

ANALOG SYSTEMS : PROBLEM SET 3

IN ALL PROBLEMS IN THIS TUTORIAL, THE OPAMP IS NONIDEAL IN THE SENSE THAT IT HAS FINITE BANDWIDTH. The transfer function of the opamp is given by $A(s) = \frac{\omega_{ut}}{s}$

Problem 1

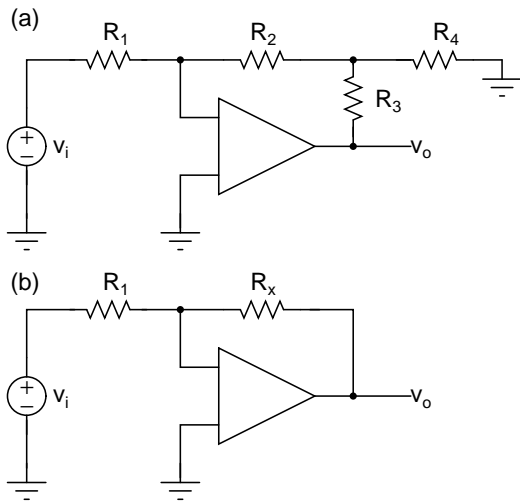


Figure 1: Circuits for Problem 1.

In the circuits above, determine the signs on the opamps for negative feedback operation, and determine the transfer function v_o/v_i . Consider the case where $R_x = 100 R_1$, $R_2 = R_1 = R_3$. Determine R_4 so that both circuits have the same gain. Compare the 3-dB bandwidths achieved for both circuits.

Problem 2

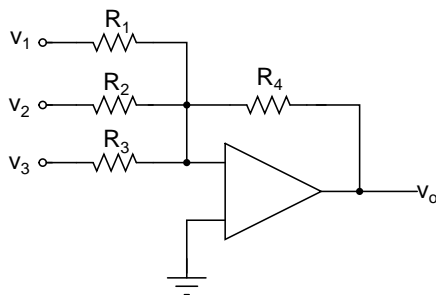


Figure 2: Circuit for Problem 2.

Determine the transfer functions from v_1 , v_2 and v_3 to v_o . What is the 3-dB bandwidth of each of these transfer functions?

Problem 3

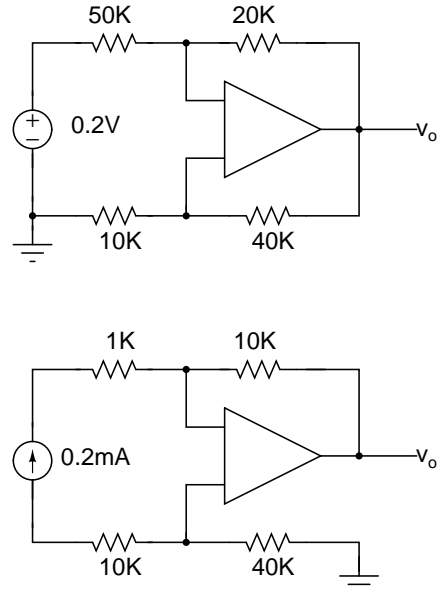


Figure 3: Circuits for Problem 3.

In the circuits above, mark the signs on the opamp for negative feedback operation, and determine the transfer functions from the input sources to v_o .

Problem 4

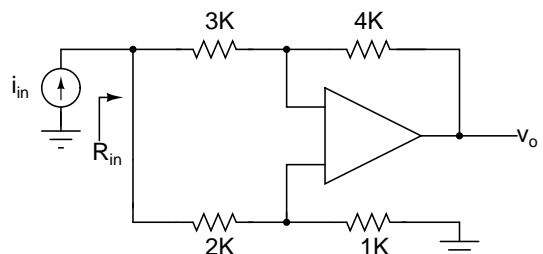


Figure 4: Circuits for Problem 4.

In the circuit above, mark the signs on the opamp for negative feedback operation, and determine the transfer function from i_{in} to v_o . Determine the input impedance (as a function of frequency) looking in, as denoted by R_{in} .

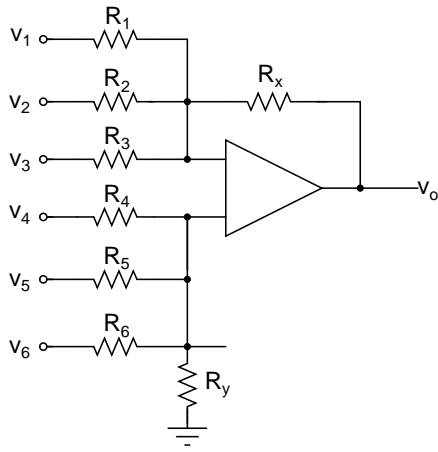


Figure 5: Circuit for Problem 5.

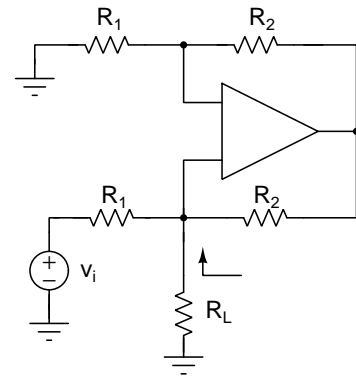


Figure 7: Circuit for Problem 7.

Problem 5

In the circuit above, mark the signs on the opamp for negative feedback operation, and determine the transfer functions to v_o from v_1, \dots, v_6 .

Problem 6

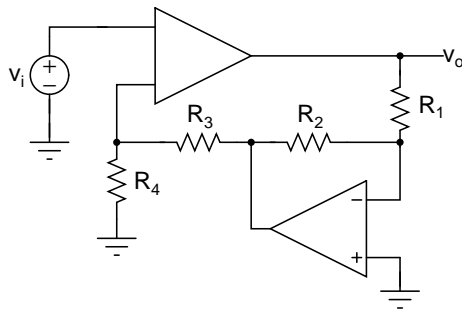


Figure 6: Circuit for Problem 6.

In the circuit above, mark the signs on the opamp for negative feedback operation, and determine $V_o(s)/V_i(s)$.

Problem 7

In the circuit above, mark the signs on the opamp for negative feedback operation, and determine the Norton equivalent for the circuit looking across the load resistor R_L . Remember, that the Norton equivalent will be frequency dependent.

Problem 8

The figure above shows three different ways of achieving an amplifier with a gain of n^2 , where $n^2 \gg 1$. If $v_{off,1,2} = 0$ and the opamps have infinite gain, all three are equivalent.

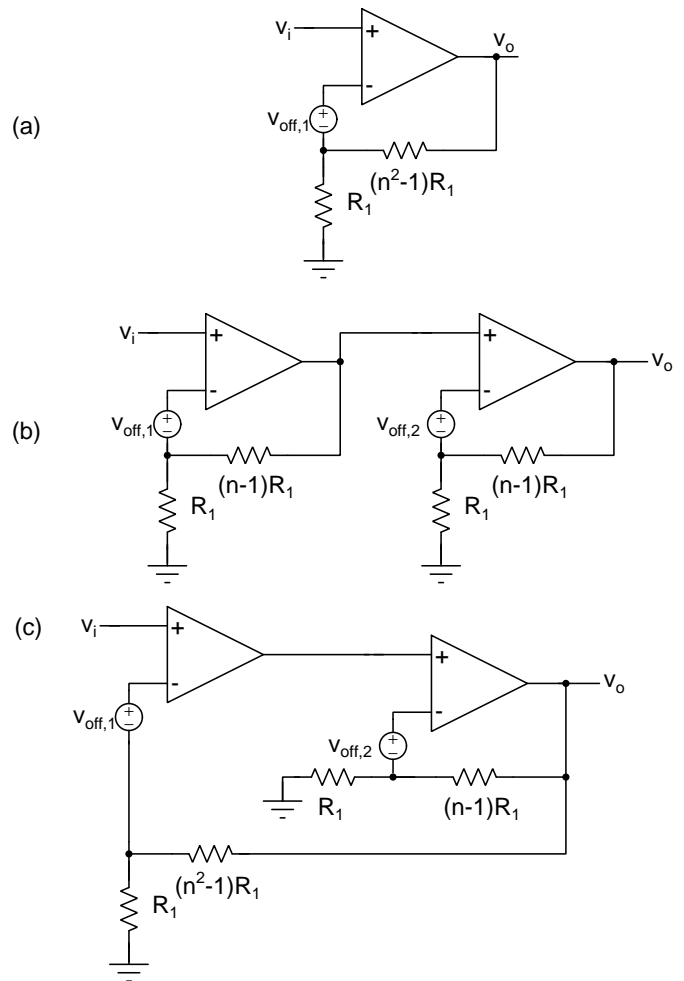


Figure 8: Circuit for Problem 8.

Determine the transfer functions of each of these amplifiers. Assume that the offset voltages are all zero. Which of them has the highest bandwidth?