UNIVERSITY OF CALIFORNIA AT BERKELEY
College of Engineering
Department of Electrical Engineering and Computer Science

R.W. Brodersen | **Homework #8** | **EECS 140**
Jianhui Zhang | **(Due 11/19/03)** | **Fall 2003**

1.

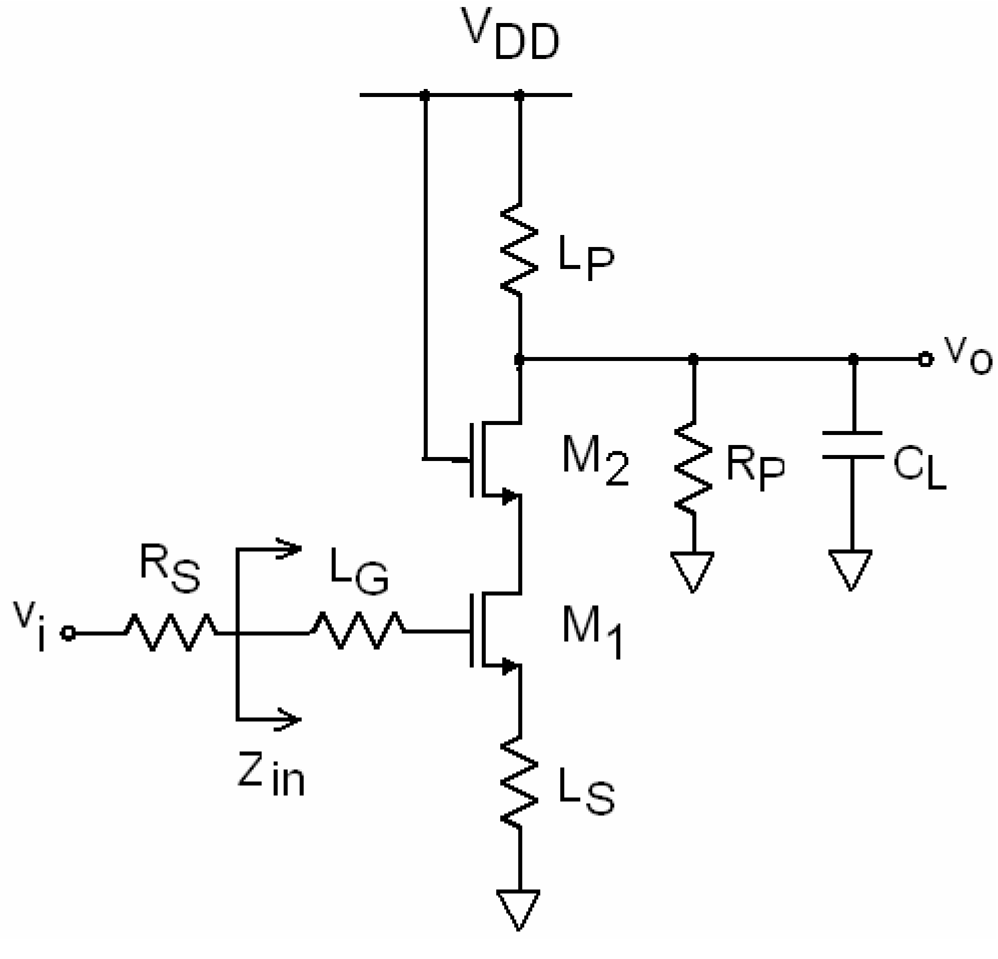

Fig. 1

Fig.1 is part of a RF amplifier (biasing circuit not shown here). The operation frequency of the circuit is 10Grad/s, g_{m1} = 23.45mS, Cgs of M1 is 0.67pF, R_S = 50Ω, L_G = 13.6nH, L_S = 1.4nH, L_P = 5nH, R_P = 100Ω and C_L = 2pF. Ignore the other capacitors.

a) What is the small signal voltage gain from input to output at the operation frequency?

b) What is the input impedance Zin at the operation frequency?

2.

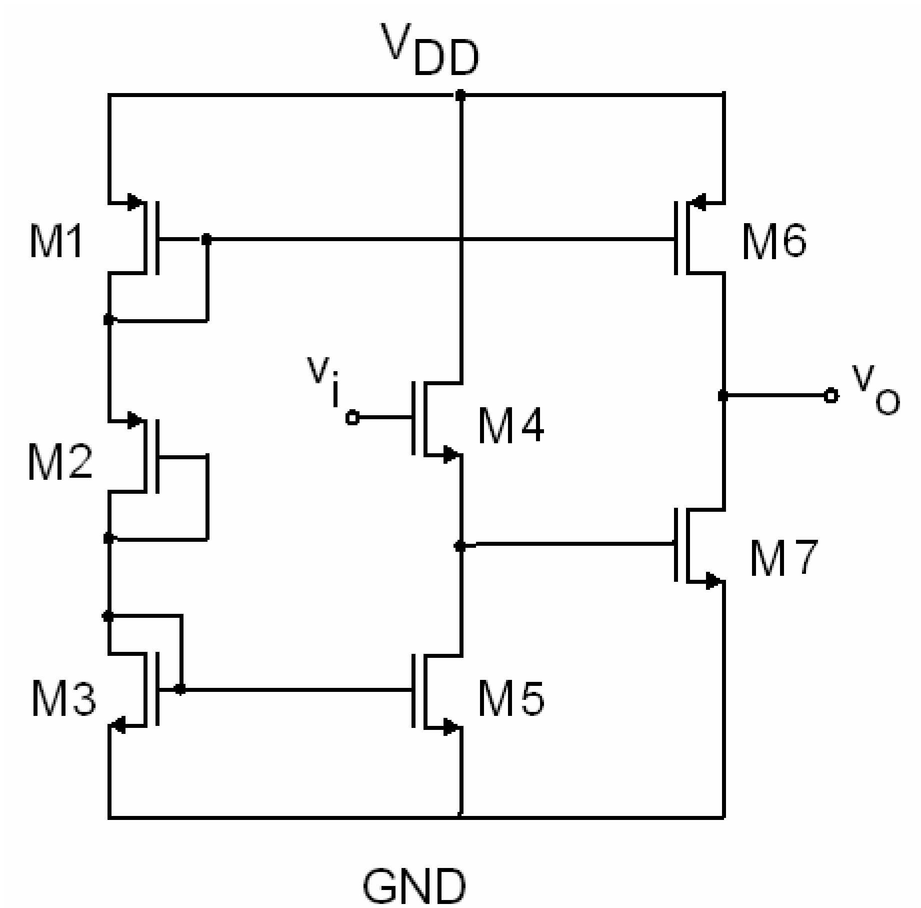

Fig.2

A CMOS amplifier stage is shown in Fig.2. All the transistor bulks are tied to the sources except M4. $(W/L)_1=(W/L)_6=(W/L)_3=(W/L)_5=(W/L)_7=100u/2u$. Select W/L for M2 and M4 to give Vi = Vo =2.5V dc and $I_D = 100uA$ bias in all devices. The minimum value of L and W is 2u. Calculate the small-signal. low-frequency gain and the -3dB frequency of the stage. Verify with SPICE. Use $\mu_n C_{ox} = 60uA/V^2$, $\mu_p C_{ox} = 30uA/V^2$, $t_{ox} = 20nm$, $C_{ol} = 0.3fF/u$, $C_{db0} = C_{sb0} = 0.8fF/u$, $\Phi = 0.6V$, $V_{t0n} = -V_{top} = 0.7V$, $\gamma = 0.4$ and $\lambda = 0.03$. VDD = 5V

3.

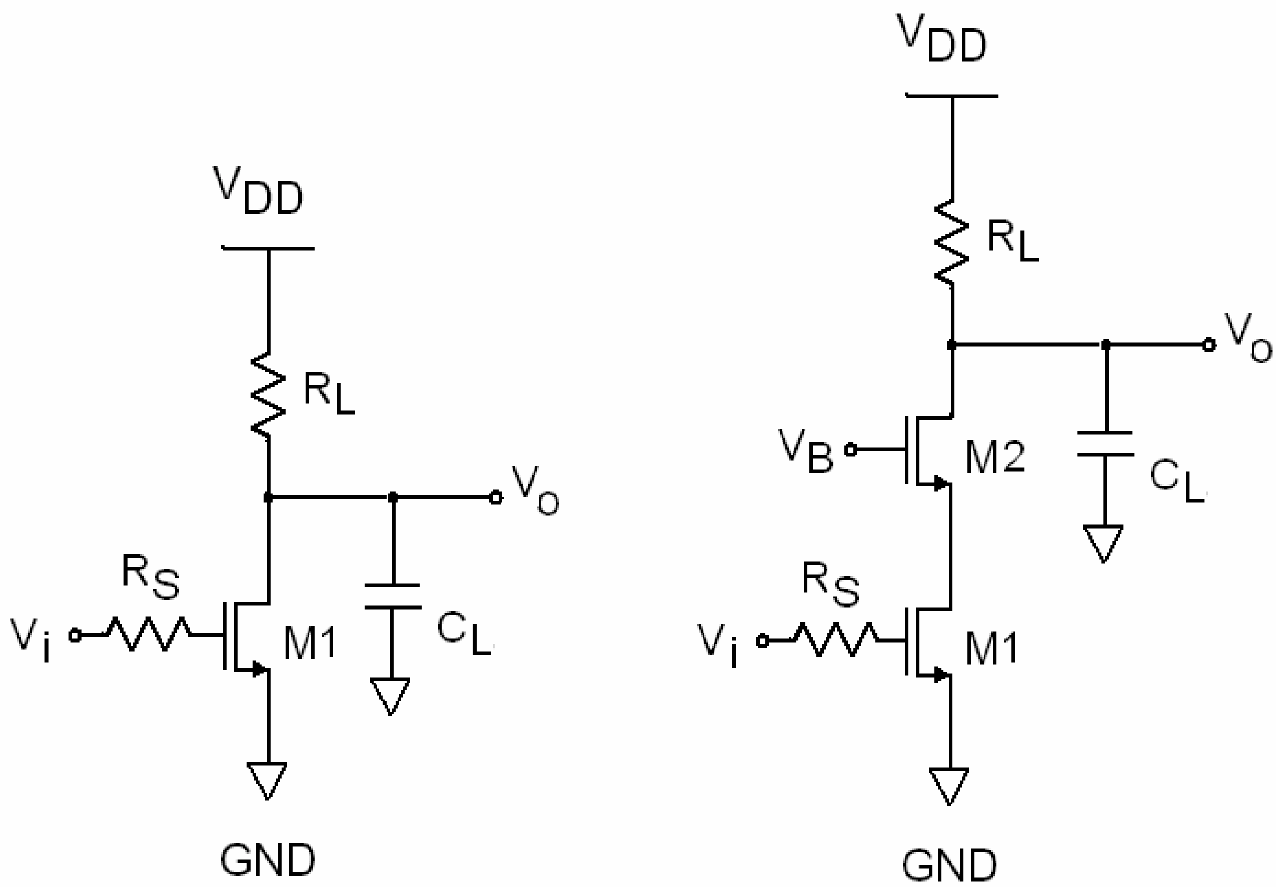

Fig. 3a

Fig. 3b

Assume $R_L C_L << g_{m1} R_L RsCgd$ and estimate all the poles in fig.3a and fig.3b (ignore Cgb in both circuits but **do** consider all the other capacitors) . Compare the dominant poles of the two circuits, what conclusion you can get.

4.

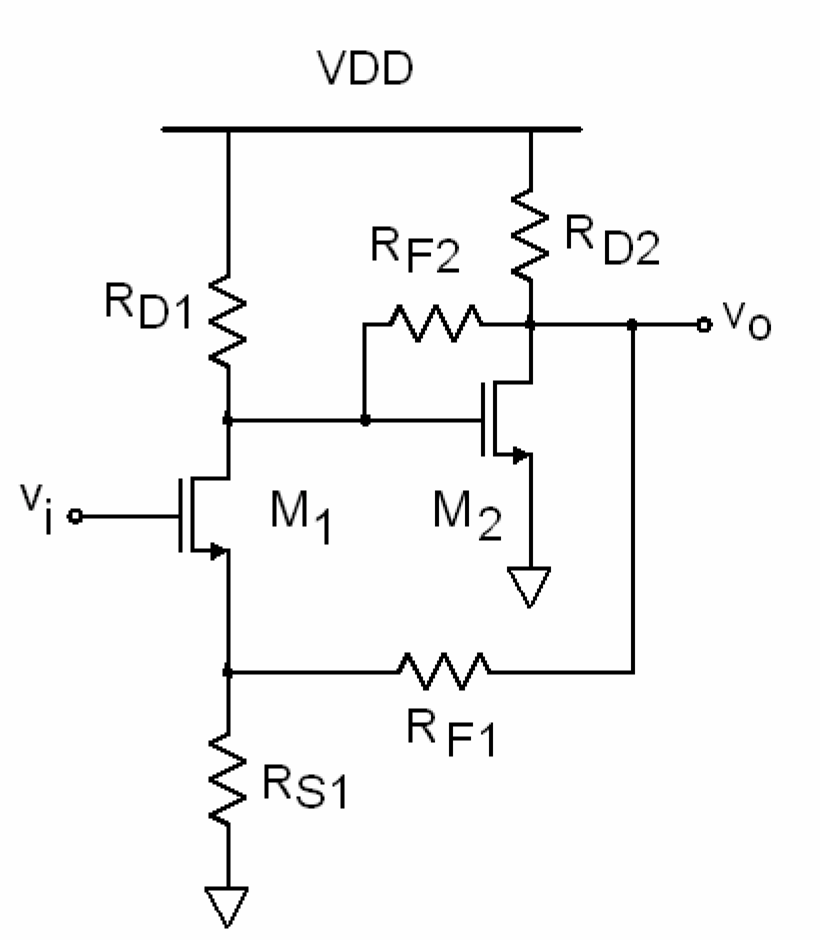

Fig. 4

For the circuit in Fig.4, suppose all resistors are equal to 2kΩ and $g_{m1} = g_{m2} = 1/200$ S Assume $\lambda = \gamma = 0$.

a) Identify the feedback loops in the circuit.
b) What kind of feedback of each feedback loop.
c) For the feedback loop include input and output, find expression for the forward gain A, the feedback gain f and the loop gain T.
d) Using feedback theory, find expression for the closed loop gain Vo/Vi, the input resistance and the output resistance.