ECE 3042
Homework Assignment No. 3

Fall 2009 Homework for Experiment No. 3

Due Week of September 14

1. Design an inverting bandpass op amp amplifier/filter with a midband voltage gain with a magnitude of 15, a lower -3db frequency of $100\,\mathrm{Hz}$, and an upper -3db frequency of $10\,\mathrm{kHz}$. The circuit shown in Fig. 1 is suggested. Pick the capacitor $C_1 = 0.1\,\mu\mathrm{F}$ and compute the other components. Perform an ac analysis with either Cadence or National Instruments SPICE to plot the magnitude of the voltage gain as a function of frequency as the frequency ranges from $1\,\mathrm{Hz}$ to $1\,\mathrm{MHz}$. Assume that the op amp is ideal. Plot the magnitude and phase of the frequency response with Mathcad.

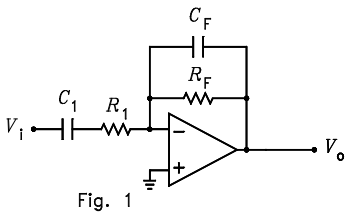

Fig. 1

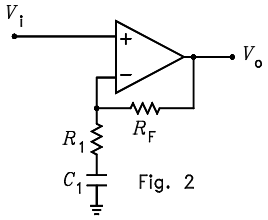

Fig. 2

2. Design an op amp noninverting high pass shelving amplifier/filter. The dc gain is to be 1, the infinite frequency gain 15, and the pole frequency $10\,\mathrm{kHz}$. The circuit shown in Fig. 2 is suggested. Pick $C_1 = 0.1\,\mu\mathrm{F}$ and solve for the other circuit components. Perform an ac analysis with either Cadence or National Instruments SPICE to plot the magnitude of the voltage gain as a function of frequency as the frequency ranges from $1\,\mathrm{Hz}$ to $1\,\mathrm{MHz}$. Assume that the op amp is ideal. Plot the magnitude and phase of the frequency response with Mathcad.

3. Design an opamp noninverting amplifier/filter that uses a single dc power supply. The input is to be capacitively coupled to prevent dc voltage from appearing on the source. The circuit is to have a high pass characteristic with a high frequency gain of 15 and a pole frequency of $10\,\mathrm{kHz}$. The circuit shown in Fig. 3 is suggested. Pick $C_1 = C_2 = 0.1\,\mu\mathrm{F}$ and compute the other circuit components. Perform an ac analysis with either Cadence or National Instruments SPICE to plot the magnitude of the voltage gain as a function of frequency as the frequency ranges from $1\,\mathrm{Hz}$ to $1\,\mathrm{MHz}$. Assume that the op amp is ideal. Plot the magnitude and phase of the frequency response with Mathcad.

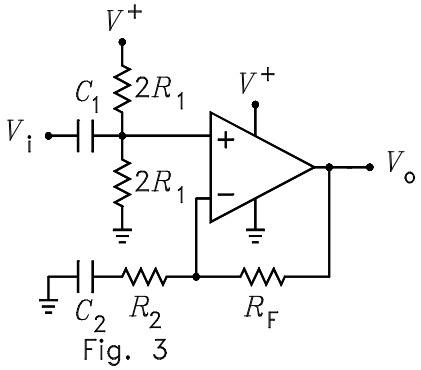

Fig. 3

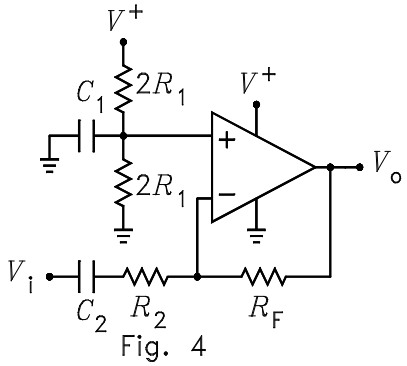

Fig. 4

4. Design an opamp inverting amplifier/filter that uses a single dc power supply. The input is to be capacitively coupled to prevent dc voltage from appearing on the source. The circuit is to have a high pass characteristic with a high frequency gain with a magnitude of 15 and a pole frequency of $10\,\mathrm{kHz}$. The circuit shown in Fig. 4 is suggested. Pick $C_1 = C_2 = 0.1\,\mu\mathrm{F}$ and compute the other circuit components. Perform an ac analysis with either Cadence or National Instruments SPICE to plot the magnitude of the voltage gain as a function of frequency as the frequency ranges from $1\,\mathrm{Hz}$ to $1\,\mathrm{MHz}$. Assume that the op amp is ideal. The value of R_1 is irrelevant. Plot the magnitude and phase of the frequency response with Mathcad.