A Simple MOS Differential Amplifier

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All experiments were conducted in LTspice.

Experiment 1: Voltage Transfer Characteristicss

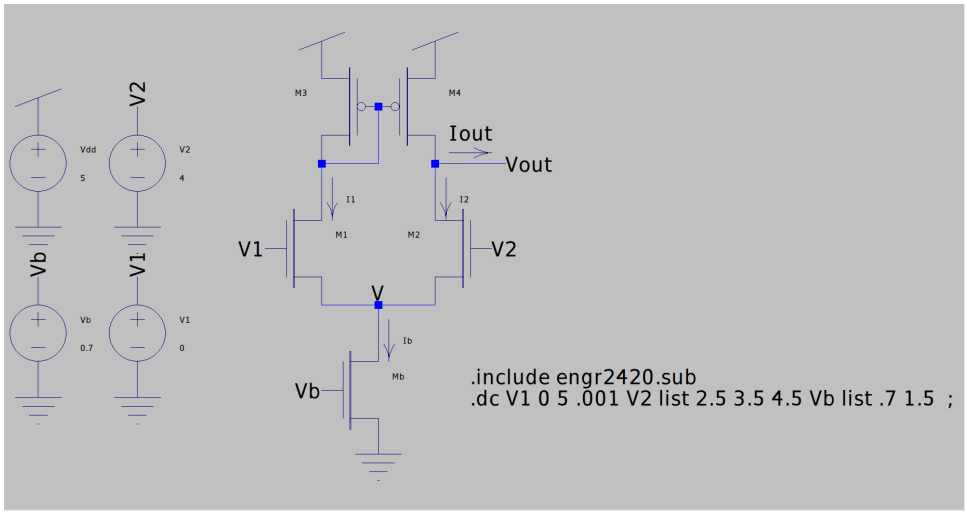

Figure 1: Schematic for Experiment 1

The VTCs for weak and strong inversion as shown in Figures 2 and 3. The VTC is significantly more nonlinear in the regions outside of $V_{dm} \approx 0$ in strong inversion than in weak inversion. Additionally, the VTC rises slower during the $V_{dm} \approx 0$ region in strong inversion, as compared to weak inversion; correspondingly, it reaches a lower height at the upper end of the region in strong inversion, as compared to weak inversion.

Experiment 2: Transconductance, Output Resistance, and Gain

V_b	R_{out}	G_m	A_{dm} Calculated	A_{dm} Fit
$0.7V$	$79.2M\Omega$	$3.89\mu\mho$	308.296	229.821
$1.5V$	$9.27M\Omega$	$43.2\mu\mho$	399.93	90.578

Table 1: A_{dm} calculation

The value for A_{dm} found in weak inversion by fitting is relatively similar to the value find via calculation. However, the value for A_{dm} found via fitting in strong version drastically differs than the value found via calculation.

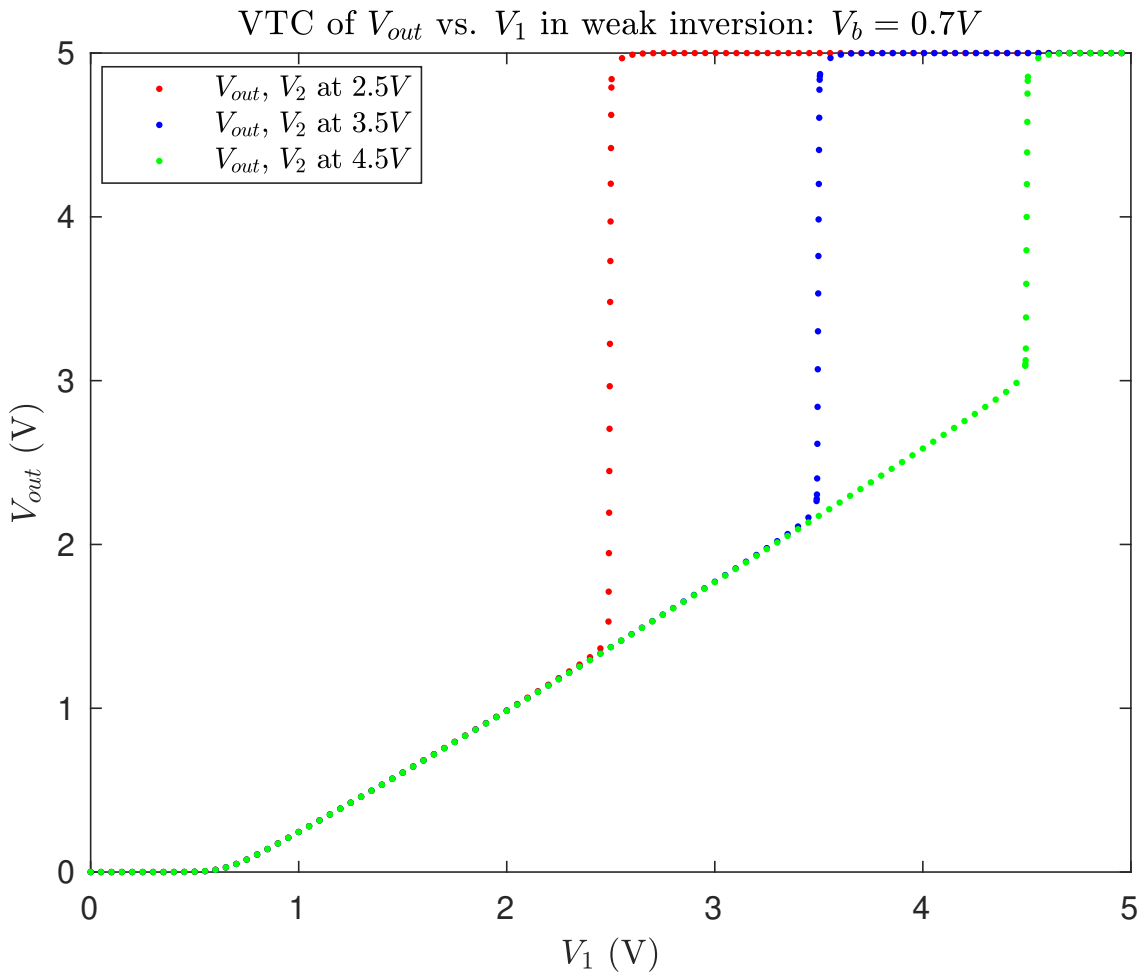

Figure 2: VTC of the simple MOS differential amplifier in weak inversion

Experiment 3: Unity-Gain Follower

The incremental gain is very close to unity. It is .9966 dim-less

Figure 11 shows us that offset voltage is near 0 for a majority of V_{in}. Below $.5V$, the offset voltage rises far above 0. Above $4.9V$, the offset voltage falls precipitously.

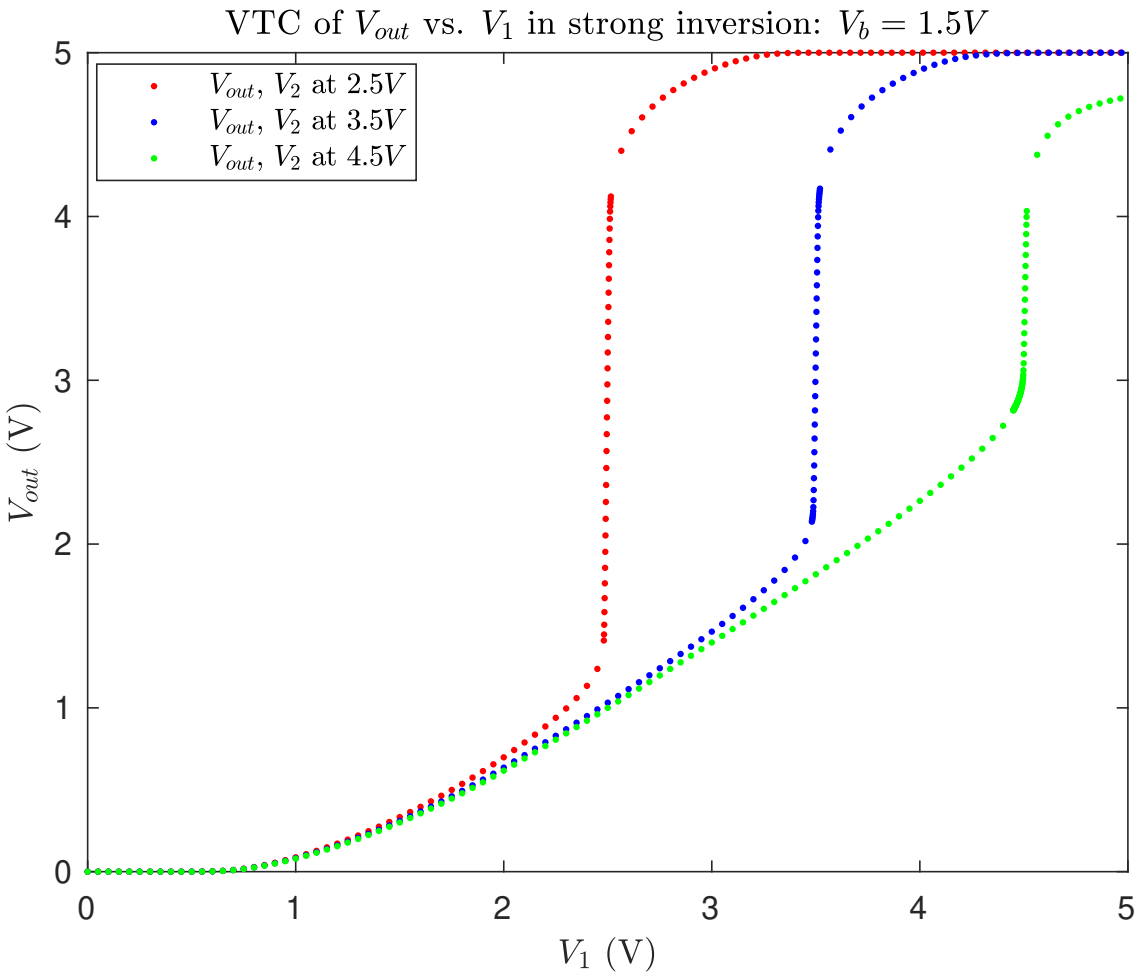

Figure 3: VTC of the simple MOS differential amplifier in strong inversion

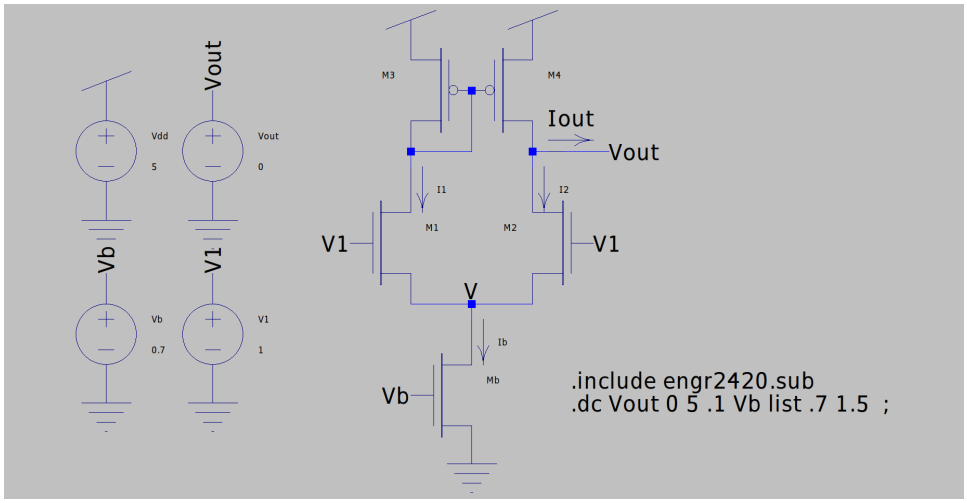

Figure 4: Schematic for Experiment 2

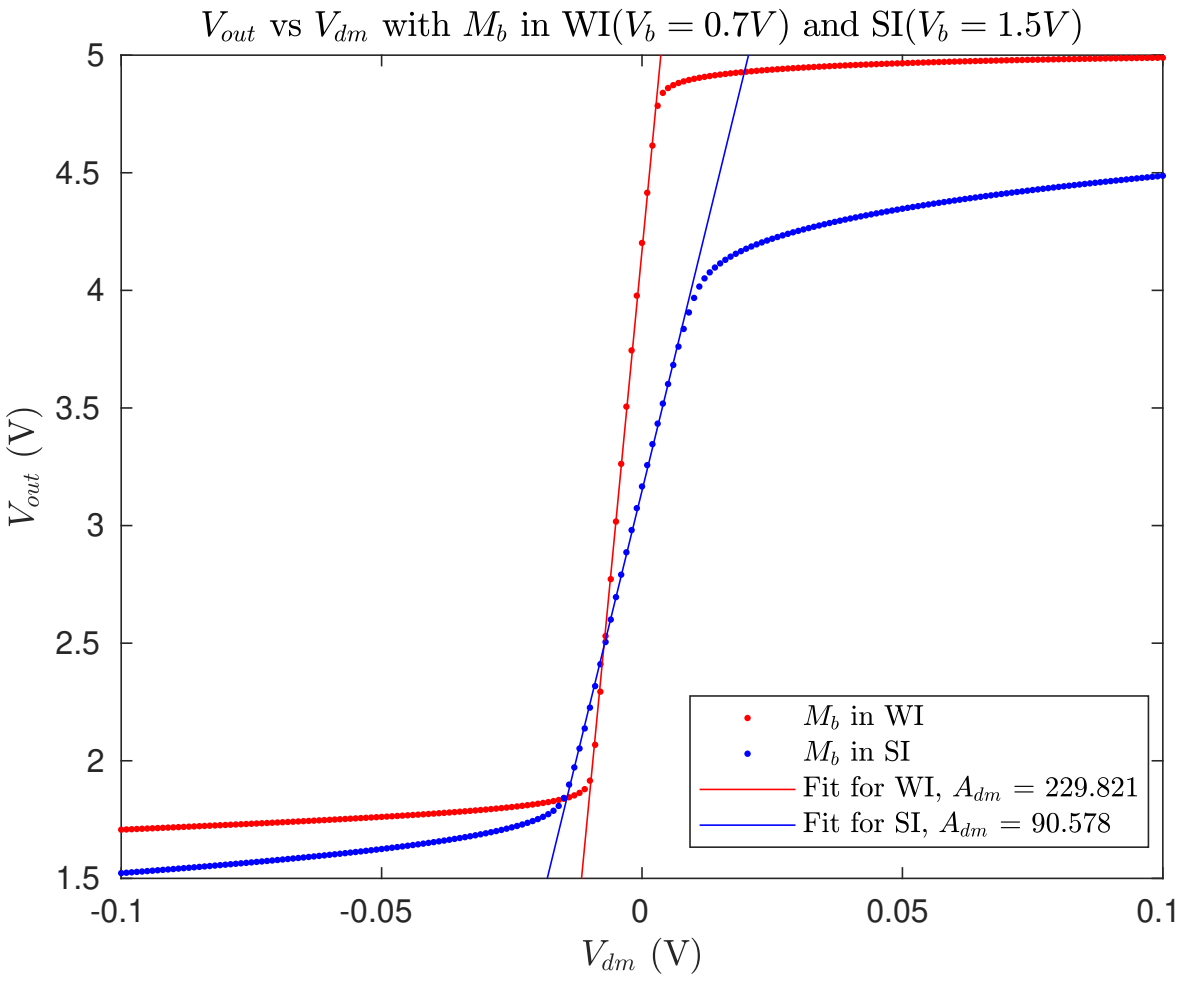

Figure 5: Differential Mode Gain

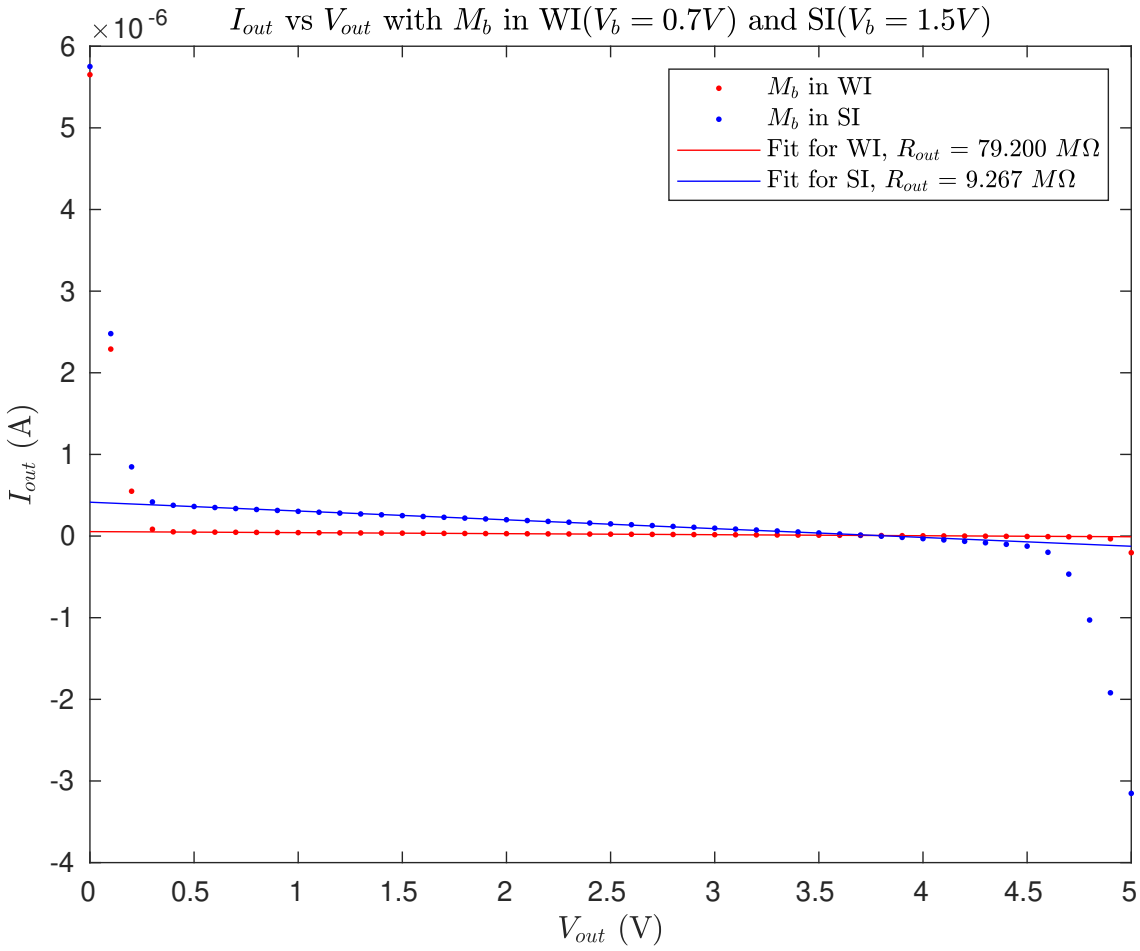

Figure 6: Incremental Resistance on Output Node

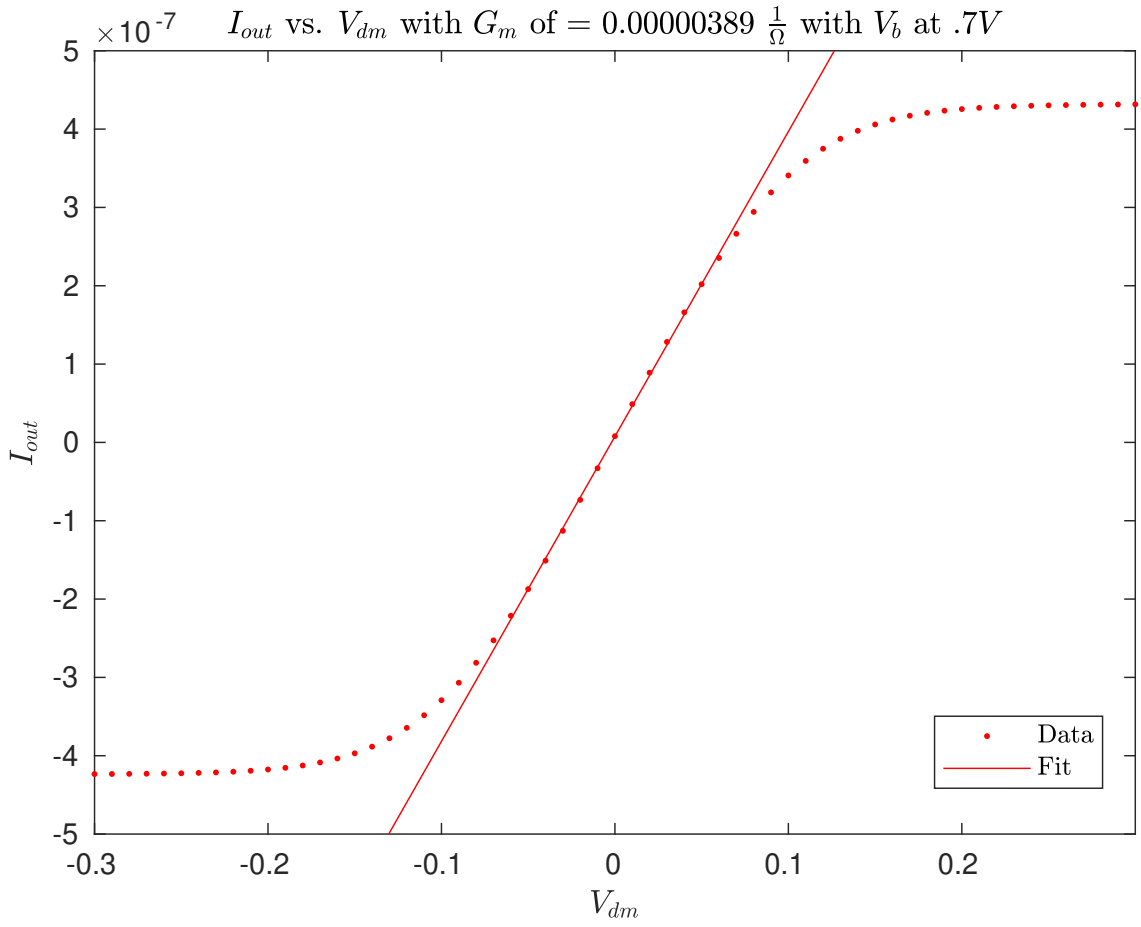

Figure 7: Incremental Transconductance in Weak Inversion

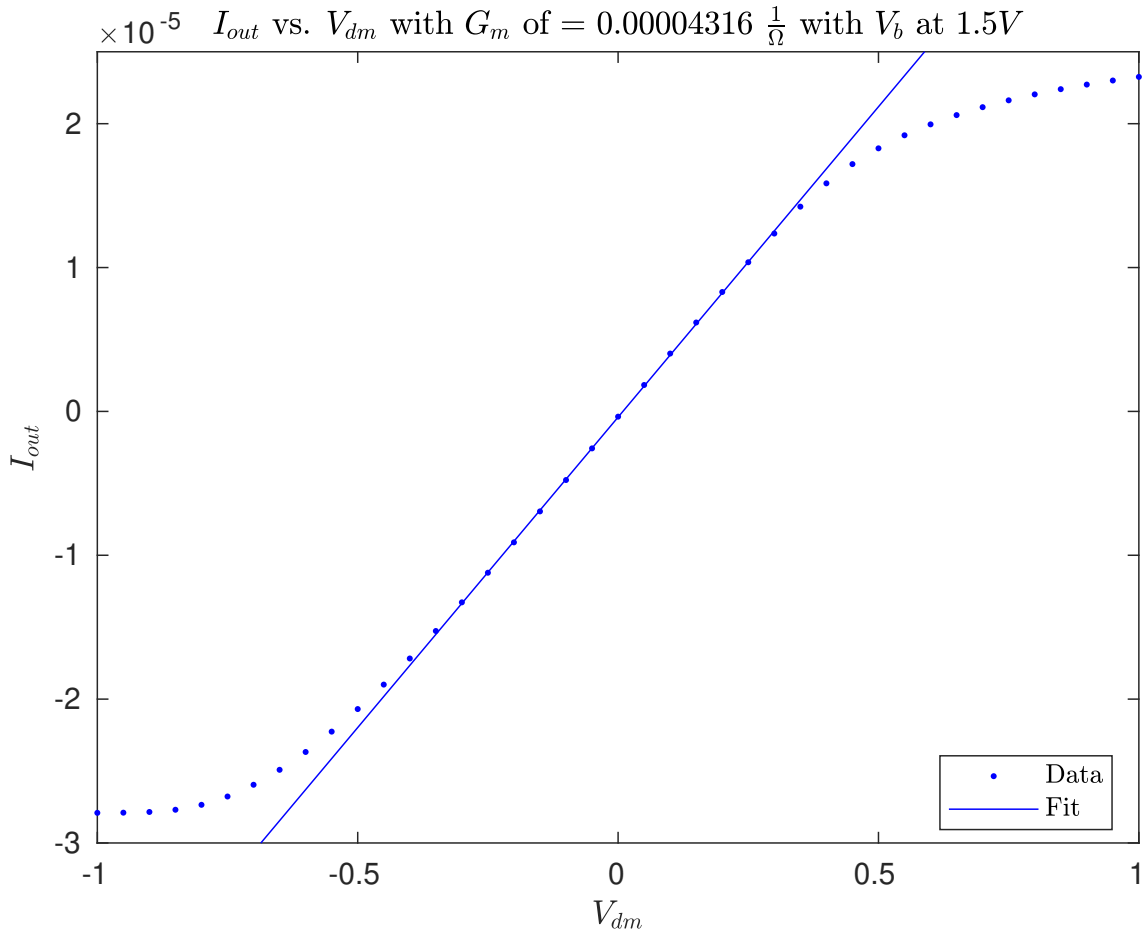

Figure 8: Incremental Transconductance in Weak Inversion

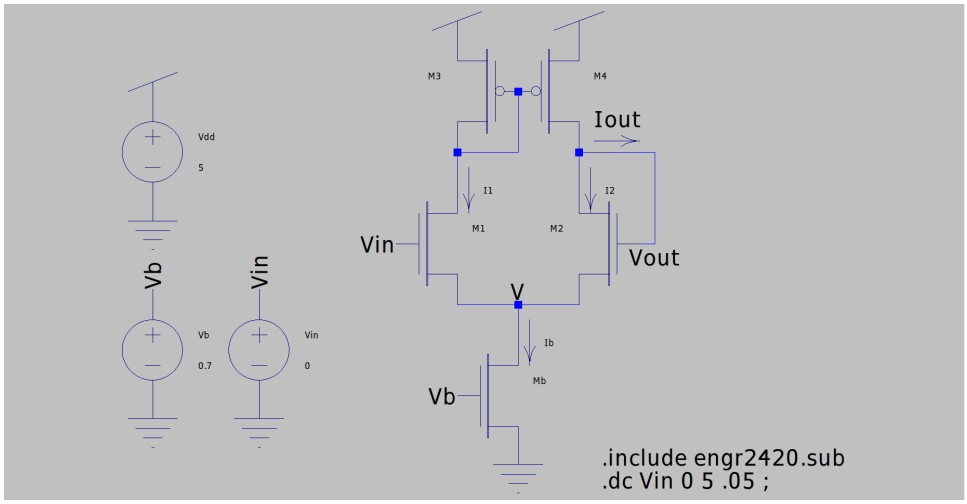

Figure 9: Schematic for Experiment 3

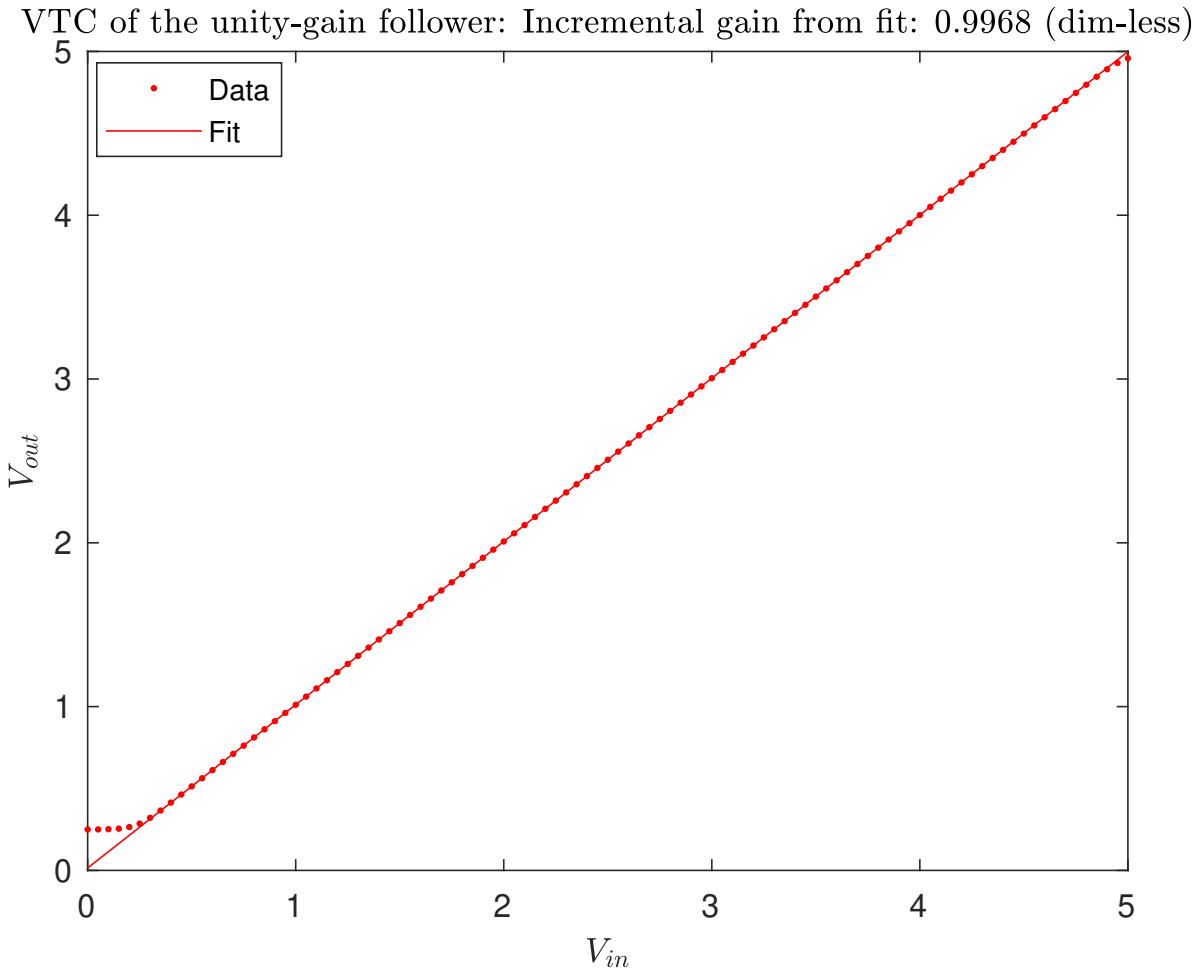

Figure 10: Voltage Transfer Characteristic of a Unity-Gain follower

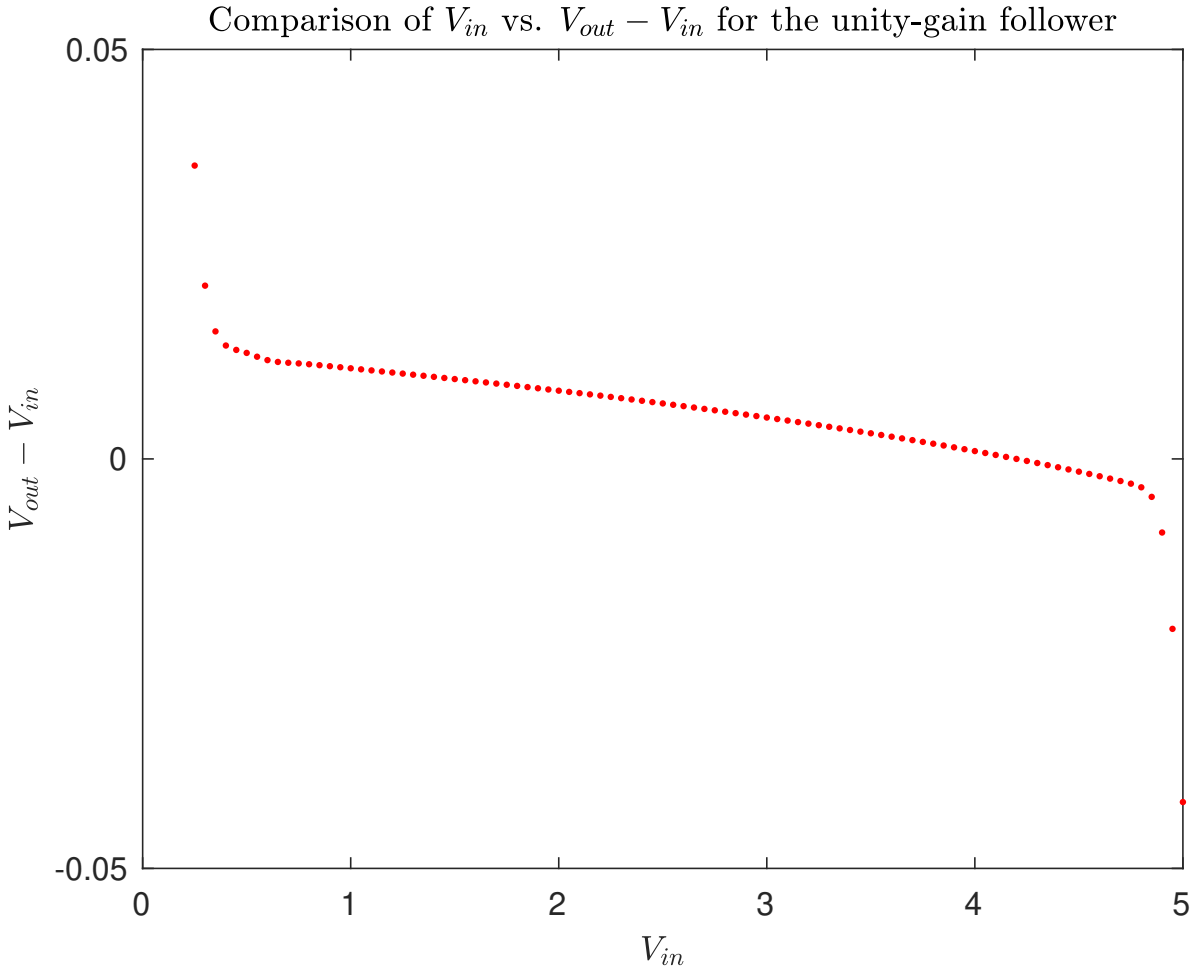

Figure 11: Offset Voltage of Unity-Gain Follower