

UNIVERSITY OF CALIFORNIA
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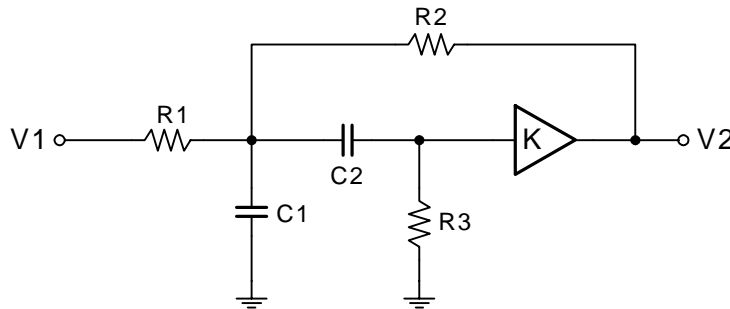
Homework 1
Due Wednesday, Feb. 7, 2001

EECS 247
Spring 2001

Design a 4th order (i.e. 4 poles) bandpass filter with 1MHz center frequency and 200kHz bandwidth (i.e. the band edges are at 0.9 and 1.1MHz, respectively).

- a) Design the filter (e.g. with Matlab). Calculate ω_0 and Q for each biquad and plot the frequency response.
- b) Implement the filter with Sallen-Key sections. Plot the frequency response with SPICE and make sure it agrees with (a).
- To simplify calculations (not necessarily the best design), make all capacitors 1pF and choose all resistors equal sizes.

Second-order Sallen-Key bandpass section:



Design equations:

Transfer function	$H_{BP}(s) = \frac{G \frac{\omega_0}{Q} s}{s^2 + \frac{\omega_0}{Q} s + \omega_0^2}$
Center frequency	$\omega_0 = \sqrt{\frac{R_1 + R_2}{R_1 R_2 R_3 C_1 C_2}}$
Quality factor	$Q = \frac{\omega_0}{\frac{1}{R_1 C_1} + \frac{1}{R_3 C_2} + \frac{1}{R_3 C_1} + \frac{1-K}{R_2 C_1}}$
Gain	$G = \frac{\frac{K}{R_1 C_1}}{\frac{1}{R_1 C_1} + \frac{1}{R_3 C_2} + \frac{1}{R_3 C_1} + \frac{1-K}{R_2 C_1}}$