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College of Engineering
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Homework 2
Due Friday, Feb. 23, 2001

EECS 247
Spring 2001

1. Design a 4th order Sallen-Key (two second order section) low-pass anti-aliasing filter with 0.3dB maximum attenuation (worst case) in the passband (0Hz to 500kHz) and a nominal gain of 1. Available resistors exhibit worst-case variations of $\pm 15\%$, capacitors vary by $\pm 10\%$ (resistors and capacitors, respectively, vary by the same percentage). What is the minimum sampling frequency required for 45dB stopband attenuation? Calculate all component values (minimum capacitor area, $R_{\max}=100\text{k}\Omega$) and verify your result with SPICE.

2. Design a 3rd order elliptic low-pass filter with 10MHz cutoff frequency and 1dB passband ripple and 40dB stopband attenuation. You may use the biquad designed in class combined with an additional first order section

$$H(s) = -\frac{K_1 s + K_0}{s + \omega_0}$$

Choose component values for unity gain at $f=0$ and to minimize total capacitor area. The minimum capacitor value that can be fabricated accurately is $C_{\min}=50\text{fF}$ and the maximum realizable resistor is $R_{\max}=100\text{k}\Omega$. Verify your result with SPICE.