Circuits Lab 8

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1 Experiment 1

We constructed a differential amplifier with an nMOS differential pair and a pMOS current mirror, swept V_1 and measured V_{out} for three different values of V_2. We constructed the a plot showing all of these voltage transfer characteristics when M_b is in weak to moderate inversion, seen in Figure 1. We repeated for M_b in strong inversion, shown in Figure 2 on the next page. The behavior does not differ significantly at all.

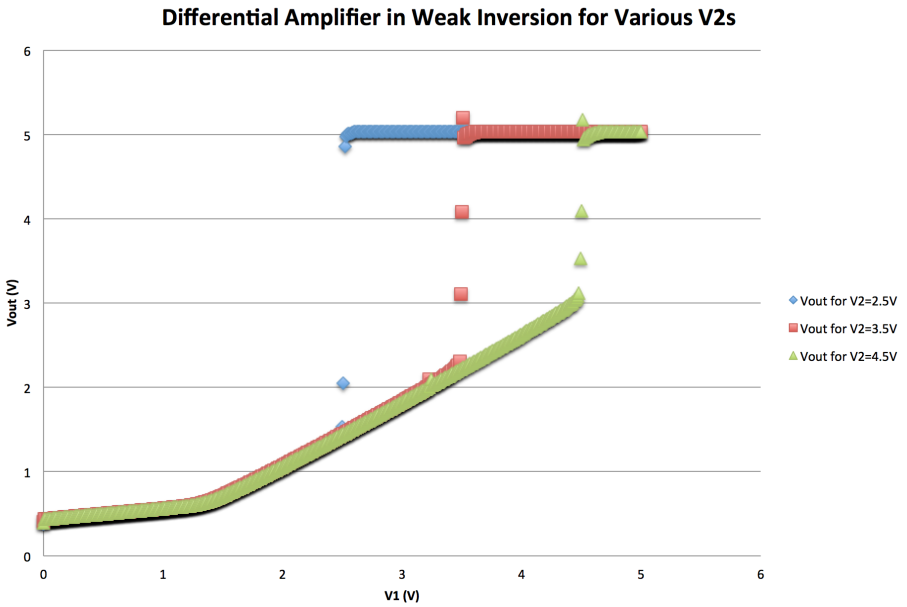

Figure 1: A plot showing the voltage transfer characteristic for a differential amplifier with M_B set to be in weak inversion. Note the slight offset in the vertical direction is due to measurement weirdness related to the internal resistances

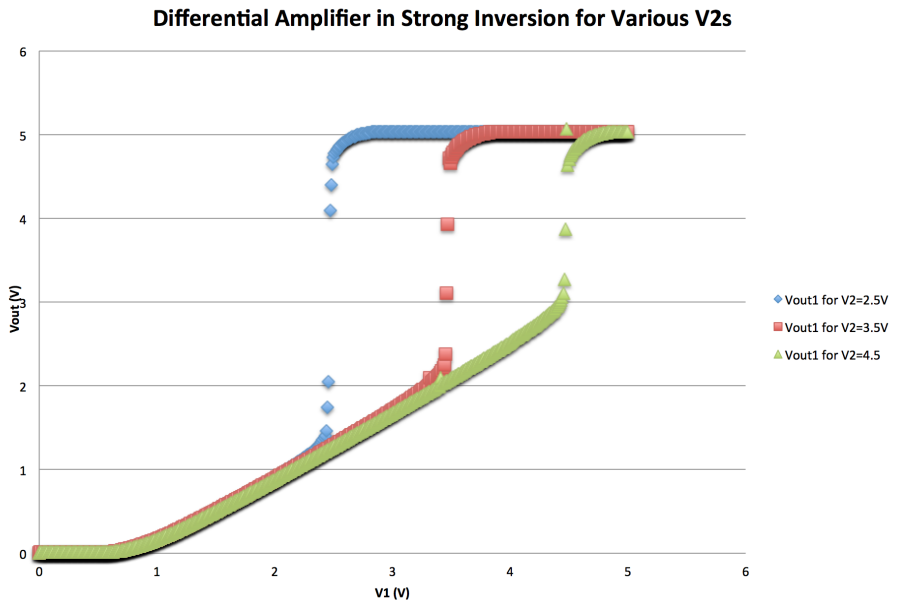

Figure 2: A plot showing the voltage transfer characteristic for a differential amplifier with M_B set to be in strong inversion

2 Experiment 2

First we swept a narrow range of V_{dm} for $V2 = 3.5V$ and extracted a differential-mode voltage gain of about 180 as shown in

Next, we measured the output current into the system as we swept V_{out} and kept V_{dm} at zero. The results are graphed in

Finally, we swept V_{dm} again for $V_{out} = 3.5V$ and measured current as before - the results are in

Using the last two figures, $A_{dm} \approx -.15$, which is very off from our direct measurement earlier. Both are higher than the common-mode gain.

3 Experiment 3

We configured our amplifier as a unity-gain follower and recorded its voltage transfer characteristic with a straight line fit, as shown in Figure 6 on page 4. The line has a slope of 1.196, which is relatively close to unity. We then measured Vout-Vin as we swept Vin as shown in plot Figure 7 on page 5, known as the offset voltage of the amplifier. This offset voltage increases until around the value of V2 after which is starts to somewhat rapidly decline.

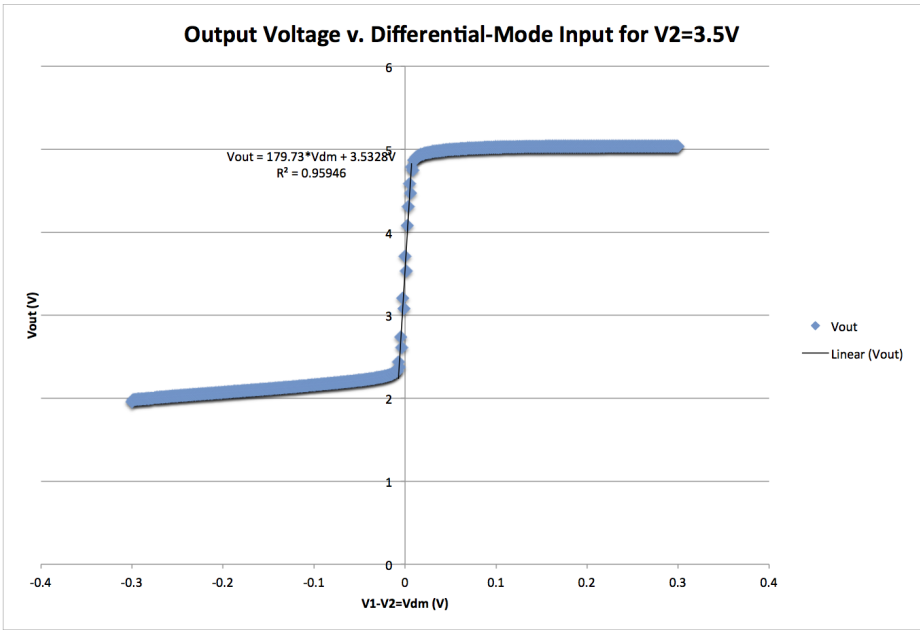

Figure 3:

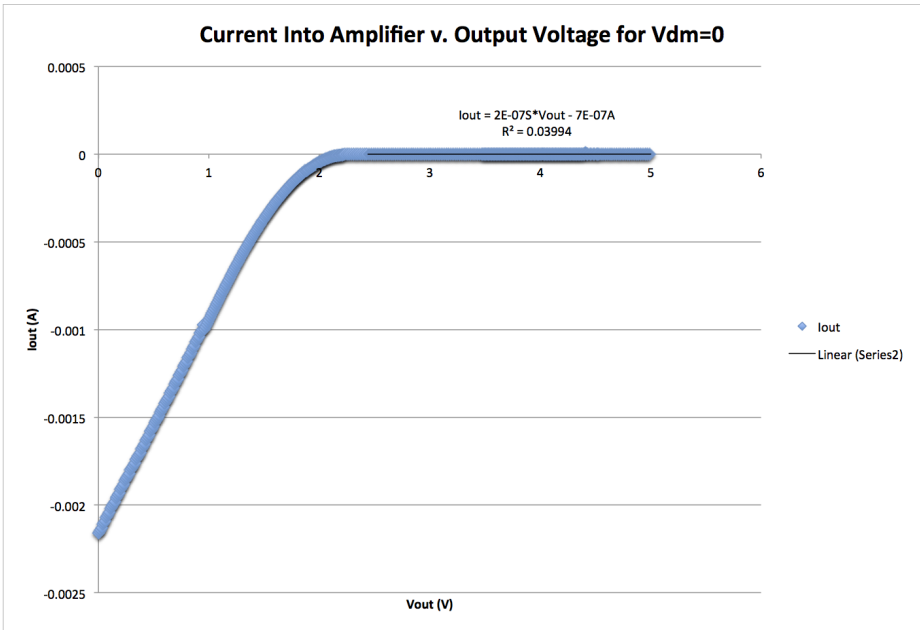

Figure 4:

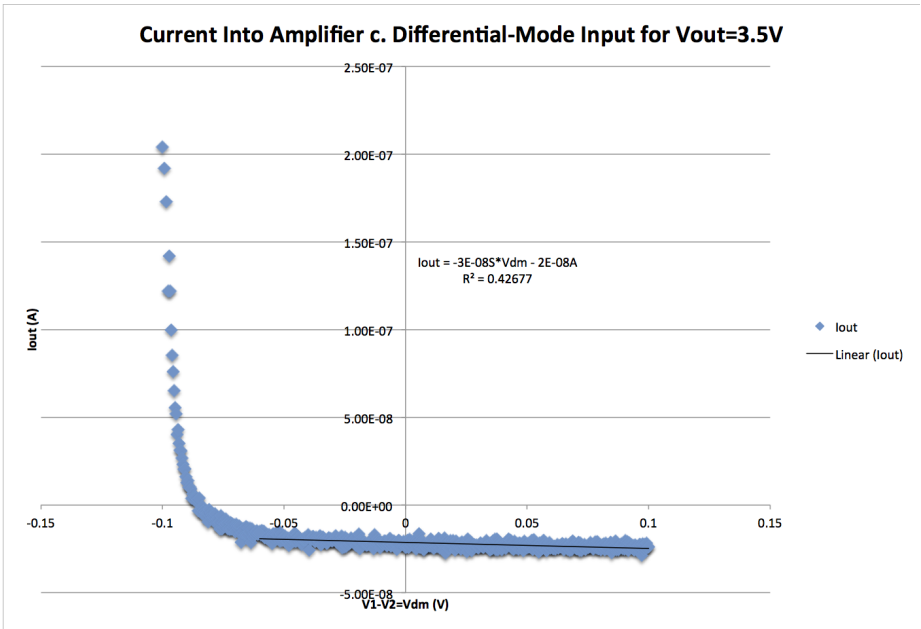

Figure 5:

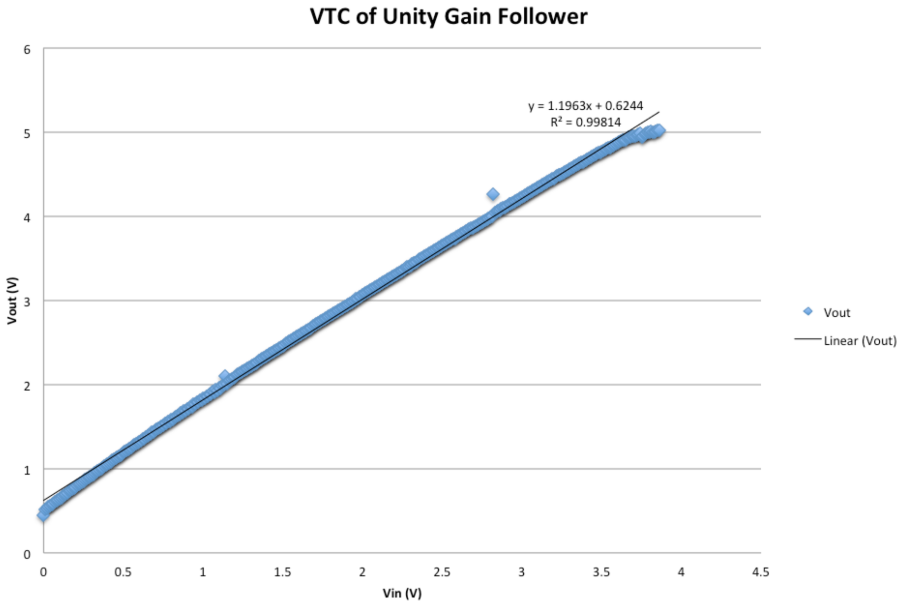

Figure 6: A plot showing Vout versus Vin along with the best-fit line with slope of 1.196

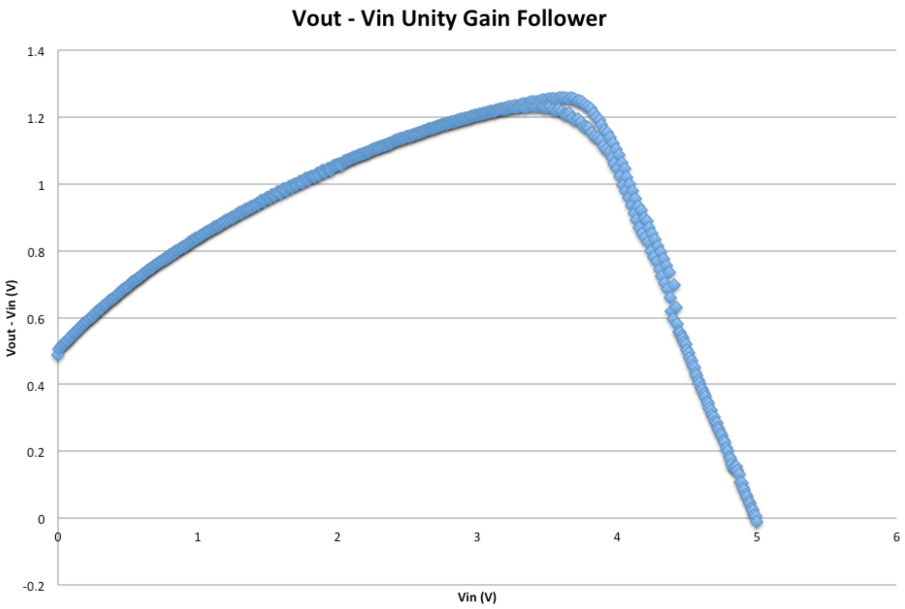

Figure 7: A plot showing Vout-Vin as a function of Vin which is the offset voltage of the amplifier. Note V2 is set to 3.5V