Problem Set Extra

April 17, 2015

1

Consider an amplifier with a gain of A, and two poles at frequencies p_1 and p_2. Express the crossover frequency of the amplifier as ω_c. $p_1 < p_2$.

1.1

What is the phase margin of this amplifier under the following conditions: $p_2 > 10\omega_c$, $\omega_c < p_2 < 10\omega_c$, $p_2 = \omega_c$, $0.1\omega_c < p_2 < \omega_c$.

1.2

What is the closed loop bandwidth of the amplifier with a feedback factor of f and $p_2¿\omega_c$.

2

Make a block diagram for the transimpedance amplifier from PS2. Find the closed loop gain using black's formula. Does it agree with the calculations from PS2.

3

Draw an op-amp with a PMOS input stage. You may use NMOS devices, PMOS devices and one current source.

4

An op-amp compensation network is made of a series RC circuit instead of a capacitor.

4.1

What is the transfer function of the feedback network?

4.2

What is the compensated transfer function of the op-amp?

5

Each stage of an op-amp generates noise at its output, and we can use our usual analog tradeoff (increase C, decrease R, increase gm) to reduce the noise from each stage. If each stage has the same relationship between noise and current, how should the current in the op-amp be distributed to minimize power at a given noise level and bandwidth?