類比積體電路設計概論 HW6, due date: 28 Nov.

Please use the process parameters in the following table. A detailed explanation of these parameters is on the textbook, page 35

Table 2.1 Level 1 SPICE models for NMOS and PMOS devices.

NMOS Model			
LEVEL = 1	VTO = 0.7	GAMMA = 0.45	PHI = 0.9
NSUB = 9e+14	LD = 0.08e−6	UO = 350	LAMBDA = 0.1
TOX = 9e−9	PB = 0.9	CJ = 0.56e−3	CJSW = 0.35e−11
MJ = 0.45	MJSW = 0.2	CGDO = 0.4e−9	JS = 1.0e−8
PMOS Model			
LEVEL = 1	VTO = −0.8	GAMMA = 0.4	PHI = 0.8
NSUB = 5e+14	LD = 0.09e−6	UO = 100	LAMBDA = 0.2
TOX = 9e−9	PB = 0.9	CJ = 0.94e−3	CJSW = 0.32e−11
MJ = 0.5	MJSW = 0.3	CGDO = 0.3e−9	JS = 0.5e−8

$\varepsilon_{ox} = \varepsilon_{SiO2} \cdot \varepsilon_0$, $\varepsilon_{SiO2} = 3.9$, $\varepsilon_0 = 8.85*10^{-14}$ F/cm

Note:

1. 只有寫答案，該題將不會計分。請寫出解題過程。
2. 若沒有電路參數的數值，請用代數式寫出答案
3.

若沒有特別註明，VDD=3.3V; VSS=0V

HW6.1 (20 points)

假設省略其他寄生電容，請計算下列電路的輸入阻抗，用小訊號參數表示。

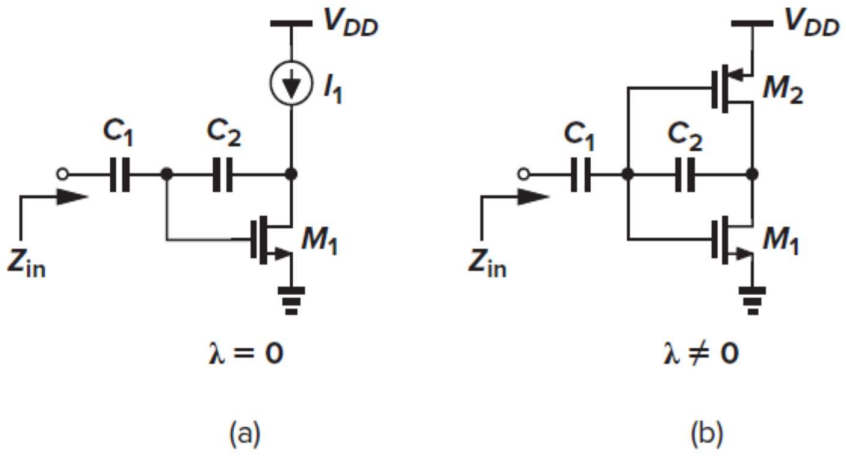

Fig. 6.1

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HW6.2 (30 points)

在Fig. 6.2中，我們將電流源I_1用一個pMOS電晶體(M2, in saturation region)取代，$(W/L)_2$ = 100μ/0.5μ。假設$(W/L)_1$ = 50μ/0.5μ, I_{D1} = 1mA, and R_S = 1kΩ，請計算所有的極點與零點頻率。For M1, its drain and source diffusion width is 0.5μm.

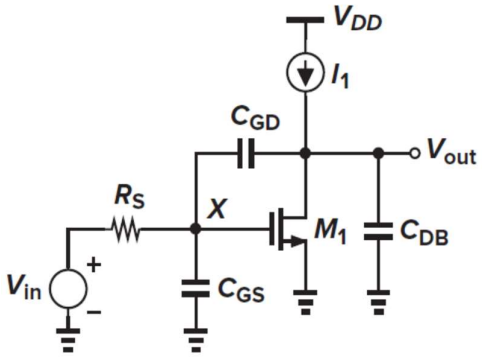

Fig. 6.2

HW6.3 (40 points)

請計算下列電路之輸入阻抗(Zin)與轉換方程式(Vout/Vin) ，用小訊號參數表示。

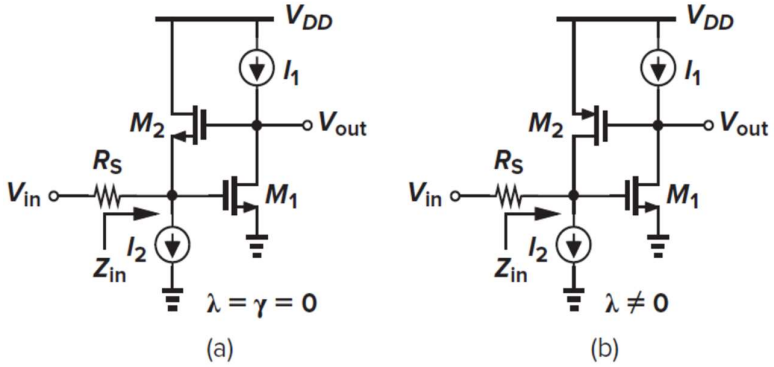

Fig. 6.3

HW6.4 (10 points)

在忽視其他寄生電容之下，計算 Zx，並畫出|Zx|與頻率之間的關係，用小訊號參數表示。

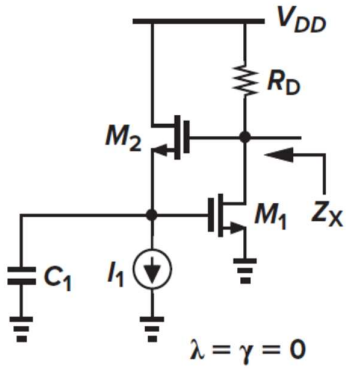

Fig. 6.4