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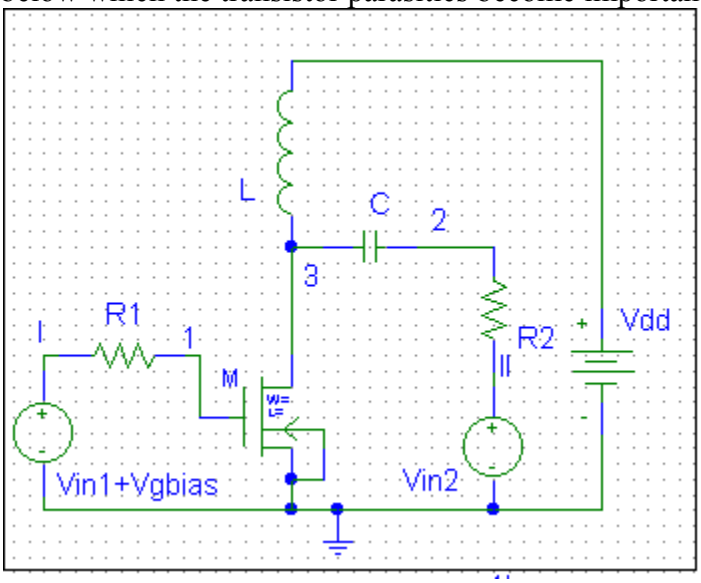
ENEE 610
Homework Problems for Grading, Set 5 (100 points)
Due at class W 11/10/04
Indefinite Y, S, Hurwitz polynomials

1. (80 points)

For the following circuit assume Vdd=9V, Vgbias=3V, and the transistor described by

$$Id = \frac{KP}{2}\frac{W}{L}(Vgs - Vth)^2$$

with Vth=1V, KP=10^{-5}A/V^2, W/L=10. Also assume Vin1 and Vin2 to be small signal and at a frequency below which the transistor parasitics become important.



a) Draw the small signal equivalent circuit evaluating gm and using C and L as parameters.

b) Find for small signals the indefinite Yind matrix for the circuit between nodes 1, 2, and ground (that is the circuit of C, L, M excluding R1 & R2).

c) Make Yind the definite Ydef by grounding the ground node and from that eliminate node 3 to calculate the Y matrix of the 2-port between nodes 1 and 2.

d) Assume R1=R2=1 and repeat b) to get the indefinite Yaug_ind for the two port between nodes I and II (the plus nodes of Vin1 and Vin2).

e) Repeat c), eliminating nodes 1, 2, 3, to get Yaug.

f) From the two matrices, Y and Yaug, find in two ways the scattering matrix S(s) of the 2-port comprising C, L, M.

g) Are there values of C and L for which S(s) is bounded-real? If so give their values while if not explain why not.

2. (20 points)

Using reactance functions check for the Hurwitz property

a) P1(s)=$s^6+6s^5+5s^4+4s^3+3s^2+2s+1$ b) P2(s)=$s^5+2s^4+3s^3+4s^2+5$