Homework Assignment No. 5

Due Monday, February 9, 2004 in class

Problem 1 - (10 points - Problem 6.2-8 of A&H)

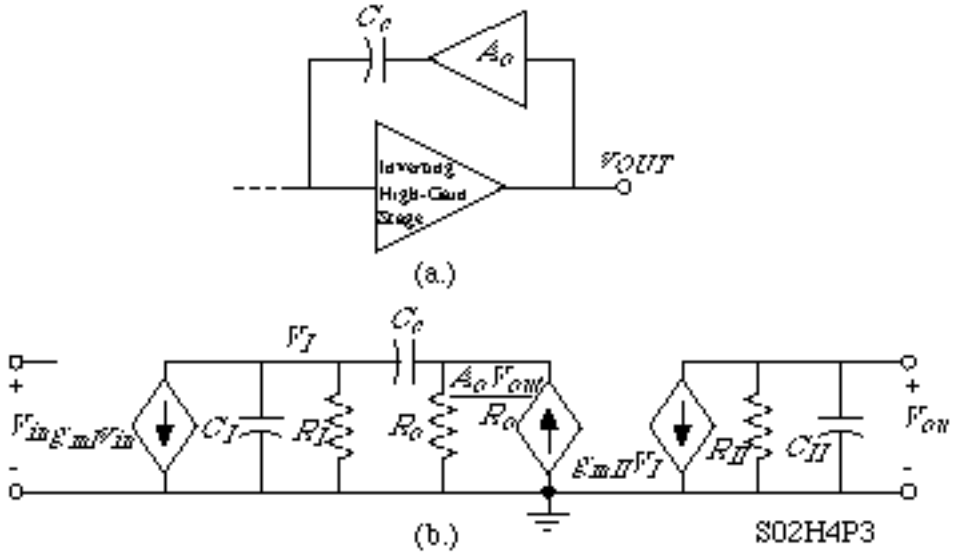
A two-stage, Miller-compensated CMOS op amp has a RHP zero at 20*GB*, a dominant pole due to the Miller compensation, a second pole at p_2 and a mirror pole at -3*GB*. (a) If *GB* is 1MHz, find the location of p_2 corresponding to a 45° phase margin. (b) Assume that in part (a) that $|p_2| = 2GB$ and a nulling resistor is used to cancel p_2. What is the new phase margin assuming that *GB* = 1MHz? (c) Using the conditions of (b), what is the phase margin if C_L is increased by a factor of 4?

Problem 2 – (10 points - Problem 6.2-10 of A&H)

For the two-stage op amp of Fig. 6.2-8, find W_1/L_1, W_6/L_6, and C_c if *GB* = 1 MHz, $|p_2| = 5\ GB$, $z = 3\ GB$ and $C_L = C_2 = 20$ pF. Use the parameter values of Table 3.1-2 and consider only the two-pole model of the op amp. The bias current in M5 is 40 μA and in M7 is 320 μA.

Problem 3 – (10 points – Problem 6.2-11 of A&H)

In the figure shown, assume that $R_I = 150$ kΩ, $R_{II} = 100$ kΩ, $g_{mII} = 500$ μS, $C_I = 1$ pF, $C_{II} = 5$ pF, and $C_c = 30$ pF. Find the value of R_z and the locations of all roots for (a) the case where the zero is moved to infinity and (b) the case where the zero cancels the highest pole.



Problem 4 – (10 points)

The poles and zeros of a Miller compensated, two-stage op amp are shown below.

(a.) If the influence of p_3 and z_1 are ignored, what is the GB in MHz of this op amp for 60° phase margin?

(b.) What is the value of $A_v(0)$? What is the value of C_c if g_{m1}=g_{m2}=500μS?

(c.) If p_2 is moved to p_3, what is the new GB in MHz for 60° phase margin? What is the new C_c if the input transconductances are the same as in (b.)?