

UNIVERSITY OF CALIFORNIA
College of Engineering
Department of Electrical Engineering
and Computer Sciences

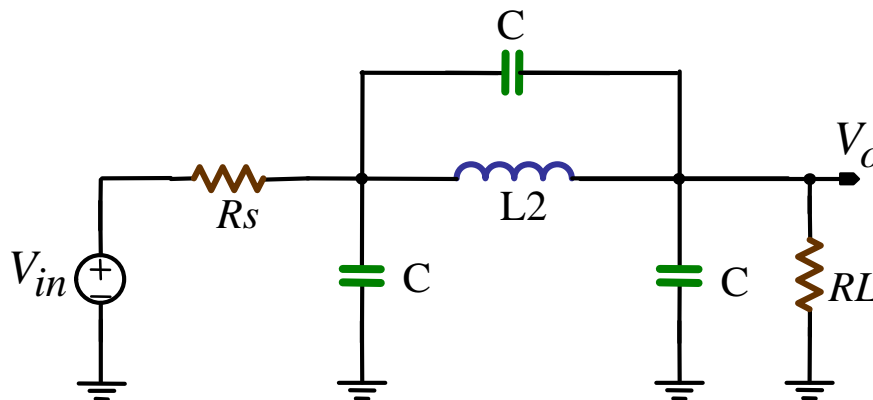
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Homework 3
Due Tuesday, Oct. 11th, 2005

EECS 247
FALL 2005

Problem 1:

Design a lowpass active filter based on a 3rd order doubly-terminated RLC ladder elliptic filter.



Use the following normalized RLC values:

$R_s=R_L=1$, $C_1=C_3= 0.635$ $C_2=0.0002$ $L_2=0.9786$

Assume the final filter -3dB frequency is to be 100kHz

- 1- Find the RLC values
- 2- Obtain the signal-flowgraph for the filter
- 3- Build a differential Gm-C filter with all the differentially connected integrating capacitors 10pF each. Find the values for all the other Cs and Gms. Submit the schematic for this filter
- 4- Simulate your filter with SPICE using SPICE G-elements for the transconductors. Submit the SPICE description along with the overall magnitude response (magnitude response in dB) and also the detailed passband
- 5- Add resistor/resistors at the output of each voltage-controlled current source in order to emulate the finite DC gain of the Gm-cell. By using SPICE determine the minimum DC gain for 0.1dB deviation in the

- passband compared to the ideal case. Find the value of the DC gain and the simulated passband
- 6- Add an extra pole to your Gm-elements to emulate the effect of non-dominant pole in a real Gm-Cell. Find the minimum frequency for the pole using SPICE for the deviation in the passband not to exceed 0.1dB (in this section remove the resistor added to emulate finite DC gain). Submit the value of the pole and the simulated passband
 - 7- Simulate the frequency response of the filter including the detail of the passband with the combined non-idealities of section 5 & 6 (finite DC gain and extra pole). Explain the effect on the passband of the filter.
 - 8- Build the switched-capacitor version of the same filter with the following assumptions:
 - a. Use single-ended bottom plate LDI switched-capacitor integrators with all equal integrating capacitors of 10pF
 - b. Assume an oversampling ratio of 32
 - c. Submit the schematic and values for all components

Problem 2:

For the system shown below, what is the minimum sampling frequency f_s that guarantee 50 dB attenuation of aliasing components in the discrete time signal $y(kT)$? ($T=1/f_s$)

