03/18/03 2 correction and two hints

EECS 42 – Introduction to Electronics for Computer Science

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Problem Set # 7 Due 2:30 PM Mar 19th, 240 Cory

Reading:. Week 9# Circuit analysis with dependent sources and comparators and op-amps (4.1-4.4).

7.1 Basic Dependent Source. Consider the circuit in Fig. P7.1.

a) Find V_{OUT}.

b) Set $V_{IN} = V_{IN\_DC} + \Delta V_{IN}$, and set $V_{OUT} = V_{OUT\_DC} + \Delta V_{OUT}$ **in your answer in part a). Then sort terms on the left and right side into groups of DC and Δ. They must be zero independently**. Then solve for the small change in V_{OUT} given by (ΔV_{OUT}) divided by the small change in V_{IN} given by (ΔV_{IN}). This is the small signal gain = $\Delta V_{OUT} / \Delta V_{IN}$.

7.2 Amplifier-Based Op-Amp. Consider the circuit in Fig. P7.2. Do not use the ideal op-amp technique but solve as a circuit assuming that there is no current through R_i **but $V_- = V_{IN} + V_{OUT}/A$**.

a) Find V_{OUT}.

b) Determine the fraction by which V_{OUT} deviates $(R_1 + R_2)/R_1$.

7.3 Ideal Op-Amp. Consider the circuit in Fig. P7.3 and use the ideal op-amp analysis technique.

a) Find V_{OUT}.

b) Explain why the answer is independent of R_2.

c) Explain why the answer is independent of R_L.

7.4 Cascade Op-Amps. Use the circuit in Fig. P7.4 and note that this circuit is made up of the circuit in 7.2 with A = infinite and the circuit in 7.3.

a) Find V_{O1}.

b) Find V_{O2}.

7.5 Independent and Dependent Sources: Consider the circuit in Fig. P7.5.

a) Find V_{OUT} as a function of the sources V_{IN}, I_B and V_{CC}.

b) Revise the circuit diagram to the case where the independent sources I_B and V_{CC} are zero and solve this circuit for V_{OUT}.

c) Check you answer by setting I_B and V_{CC} to zero in your answer to part a).

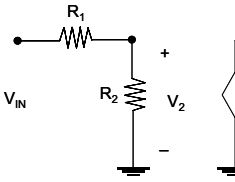

Fig. P7.1

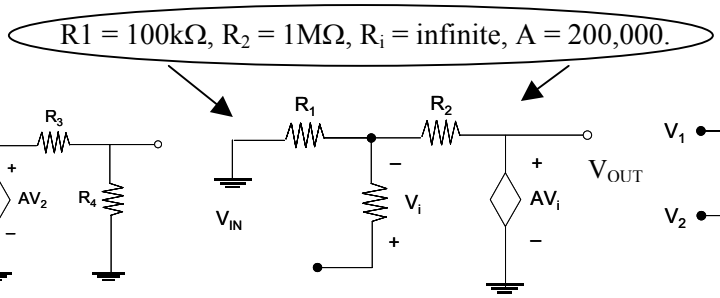

Fig. P7.2

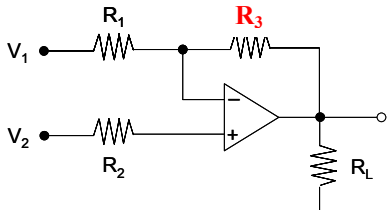

Fig. P7.3

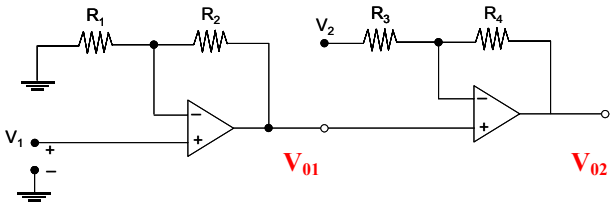

Fig. P7.4

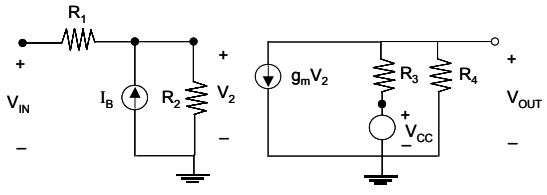

Fig. P7.5