mV, 100 kΩ source and a 100 Ω load. The amplifiers have voltage gain, input resistance, and output resistance as follows: for A, 100 V/V, 100 kΩ, 10 kΩ, respectively; for B, 10 V/V, 10 kΩ, 1 kΩ, respectively. Your problem is to decide how the amplifiers should be connected. To proceed, evaluate the two possible connections between source S and load L, namely, SABL and SBAL. Find the voltage gain for each both as a ratio and in decibels. Which amplifier arrangement is best?

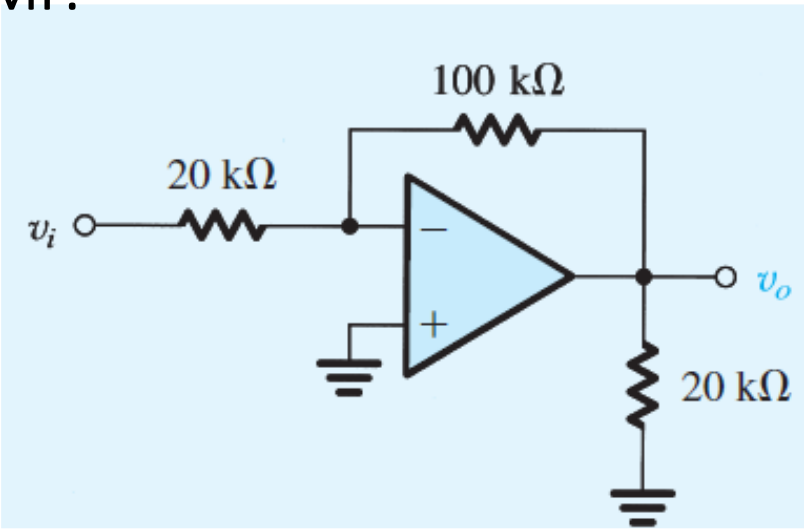
3. A current amplifier for which R_i = 100 Ω, R_o = 10 k Ω, and A_{is} = 100 A/A is to be connected between a 100 mV source with a resistance of 10 k Ω and a load of 1 k Ω. What are the values of current gain i_o/i_i , of voltage gain v_o/v_s, and of power gain expressed directly and in decibels?

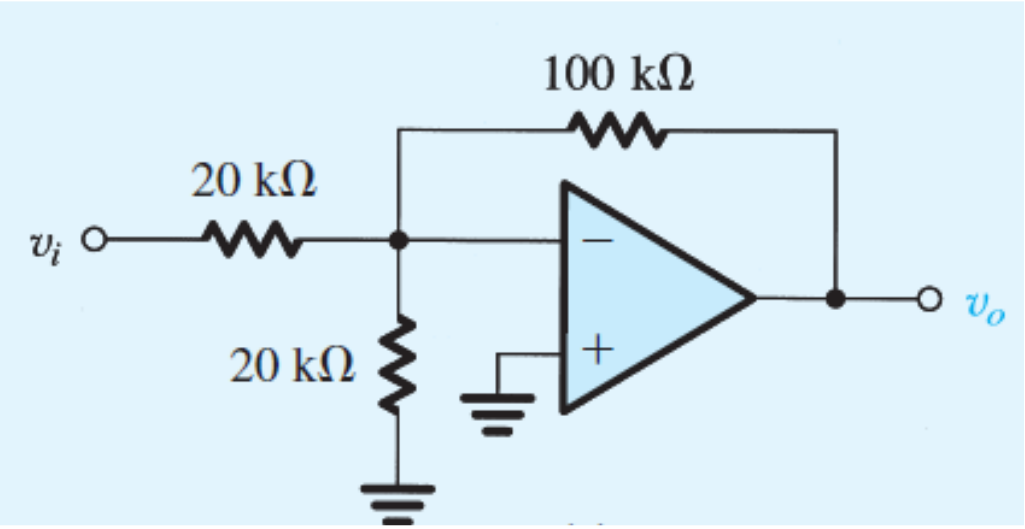


4. A transconductance amplifier with R_i = 2 k Ω, G_m = 60 mA/V, and R_o = 20 k Ω is fed with a voltage source having a source resistance of 1 k Ω and is loaded with a 1k Ω resistance. Find the voltage gain realized.



5. Calculate current through each resistor, voltage at each terminal of the OP-AMP.



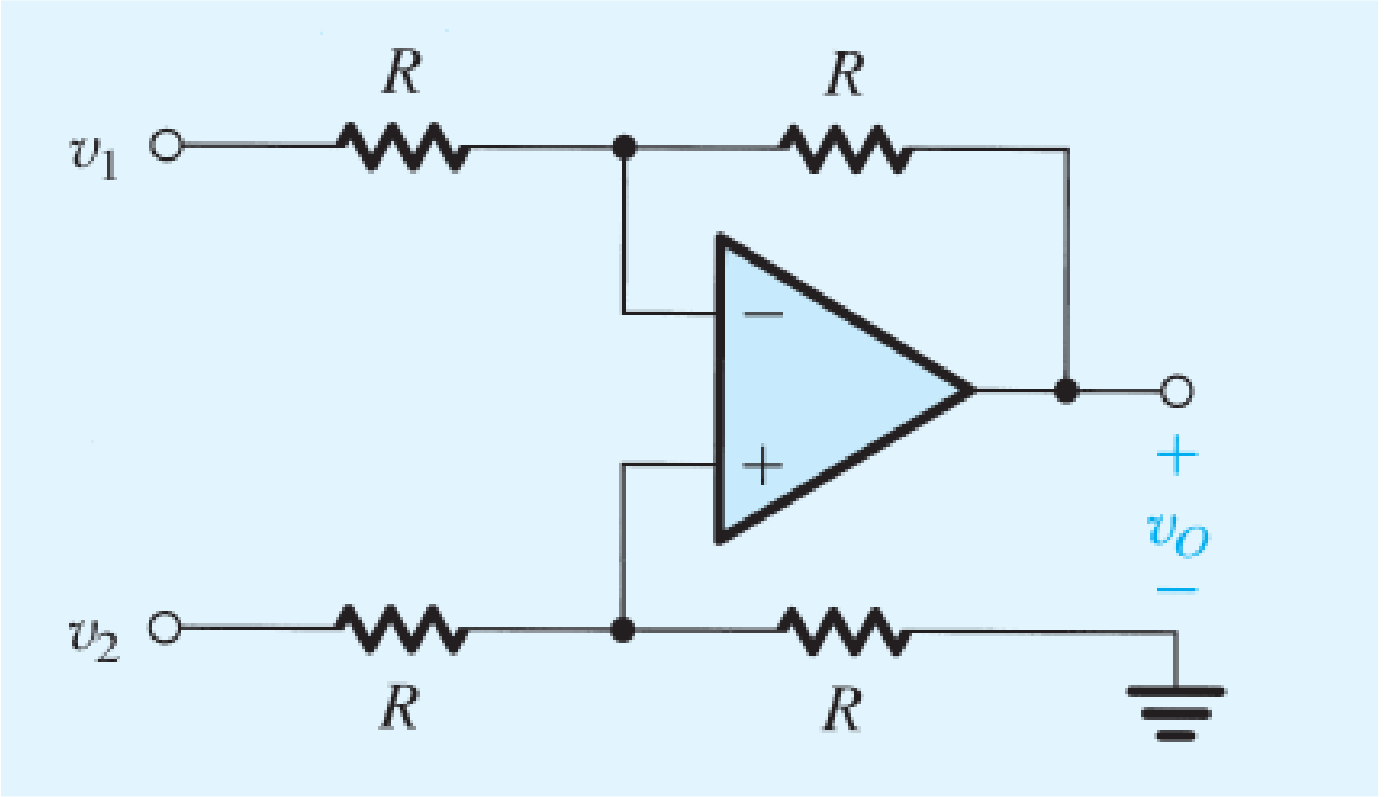


6. For the non-inverting configuration, determine the closed-loop gain of the op-amp circuits with following resistive networks, also determine the current through each resistor and voltage at each terminal of the op-amp.

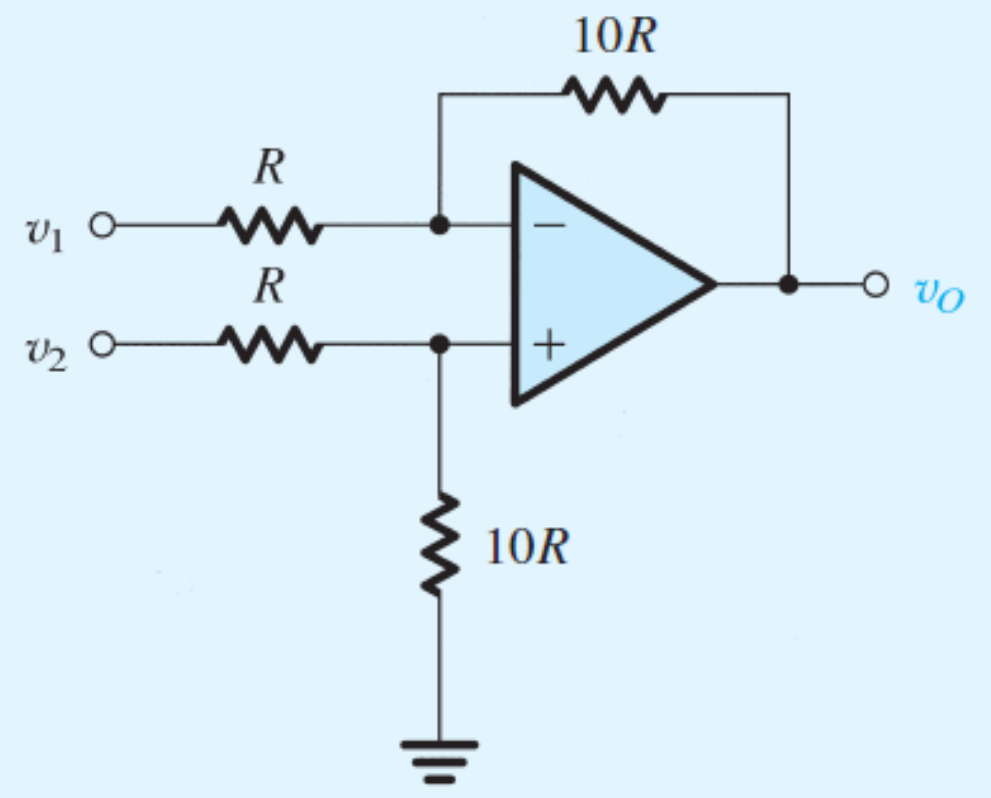
(i) $R_1 = 10K\Omega$; $R_f = 100K\ \Omega$.

(ii) $R_1 = 1K\Omega$; $R_f = 1M\Omega$; $R_L = 5K\Omega$.

7. Express v_o in terms of v_1 and v_2.



8. Use superposition to determine v_o in terms of v_1 and v_2.



$$v_1 = 10\sin(2\pi \times 60t) - 0.1\sin(2\pi \times 1000t), \text{ volts}$$

$$v_2 = 10\sin(2\pi \times 60t) + 0.1\sin(2\pi \times 1000t), \text{ volts}$$