Lab 4: OTAs and Op Amp Circuits
Part B: Physical Experiments

This is a physical lab that should be completed during your regular lab session. The report will be due the following week, and should include the combined results from your simulations (Part A) and experiments (Part B).

Materials

- ALD1105 MOSFET array (2)
- 10kΩ resistor (1)
- Potentiometer
- Breadboard and hookup wire

Equipment

- Dual-output power supply
- Multimeter
- Oscilloscope

Procedures

Procedure 1. Using the ALD1105 MOSFET array chips, construct the circuit shown in Fig. 1 on a breadboard. Adjust the potentiometer until v_{ICM} is approximately 2.5 V.

Procedure 2. Connect the function generator's output to v_{sig}. Carefully adjust the signal settings to achieve a *very small* amplitude with an offset of 2.5 V at a frequency of 1 kHz. Using the oscilloscope, measure the precise peak-to-peak amplitude, offset votlage and frequency.

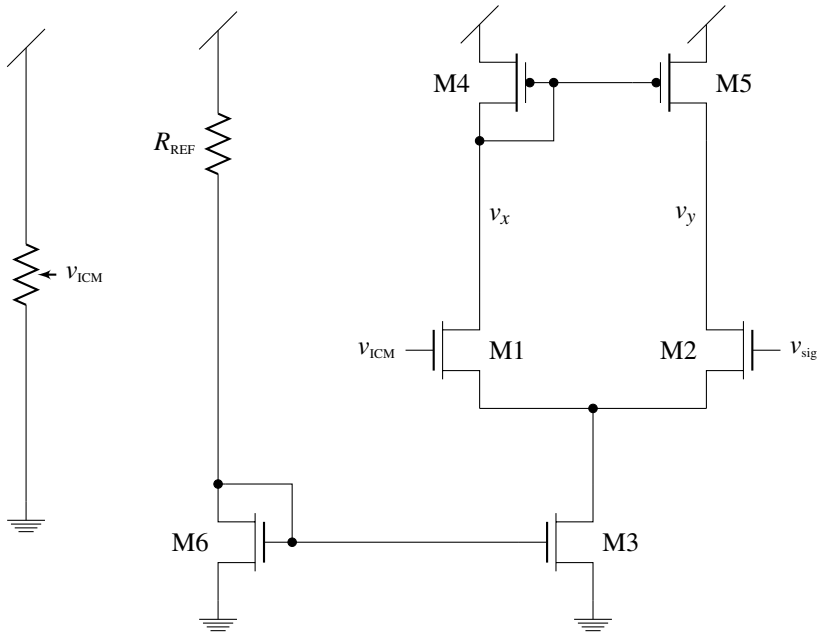

Figure 1: A simple OTA circuit. Since the lab's function generator does not provide differential signals, this circuit uses a potentiometer to control the input common-mode value, v_{ICM}. There is an implicit (not drawn) connection between the potentiometer's center tap and the gate terminal of M1.

Procedure 3. Now observe the circuit's output at v_y using the oscilloscope. If necessary, carefully adjust the potentiometer until a clean sinusoidal output is displayed. Measure the amplitude of v_y and, using this measurement, calculate the OTA's open-loop gain. How closely does this compare to your results from the pre-lab?

Procedure 4. Now increase the function generator's frequency until you locate the -3 dB frequency (i.e. the frequency at which the output amplitude is reduced by 30%). Record the measured frequency. How closely does it compare with your pre-lab calculation?

Procedure 5. Now activate the oscilloscope's FFT display and adjust the settings until you can see the fundamental and harmonic components. Measure the height of the fundamendal and first harmonic.

Procedure 6. While viewing the oscilloscope's FFT output, carefully increase the amplitude of v_{sig}. Measure and record the heights of the fundamental and first harmonic component. What do these measurements reveal about distortion? How is distortion affected by the signal amplitude? Do the physical distortion measurements match with the trend observed in simulation?