VE311 Electronic Circuit Lab 4 Manual
Due: **Jul 20th 11:59 a.m.**

1 Objectives

- Study the Common-Source amplifier, and factors that may affect the voltage gain.
- The Exercise with * should be done in the Proteus and in-Lab sections.
- Caution: the transistors could become very hot with a high drain current. Don't touch them with bare hands before they fully cool down.

2 Exercises

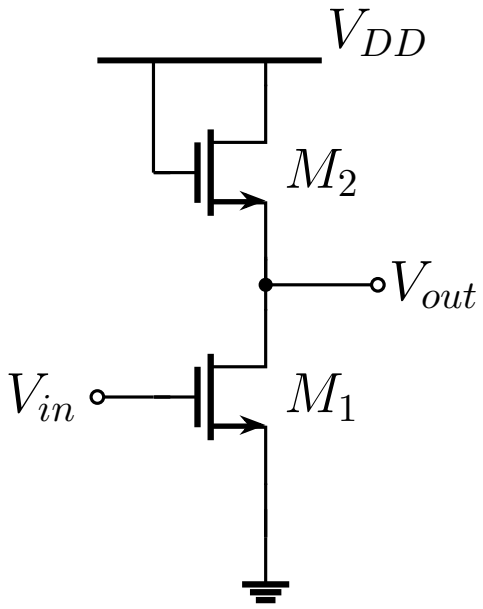
2.1 Common-Source with NMOS Diode-Connected Load

Choose $V_{DD} = 5\mathbf{V}$

1. Design and build a common-source with diode-connected load amplifier using NMOS(2N7000). Plot V_{OUT} vs V_{IN}. What is the voltage gain A_v? (Hint: Perform DC sweep of V_{IN} from 0 V to 3 V. Choose a V_{IN} at which both transistors are in the saturation region. The voltage gain is the slope of the DC sweep curve at the chosen V_{IN}.)

2. Following (2.2.1), now put two common-source NMOS in parallel. Plot V_{OUT} vs V_{IN} again. At the V_{IN} chosen in (2.2.1), does the voltage gain A_v double? Briefly explain the reason. (Note: Make sure all NMOS remain in the saturation region.)

3*. Following (2.2.2), choose a proper u (around 100mV), for $V_{in} = V_{IN} + u \cdot \sin(2\pi 10^2 \cdot time)$, plot $V_{out} = V_{OUT} + v_{out}$ vs time. Confirm that the amplitude of v_{out} is close to $u \cdot A_v$.



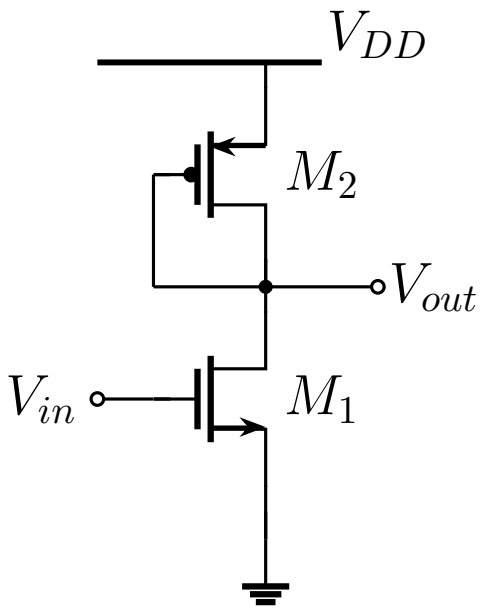
2.2 Common-Source with PMOS Diode-Connected Load

Choose $V_{DD} = 5\mathbf{V}$

1. Design and build a common-source with diode-connected load amplifier using NMOS(2N7000) and PMOS(TP2104). Plot V_{OUT} vs V_{IN}. What is the voltage gain A_v ? (Hint: Perform DC sweep of V_{IN} from 0 V to 3 V. Choose a V_{IN} at which both transistors are in the saturation region. The voltage gain is the slope of the DC sweep curve at the chosen V_{IN}.)

2. Following (a), now put two PMOS diode-connected loads in parallel. Plot V_{OUT} vs V_{IN} again. At the V_{IN} chosen in (a), how does the voltage gain Av change? Briefly explain the reason. (Note: Make sure all NMOS and PMOS remain in the saturation region.)

3*. Following (b), choose a proper u (around 100mV), for $V_{in} = V_{IN} + u\sin(2\pi 10^2 \cdot time)$, plot $V_{out} = V_{OUT} + v_{out}$ vs time. Confirm that the amplitude of v_{out} is close to $u \times A_v$.



3 Deliverable

You should attend the regular lab session and demonstrate your lab exercise to the TA. You should submit a lab report containing the following:

- Objectives
- Experimental results (numerical results, figures)
- Simulation results (numerical results, figures)
- Error analysis, and discussion
- Conclusion

Everyone needs to submit the report individually.