California State University Sacramento
Electrical and Computer Science Department

EEE 108L Lab - Section 05
Laboratory Experiment Number 1: Lab Report

<u>PSPICE Analysis Techniques</u>

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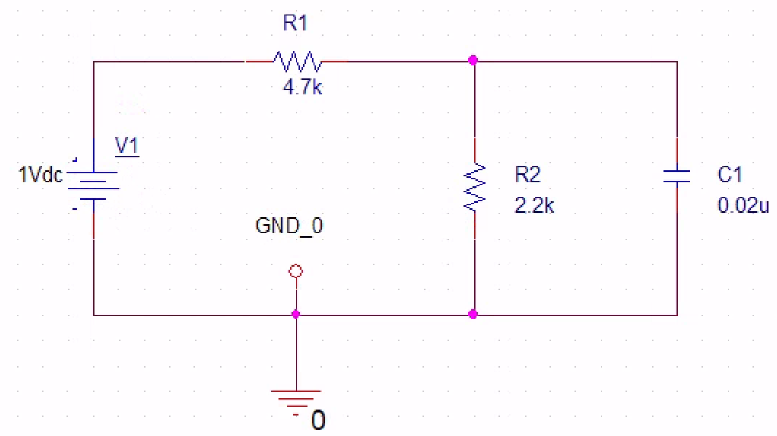
Abstract

For this laboratory experiment I used Pspice to investigate and analyze a simple circuit. The experiment has three different types of analyses tests which include DC sweep, AC sweep, and transient. This lab is meant to give a better understanding on Pspice as it shows you many different tracing functions and applications that are necessary for this course.

Preliminary Calculations

STEP 1: Set up the given circuit in Pspice with the values R1=4.7kΩ R2=2.2kΩ C=0.02μF



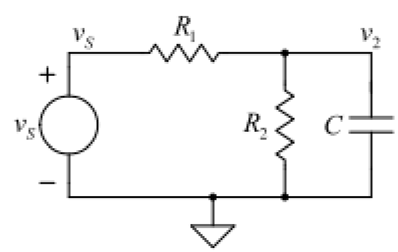


Figure 1. Drawn Schematic

Figure 1

Calculate the magnitude of the transfer function V2/Vs

V2/Vs= R2/(R2+R1)

2.2kΩ/(2.2kΩ+4.7kΩ)=0.318V

Also calculate the upper -3db frequency of V2/Vs (see appendix A3.2)

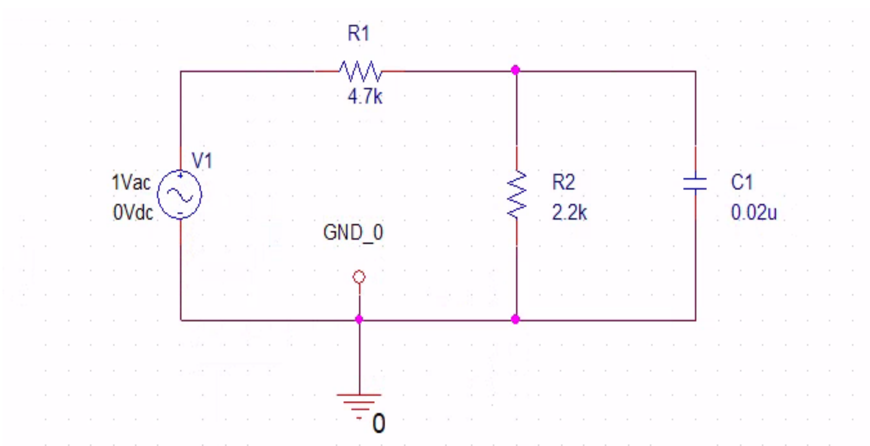
1/2**π**RC = 1/ 2**π**(1.499Ω)(0.02**μF**)= 5311Hz

STEP 2: Calculate the rise time of the V2 from 10% to 90% in response to a step input of Vs.

TR = 0.35/5311= 0.00006

Part 1: Setting up the simulation

STEP 3: Set of the circuit with the values for R1, R2, C.



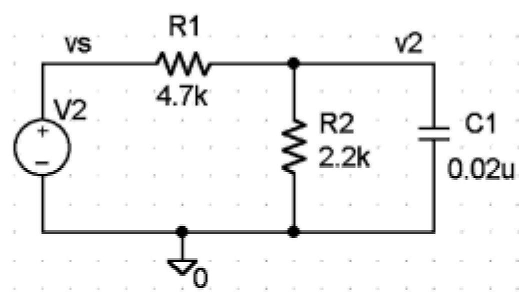


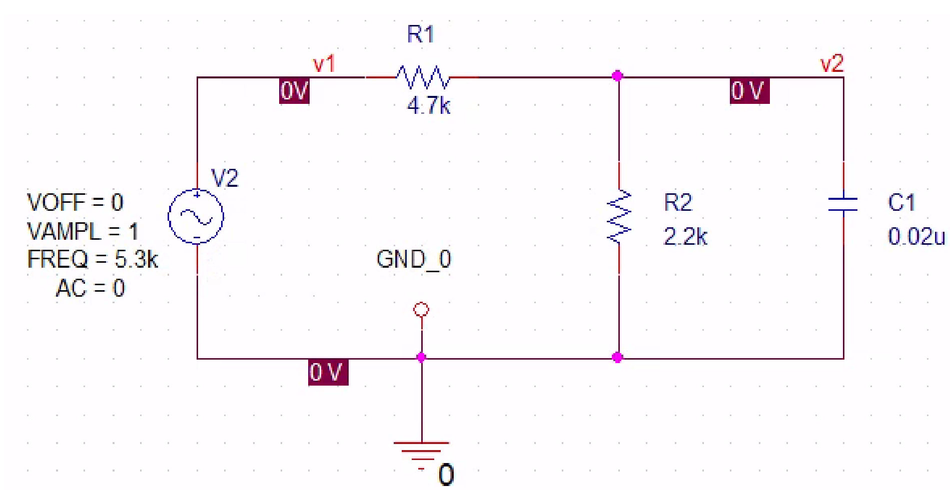
Figure 2. PSPICE Schematic

In this circuit you can see in the next figure that V1 and V2 were added to the circuit to be used in the trace function.

Part 2: DC Sweep

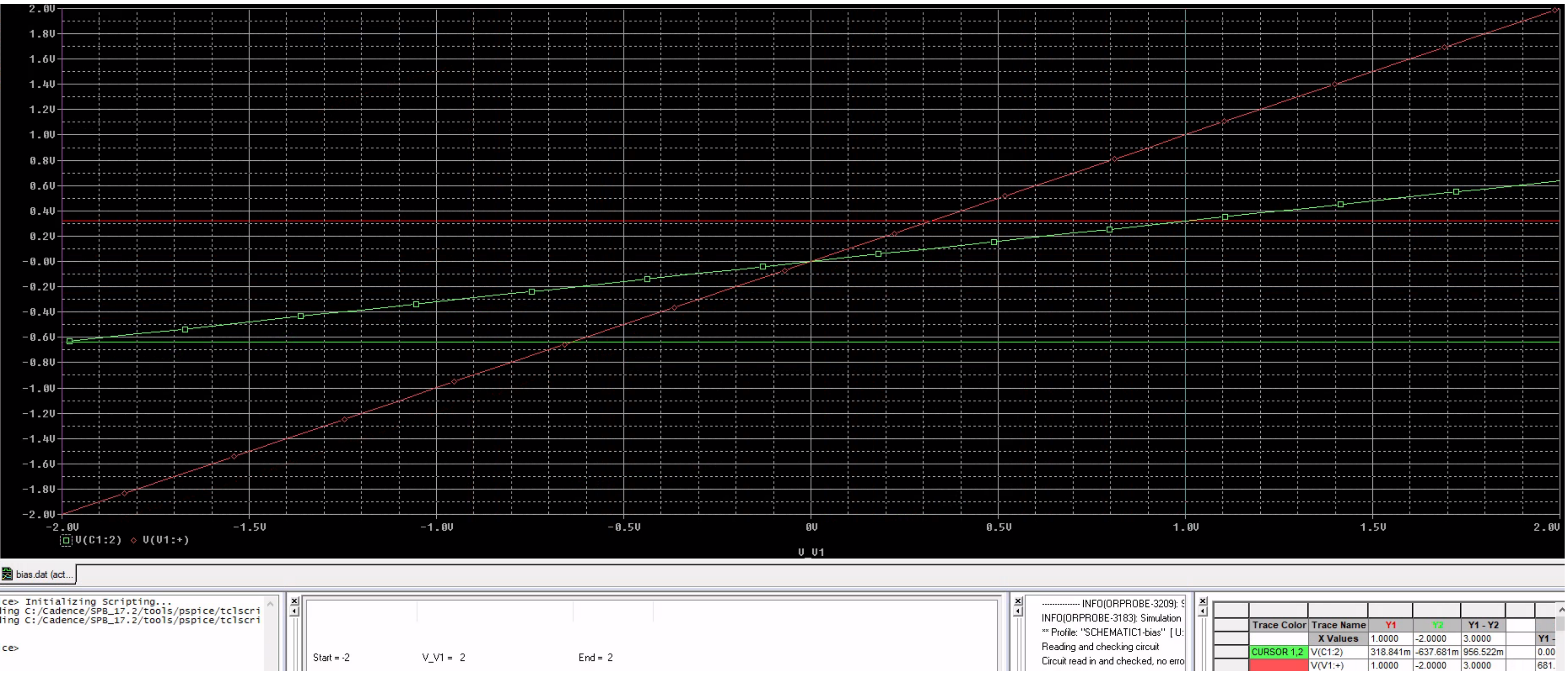
STEP 4: DC sweep analysis

This is the circuit ready to be used to find the DC sweep. In this step I will run the simulation of this circuit.

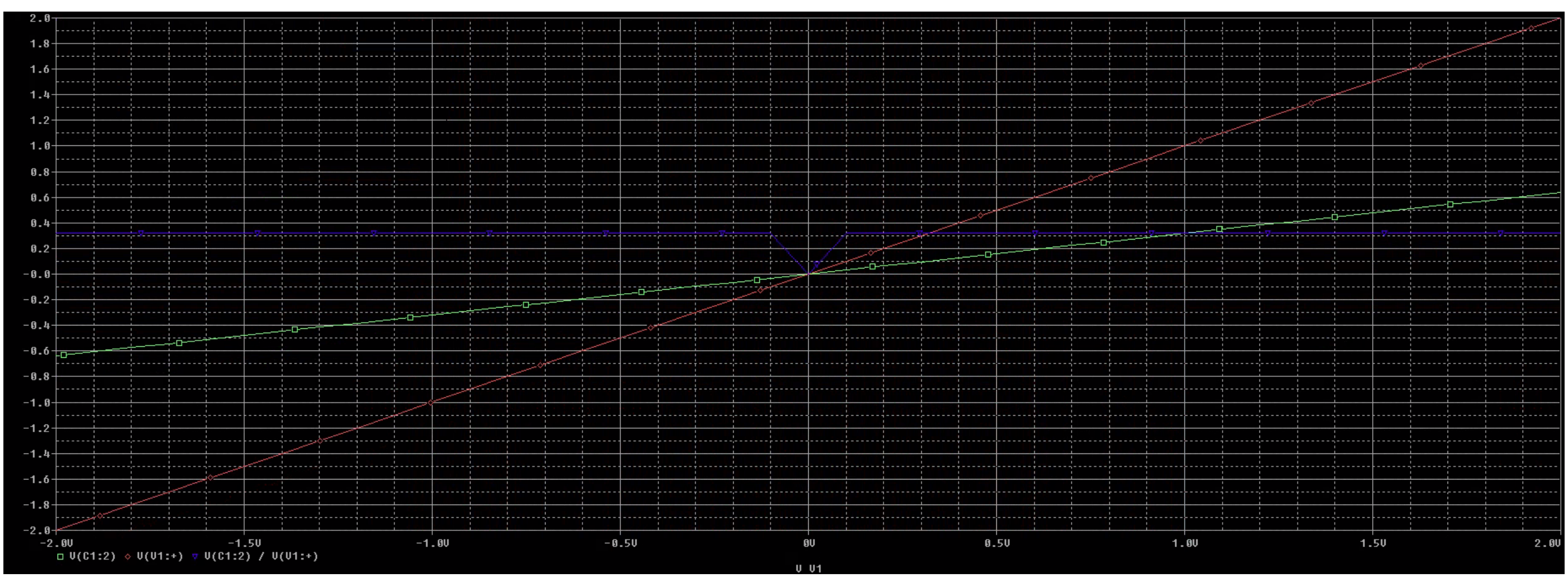


STEP 5: Trace the display

Once setting up the trace function with the required settings from the lab manual. The redline is the input while the green line represents the output of the DC sweep.



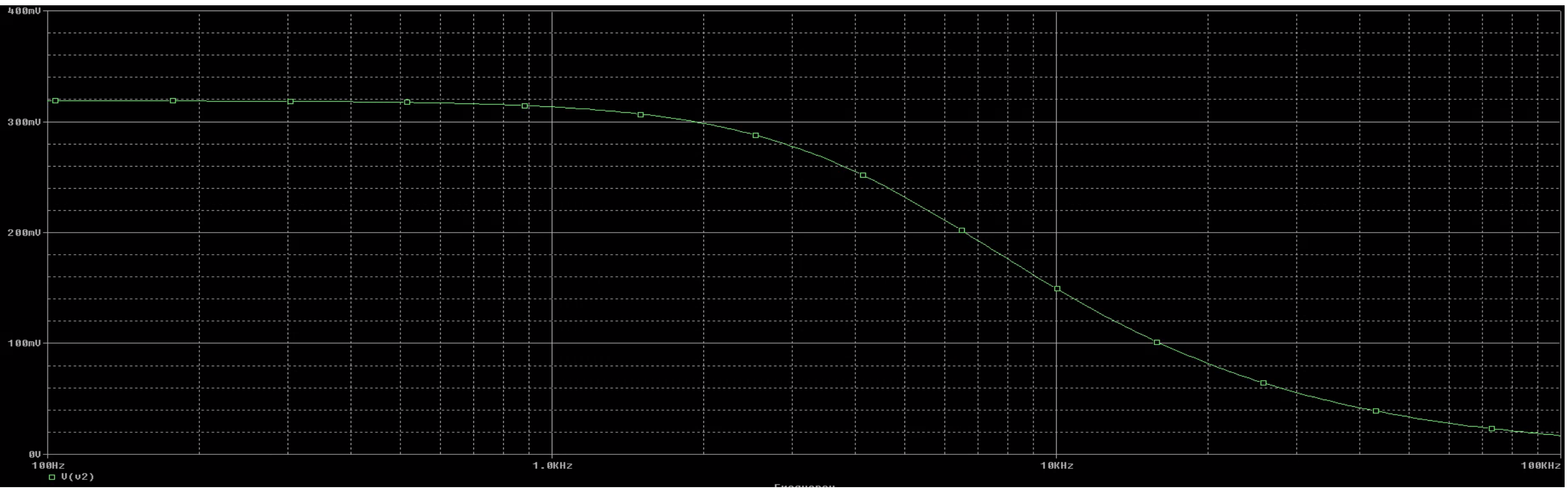
STEP 6: Explore alternate ways of finding the gain.



The blue line is proof of the gain in the circuit. When making a trace using v(v2)/v(v1) the blue line was the output.

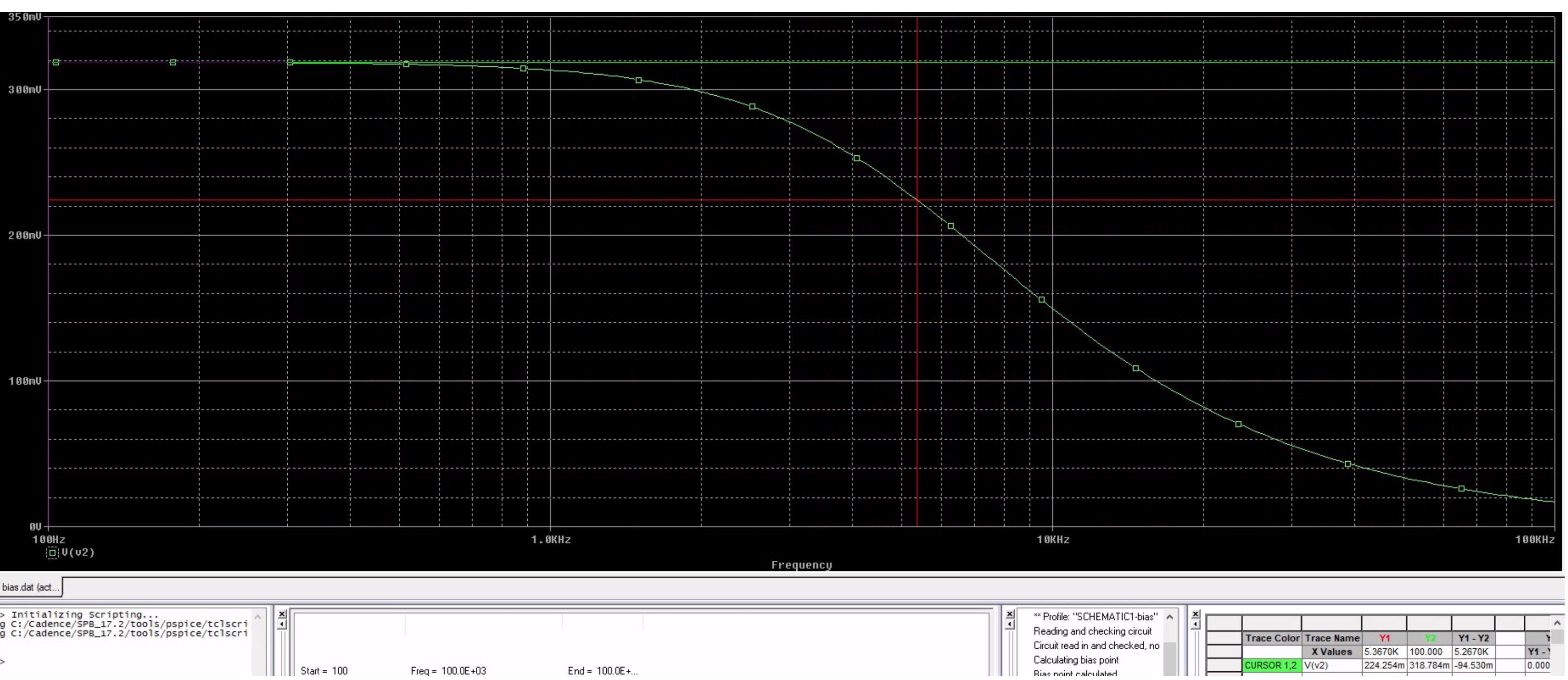
Part 3: AC Sweep

STEP 7: AC sweep analysis

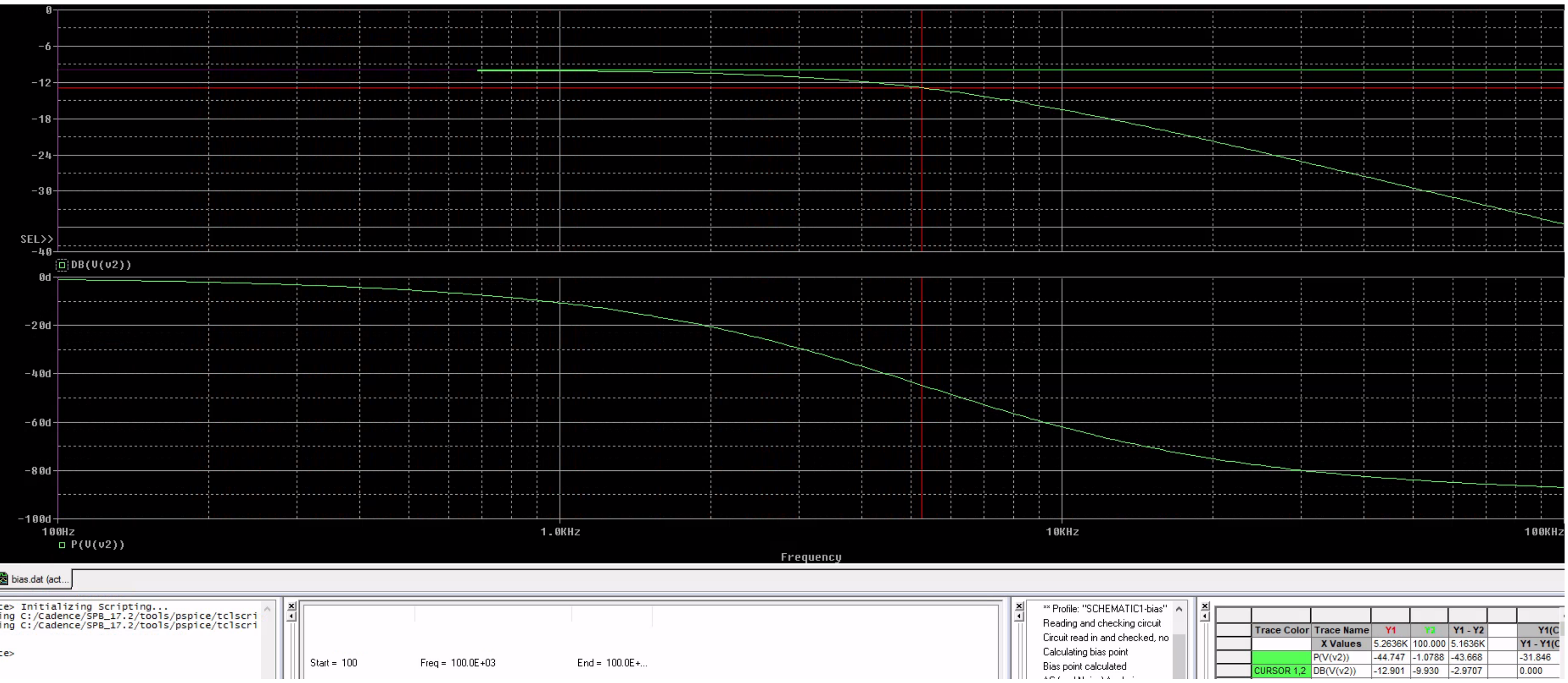


STEP 8: Start a new trace with cursor

This figure is of the trace used find DB(V(v2))



STEP 9: Determine -3db frequency and compare to Step 1.



For this cursor value, I put the cursor Y1 on -12.901 with gave me the value of the green graph and that would be Y2 = -9.930 and when you subtract Y1- Y2 = -2.97db

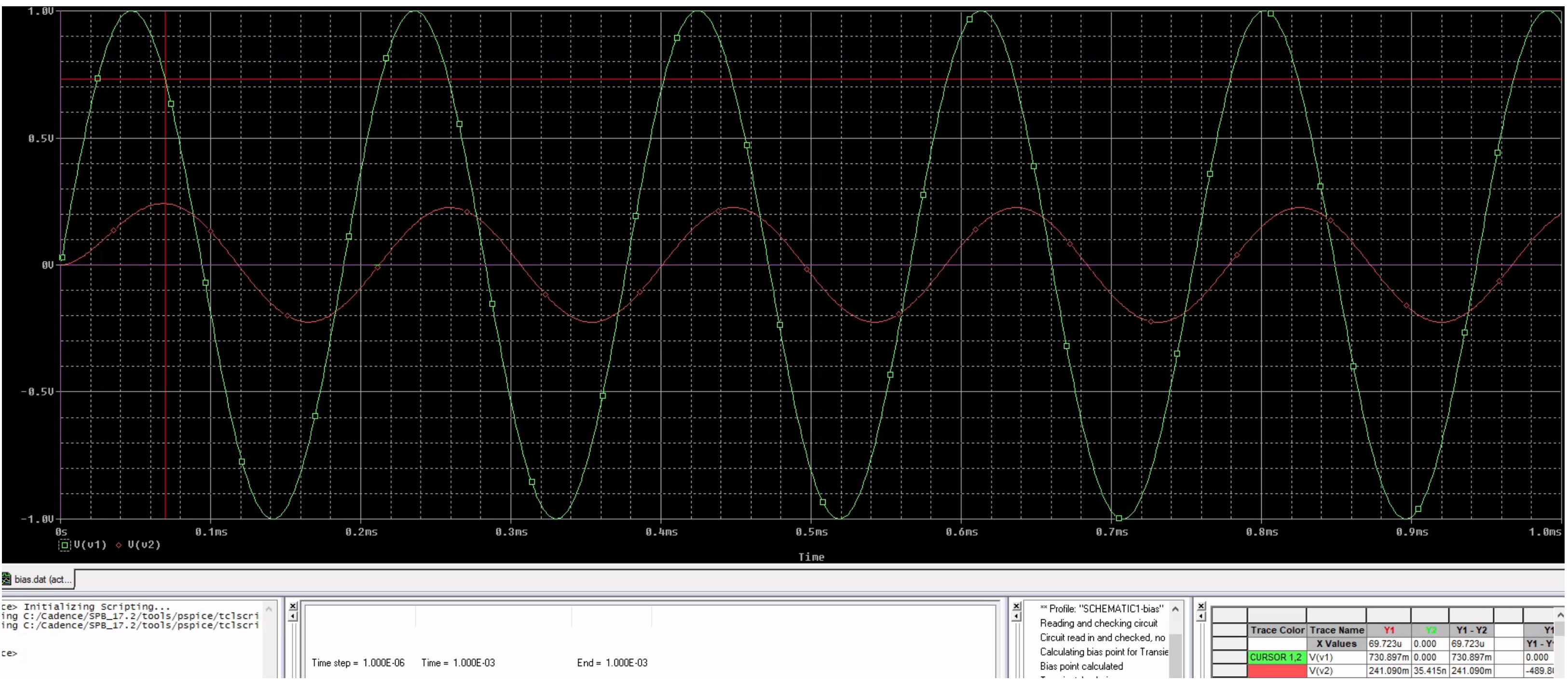
STEP 10: Determine the phase

From the plot, determine the phase of at the upper –3dB frequency.

Y2 = -9.930 and when you subtract Y1- Y2 = -2.97db

Part 4: Transient simulation

STEP 11: Use Vsin and set the values. Find the peak to peak magnitude of Vs and determine the absolute value of V2/Vs

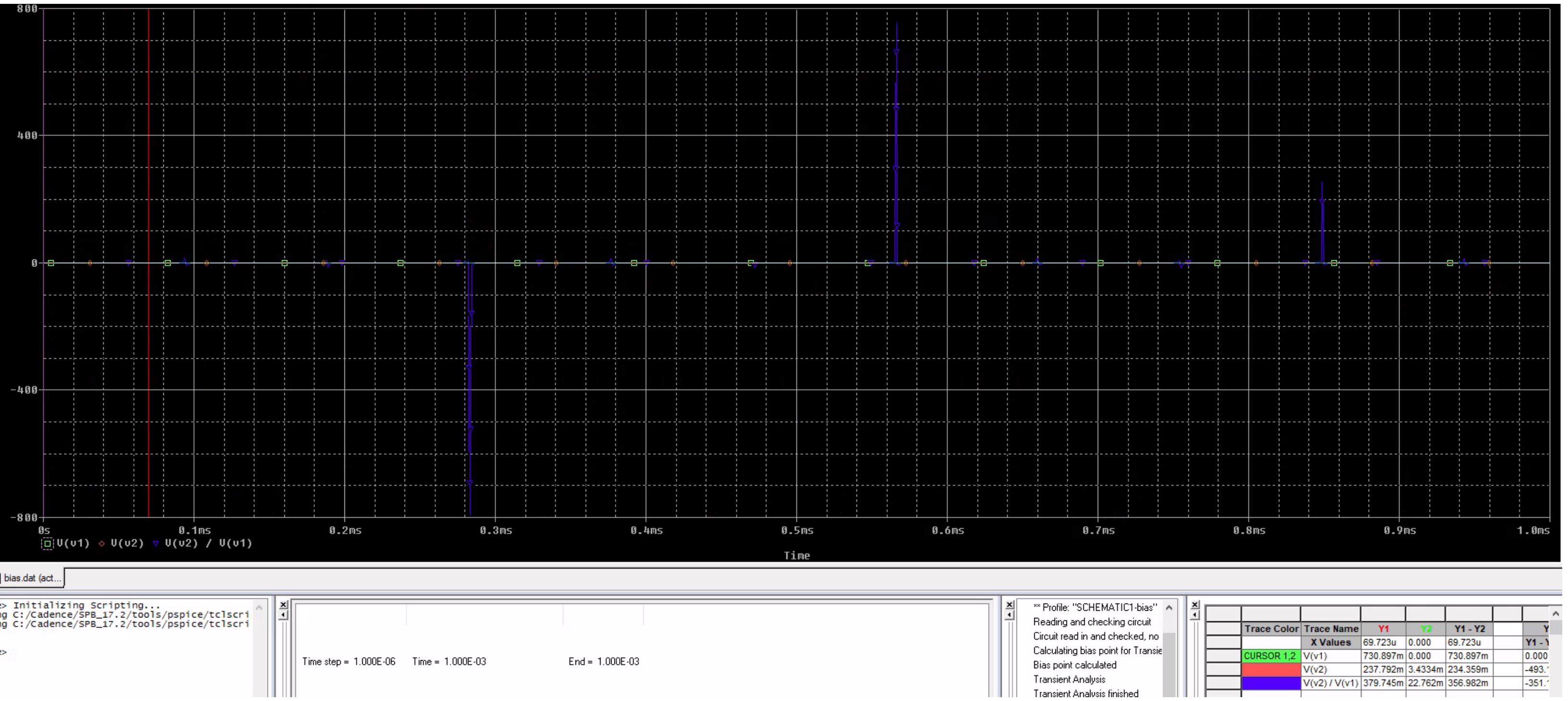


The peak magnitude that I found was 241.090m for V2.

STEP 12: How is the very first cycle of the output sine wave different from subsequent cycles?

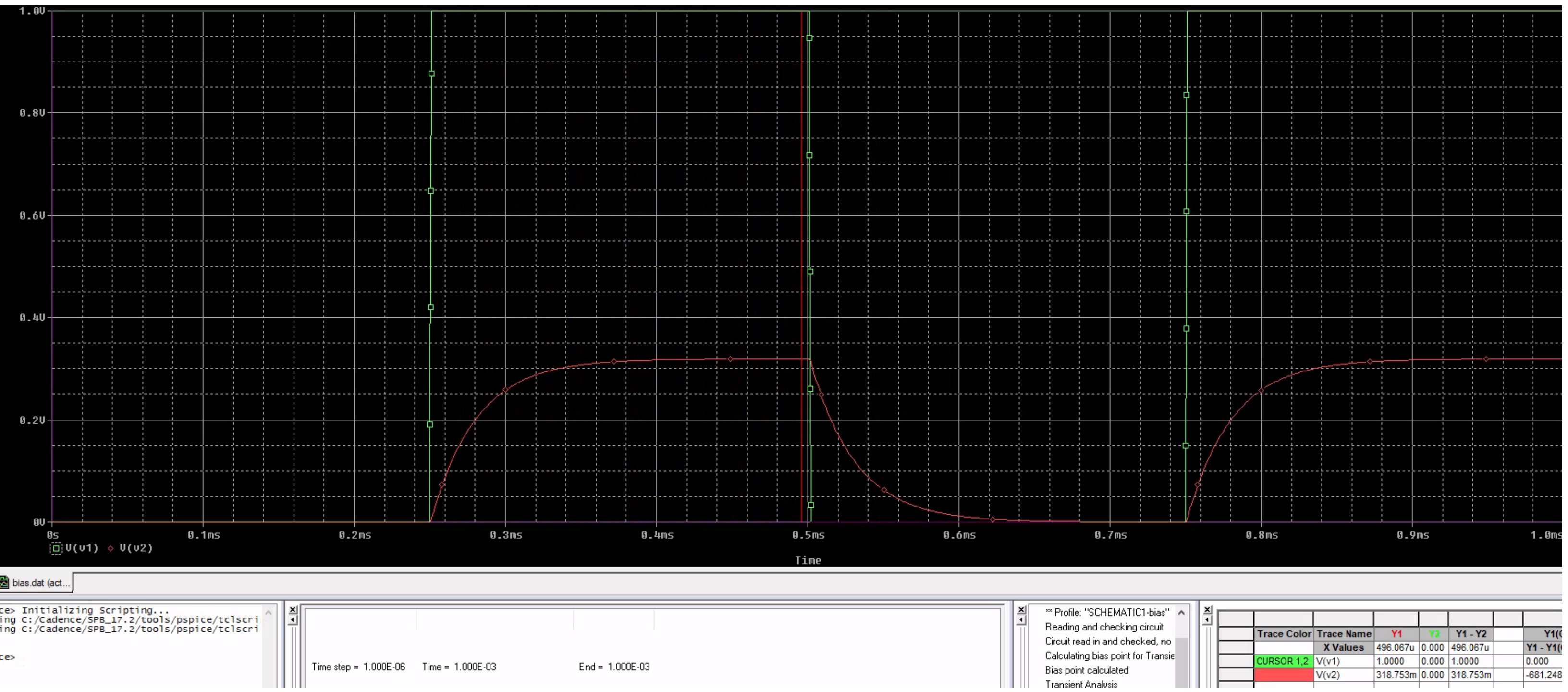
The first cycle of the output sine seems to start off slower than the other waveform.

STEP 13: Display the trace "v(v2)/v(vs)"



This graph does not show the value of V2/Vs due to the fact that the waveform is out of phase.

STEP 14: edit the circuit of Figure 2 by replacing the vsin voltage source with the part vpulse



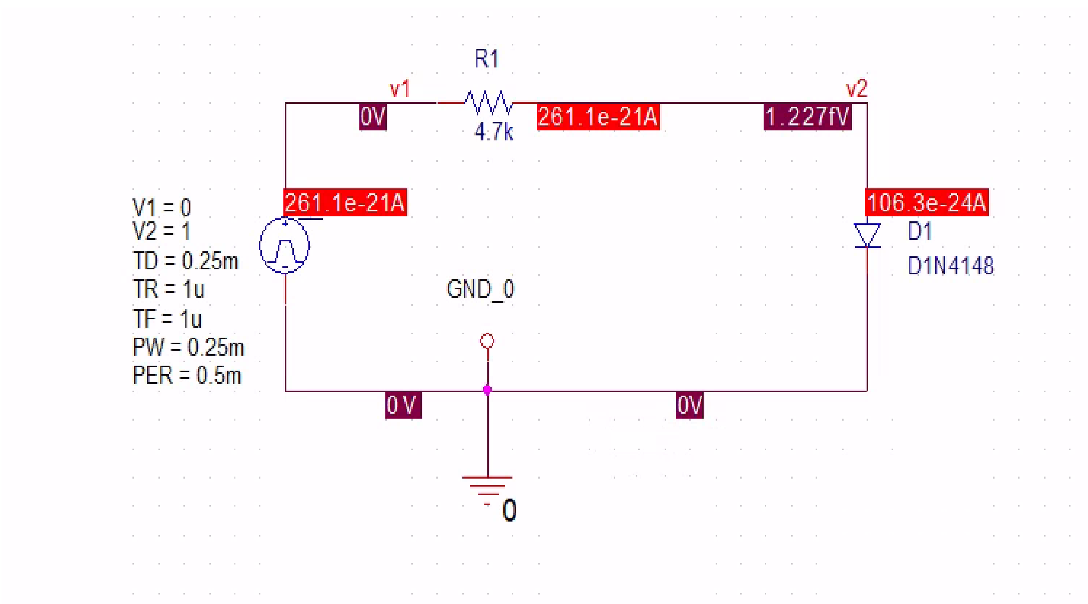
This is the output of the trace after using the Vpluse as the voltage source.

STEP 15: determine the 10% to 90% rise time of and compare this value with that calculated in Step 2.

10% = 251ms
90% =318ms

TR= 318ms-252ms = 66ms

STEP 16: A non-linear DC Sweep. Use the diode



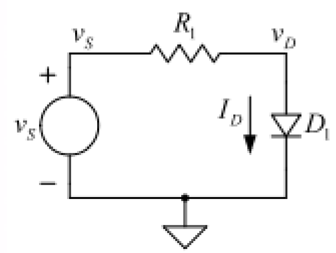
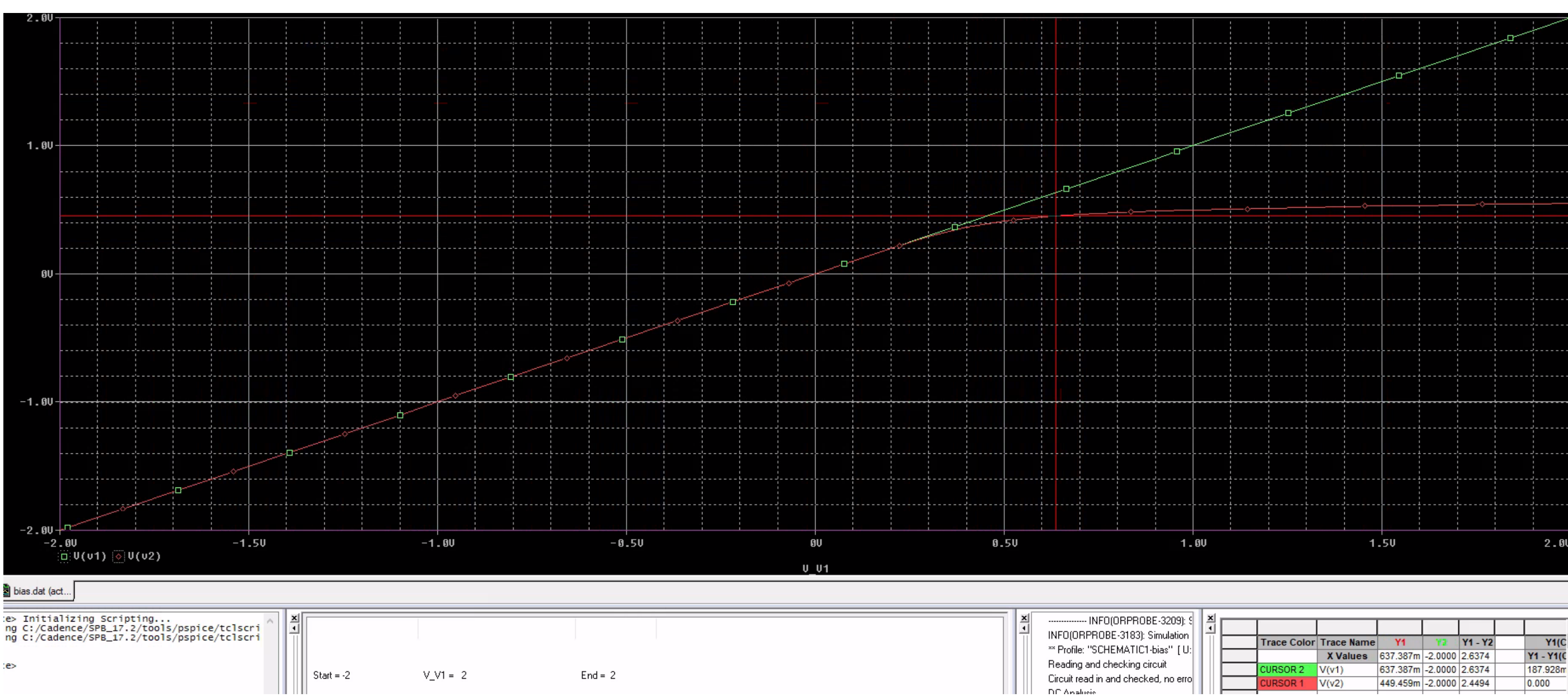
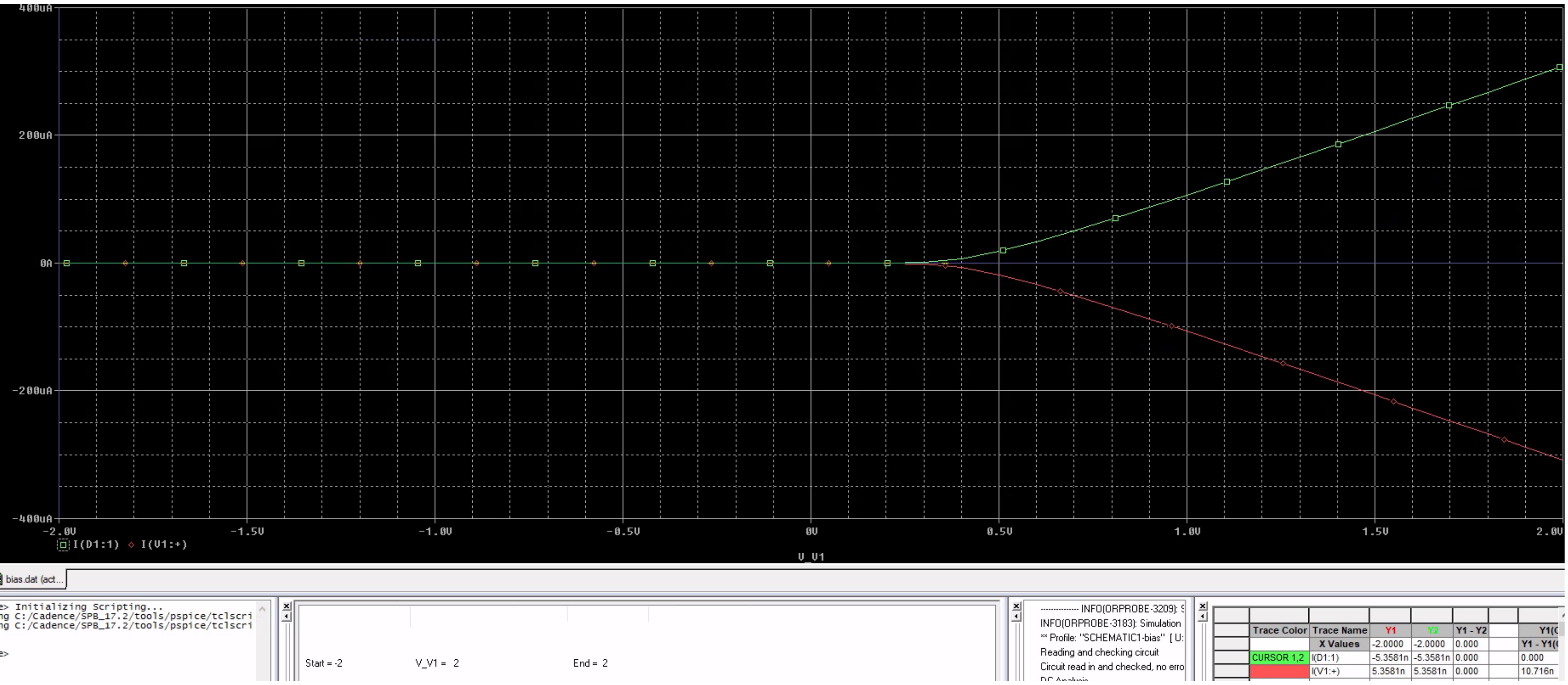


Figure 4.

DC Sweep



Transient sweep



CONCLUSION:

ITEM 1: For step 5 the reason why the same values are found is because it is a DC sweep. That means that the values are still the same as there is no frequency.

ITEM 2: I believe that obtaining the trace of V(Vy)/V(Vx) would show a small gain for DC sweep as long as it has low frequencies.

ITEM 3: the midband (low-frequency) gain found in Steps 8 and 9 the same as the gain obtained from the DC transfer characteristic (convert dB to V/V) as it should be around 0.318. Yes the gains should be the same. Under the condition DC can transfer characteristics that can be used to find the midband AC gain when the frequencies are low.

ITEM 4: the general shape of the graph produced in step 7 was the AC sweep. It was seen to be flat at the beginning of the waveform. The waveform is seen to be decreasing around 0.318V. This circuit is a low-pass filter as the graph is not forming a wave-like form. The waveform does not appear like a sine wave because of the simulation and the specific frequency we are using.

ITEM 5: The phase response of the circuit from figure 1 of the manual is -45 degrees. Yes, the AC and transient analysis simulation results agree.

ITEM 6: No, the diode-resistor does not have the same values seen on step 16. The maximum is 0.4V and the minimum -0.4V