ELEN 607 (ESS) **Due: March 6, 2008**
Spring '08

HOMEWORK ASSIGNMENT # 6

Read the IEEE J of Solid State-State Circuits, Vol. 42, No. 3, March 2007 i) pp 463-475, see Fig.13, and ref [17, Fig. 8] of that paper ii)pp 475-485, see Figs.3& 4 and Table II; iii) pp 496—507, consider the bulk-driven OTA of Figs 11 &12; iv) pp 508-517, in particular bulk-driven Op Amp Fig.5.

Prob. 1. Design a negative impedance circuit for $V_{DD} = -V_{SS} = 1.00$ V with 0.35μm CMOS technology. The load is 1 Mohm and 20 pF. Use this differential negative resistor to design an Op amp with Ao=110 db, GB> 5MHz, maximize input voltage swing, also employ a LV tail current source, i.e., F. You et all IEEE JSSC, Vol. 32, pp. 1173-1180, August 1997. Discuss the reason for using a PMOS or NMOS driver for each building block of your amplifier. Provide a Table summarizing your results; also include S/N, PSSR, CMR, CMRR, 1% settling time, offset voltage, power consumption, phase and gain margins.

Prob. 2. Using 65nm technology design a Fully Differential Op Amp whose topology you can select and justify, discuss at least two different CMFB circuit implementations. The load is 1.2 Mohms and 10 pF. The main specifications to satisfy include Ao > 130 db, GB> 2.0GHz, and phase margin > 55 degrees. Summarize your results and discuss the design procedure you propose for this design.

Prob. 3 Consider a NMOS differential pair with an ideal tail current Is and two R_L resistive loads. Prove that the corresponding input offset voltage for the three cases is as shown below. Then determine the values of Voff when the resistive mismatch is 2.5%, the K mismatch is 2.5% and ΔV_T=3mV.

$$V_{OFF} = \left(\frac{V_{gs} - V_T}{2}\right)\frac{\Delta R_L}{R_L}$$

when

$$R_{L1} = R_L + \frac{\Delta R_L}{R_L}$$

$$R_{L2} = R_L - \frac{\Delta R_L}{R_L}$$

$$V_{OFF} = \left(\frac{V_{gs} - V_T}{2} \right) \frac{\Delta K}{K}$$

when

$$\left(\frac{W}{L} \right)_1 = \frac{W}{L} + \frac{\Delta \left(\frac{W}{L} \right)}{2}$$

$$\left(\frac{W}{L} \right)_2 = \frac{W}{L} - \frac{\Delta \left(\frac{W}{L} \right)}{2}$$

$$K = \frac{\mu C_{OX}}{2} \left(\frac{W}{L} \right)$$

$$V_{OFF} = \Delta V_T$$

when

$$V_{T1} = V_T + \frac{\Delta V_T}{2}$$

$$V_{T2} = V_T - \frac{\Delta V_T}{2}$$