Introduction and Top-SPICE Demo

Lab 1 - Jason Ivey 9/13/2022

Exercise 1)

Name: Jason Ivey
Preferred Email: jiveyguy@nmsu.edu
Hometown: Clint Texas
Expected Degree from NMSU: BSc in Computer Science with a focus on AI
Expected Graduation Date: Summer 2023

Why did you choose to major in EE?

I am actually a CS major pursuing a minor in EE. Why? Because I want to do embedded and hardware design like CPUs and GPUs.

Most Recent Job Title: Programmer for NMSU NanoSat Lab
Company & Location: New Mexico State University, Las Cruces, New Mexico
Responsibilities:

- Delivered a working satellite to a private spaceflight company in partnership with NASA.
- Developed a state machine in c++ & other languages on space-grade hardware.
- Work in a clean room environment on flight hardware.
- Troubleshoot software in order to achieve a successful flight unit.

Next Most Recent Job Title: Computer Science Mentor
Company & Location: El Pas Community College, El Paso, Texas
Responsibilities:

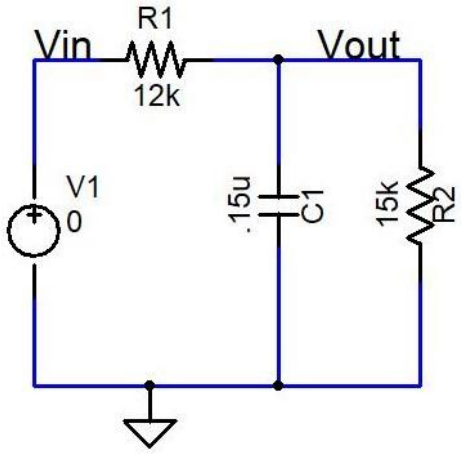
- Assist professor and students in programing and conceptual problems.
- Prepare and deliver lectures.
- Provide office hours to help students work through problems.

What are your personal areas of strength? Why might someone choose to hire you?
Personal areas of strength are perseverance in difficult situations, and a positive outlook no matter the work ahead. For example, I once was on a team where the code base was 90% non-functional and despite this, I worked tirelessly to understand and fix undocumented and fragmented code without much aid from others. Despite these conditions, I enjoyed the experience, learned a lot, and met all my responsibilities.
If you hire me, I will happily meet your goals and talk to you openly about the feasibility of your vision.

List one unique talent or accomplishment, something that will help us remember you by:
I was very shortly part of a small and exclusive group of programmers running in space. However, through no fault of my team, the code promptly exploded when the launch vehicle failed to reach orbit.

Exercise 2)

A)



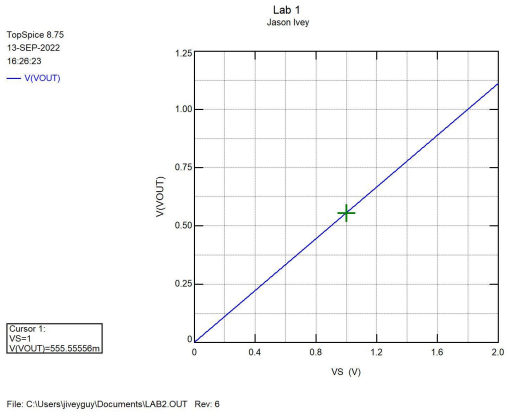
B) Calculate

a) $A_{VO} = \frac{15}{12+15}$ =. 555(cont.)

b) $f_o = \frac{1}{2\pi(0.015\,\mu\ \text{(micros)}\ (\text{F (farad)})) \times \frac{1}{\frac{1}{12000\,\Omega\ \text{(ohms)}} + \frac{1}{15000\,\Omega\ \text{(ohms)}}}}$ = $1.59\ Khz$

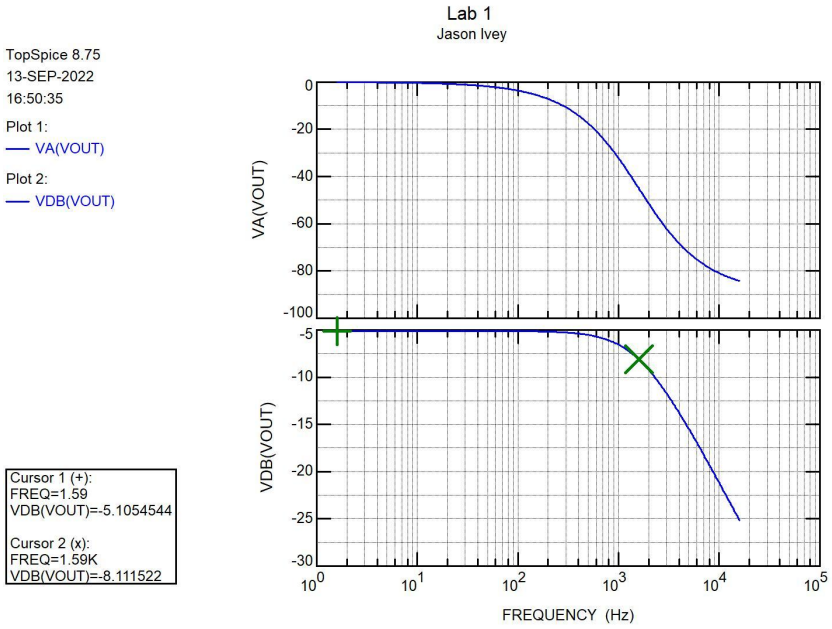
C) Simulate

a) Output:



b) $\%error = \frac{100 \times \frac{0.55555556 - \frac{5}{9}}{\frac{5}{9}}}{} = 8 \times 10^{-7}\%$

D) AC analysis



a) File: C:\Users\jiveyguy\Documents\LAB2.OUT Rev: 8

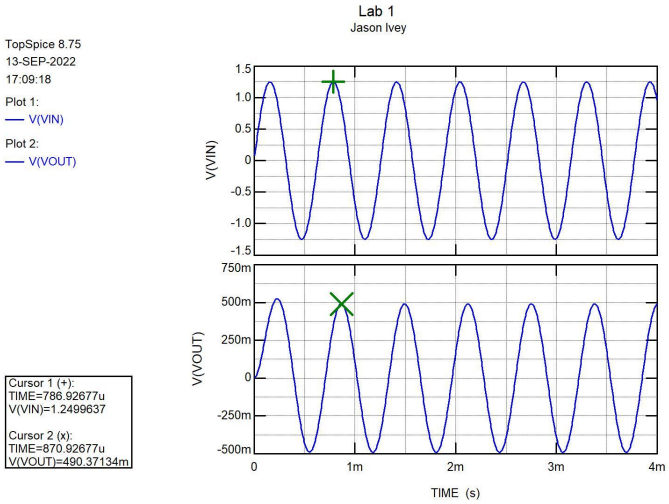
b) Vout = -8.11db -> 0.393028

i) %error = $100 \times \frac{0.393028 - \frac{5}{9}}{\frac{5}{9}}$ = -29%

c) Freq %error = 0% (identical)

E) T(if) = ?

F) Transient sinusoidal analysis



a) File: C:\Users\jiveyguy\Documents\LAB2.OUT Rev: 11

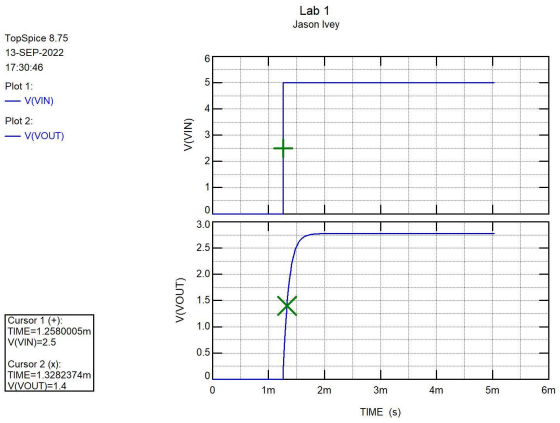
i) peak-to-peak input = 2.5v

ii) peak-to-peak output = .982 V

iii) $A_V = \frac{A_{V0}}{\sqrt{2}} = \frac{.556}{\sqrt{2}} = .393$

iv) %error = $100 \times \frac{(.3928 - .393)}{.393} = -.05\%$

G) a transient pulse (square wave) analysis



a) File: C:\Users\jiveyguy\Documents\LAB2.OUT Rev: 12

b) $t_d = \frac{0.7(12000\,\Omega \text{ (ohms)} + 15\,k\Omega \text{ (kilohms)})(0.015\,\mu \text{ (micros) (F (farad))})}{} = 284\ microseconds$

c) rise_time input = .00005$microseconds$

d) trise_time output = 70 $microseconds$

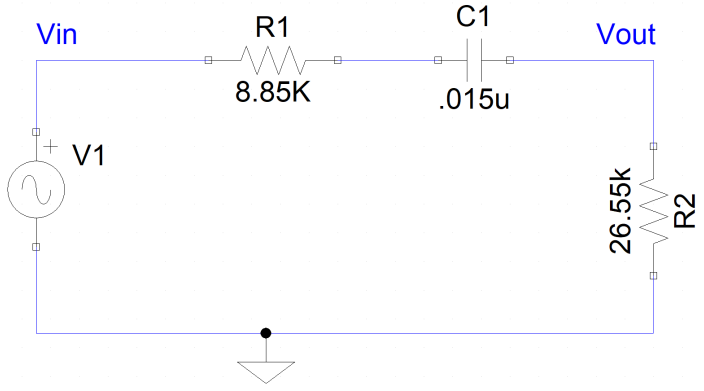
e) %error = $100 \times \frac{70 - 284}{284}$ = -75%

Exercise 3)

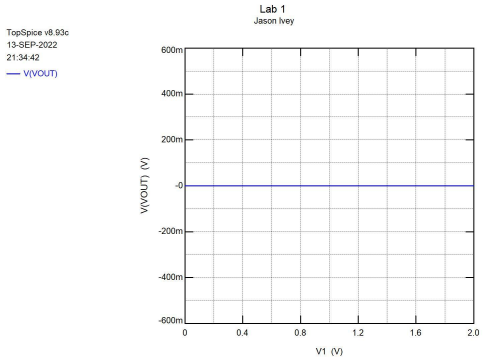
A. Assume c = .015uF

a. $f_o = \frac{1}{2\pi C_1(R_1+R_2)} \Rightarrow R_{tot} = \frac{1}{2\pi \times .015uF \times 300Hz} = 35.4K\Omega$

b. $\frac{R_2}{35.4K\Omega} = \frac{3}{4} \Rightarrow R_2 = 26.55k\Omega \Rightarrow 26.55k\Omega + R_1 = 35.4K\Omega \Rightarrow R_1 = 8.85K\Omega$



B.

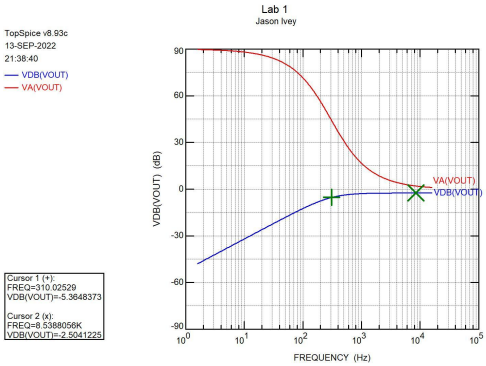


C. File: C:\Users\jivey\Downloads\LAB2.OUT Rev: 15

a. Why is the DC gain 0? How does a capacitor behave at 0Hz?

i. The gain is zero because the Capacitor is behaving like a short circuit to ground and Resistor_2 has no impact.

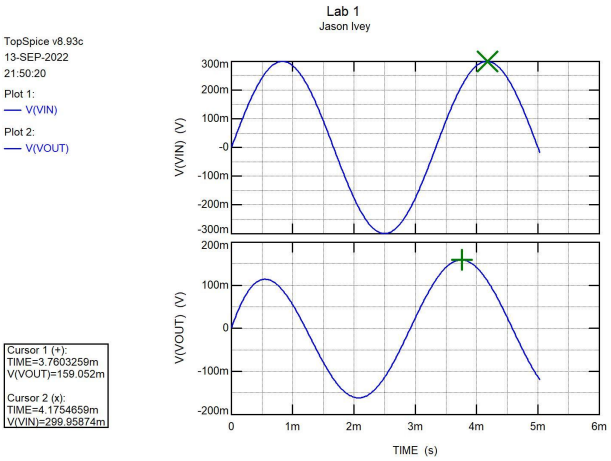
D. AC analysis



a. File: C:\Users\jivey\Downloads\LAB2.OUT Rev: 16

b. Measured gain -5.3648373dB -> 0.53921V/V

c. %error = $100 \times \dfrac{0.53921 - \frac{0.75}{\sqrt{2}}}{\frac{0.75}{\sqrt{2}}}$ = 1.67441%



E. File: C:\Users\jivey\Downloads\LAB2.OUT Rev: 16

a. Vin peak-to-peak = 600mV
b. Vout peak-to-peak = 320mV
c. V/V= $0.5\overline{3}$ (period 1)
d. %error = $100 \times \frac{\frac{8}{15} - \frac{0.75}{\sqrt{2}}}{\frac{0.75}{\sqrt{2}}}$ = 0.57%

TABLE)

	Low Pass		High Pass	
	Value	% error	Value	% error
Expected Av	.5555		.530330…	
Expected fo	1.59		300 Hz	
DC Analysis Measured Av	.55555556	8E-7%	0	
AC Analysis Measured Av	.393028	29%	0.53921	1.67441%
Transient Expected Av(fo)	.393		.530330	
Transient Measured Av(fo)	.39328	-.05%	0.53333…	0.57%