類比積體電路設計概論 HW5, due date: 23 Nov.

Please using process parameters in the following table. The detail explanation of these parameters is in 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

HW5.1 (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。

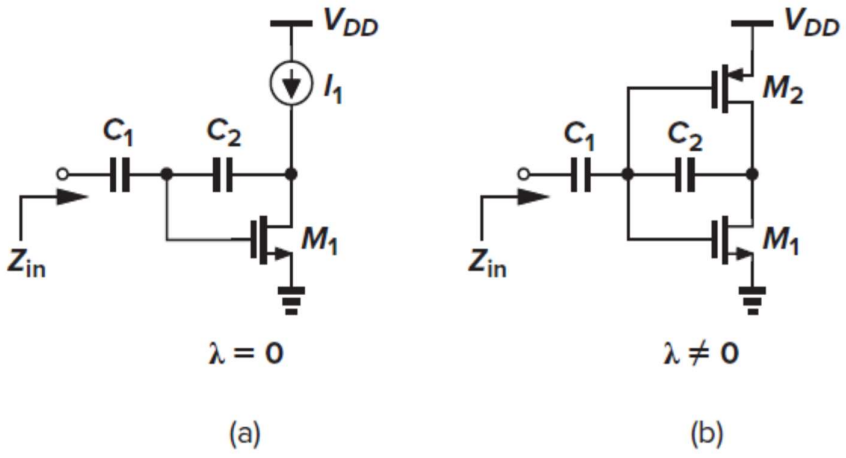

Fig. 5.1

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HW5.2 (30 points)

在Fig. 5.2中，我們將電流源I_1用一個pMOS電晶體(in Saturation region)取代。假設$(W/L)_1 = 50/0.5$, $I_{D1} = 1mA$, and $R_S = 1k\Omega$，請計算所有的極點與零點頻率。

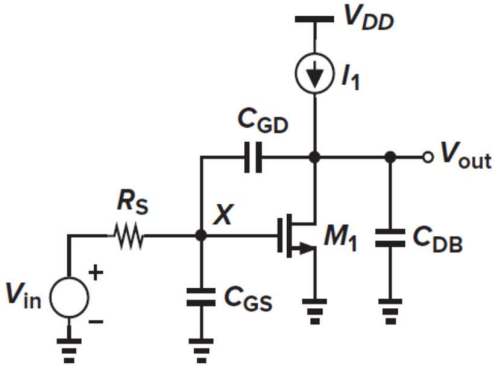

Fig. 5.2

HW5.3 (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。

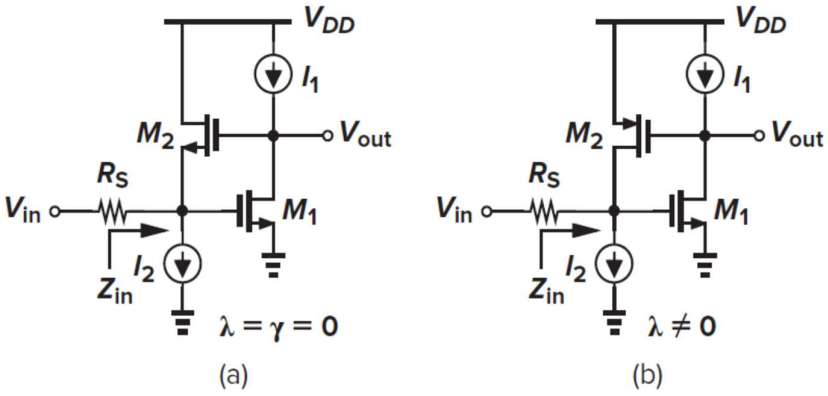

Fig. 5.3

HW5.4 (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。

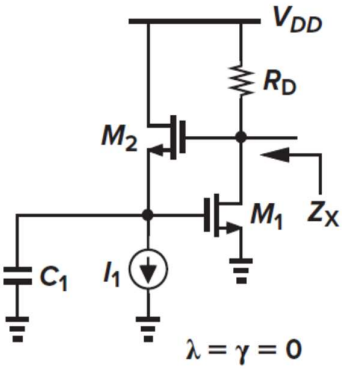

Fig. 5.4