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

**Homework 3** **EECS 247**

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**Due Thursday, October 9, 2003** **Fall 2003**

Design an elliptic filter with the following specifications:

| | |
|---|---|
| $f_{pass}$ | 20 MHz |
| $f_{stop}$ | 35 MHz |
| $r_{pass}$ | < 0.2 dB |
| $r_{stop}$ | > 65 dB |

a) What is the required filter order?
b) Obtain the doubly-terminated, denormalized LC ladder prototype using a table (e.g. the attached copy from Williams) or a synthesis program.
c) Synthesize a parasitic insensitive Gm-C filter based on the ladder prototype. Note all element values.
You may use SPICE G-elements for the transconductors. Add a noise to simulate the noise ($4k_BT/G_m$). Do not use resistors for any other purpose—synthesize them from transconductors.
d) Scale the filter elements to obtain a peak gain of unity from the filter input to each integrator output and to achieve a total integrated noise at the output of 100μV rms integrated from DC to 100MHz. Verify your design with a SPICE AC analysis that you compare to the LC ladder. Show the output of each integrator and indicate the filter output. Note all element values on your filter schematic.
e) Consider the effect of finite amplifier bandwidth $f_u$. Using first order pole cancellation, determine the minimum unity gain frequency that meets specifications and explain why some poles are not cancelled.