Analog electronics, Fall 2012

Exercise 4, 30.11.2012

1.

Optimize the dynamic range of a 6th-order low pass filter described by $T(s)$ by assigning Q values and gains appropriately. Assume that the filter is composed of three 2nd order sections. The total gain should be 9 dB.

$$T(s) = \frac{k_1}{s^2 + 2.5s + 1.2} \frac{k_2}{s^2 + 3s + 1.5} \frac{k_3}{s^2 + 5s + 2}$$

2.

Compute the pole angles, coordinates and Q values for 9th-order Butterworth low pass filter.

3.

You want to design a low pass filter with $\alpha_{max} = 0.5\ dB$ at $\omega_p = 1$ and $\alpha_{min} = 40\, dB$ at $\omega_s = 2$ (normalized frequency). Compute the required filter order for Butterworth and Chebyshev filters. Hint: Chebyshev design formulas are on page 291 of Schaumann.

4.

Design a Butterworth low pass filter with the following specifications: $\alpha_{max} = 1\ dB$ at $f_p = 20\ kHz$, $\alpha_{max} = 25\ dB$ at $f_s = 50\ kHz$, 0 dB DC gain.