

Electrical and Electronic Principles Assignment - 2219605 - William Mills

by Will Mills

Submission date: 12-Jan-2024 01:40PM (UTC+0000)

Submission ID: 221746420

File name: 40450_Will_Mills_Electrical_and_Electronic_Principles_Assignment_-_2219605_-_William_Mills_546479_419108128.odt (79.5K)

Word count: 2265

Character count: 11161

Electrical Principles

By William Mills

Module: Electrical and Electronic Principles

Module Code: ACDA4006

BSc Electronics and Electrical Devices Engineering

12th of January 2024



Table of Contents

Contents

The project 2

Simulation Setup 3

Results 4

Discussion of Results 5

Conclusion 7

References 8

 3
 4 **project**

During this project, the task was do create and test a specific circuit, in both its simulation form and physical breadboard form. Both are the same on paper, but in this report I will discuss the main differences and factors that cause these differences, using my results as a  5 g point for this to  6 ny words, along with outside sources that may also provide a good insight as to what is happening. As well as this, the resonant frequency will also be discussed, including its effects, implications and how important it is to be able to read or predict the resonant frequency and even further than this, we will discuss how our resonant frequency was changed or effected due to our results, such as attenuation.

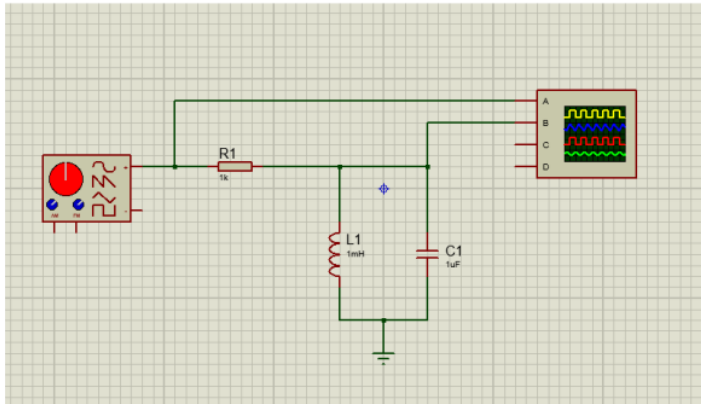
This report will also cover things such as, how I could have done better, where I went wrong and how I will improve on this for future projects and re  7 this is less relevant and may not be mentioned as much or as often as the more relevant points.

The circuits in question for this report have the specific use to be measured, for example, the measurement of voltages across certain component at certain frequencies, which I  8 ver later in the report. However, these circuits are also used to measure attenuation or even ju  8 dict it, so that we can have a clearer picture of what the ideal frequencies are to run through these kinds of circuits, this however, is not too much of a concern for us, we will be talking about resonant frequencies but most likely not to that level.

Simulation Setup

The first part of this experiment was to have a simulated version of the circuit working, to do this we used a software called Proteus, it allowed us to create a circuit with perfect conditions and measure aspects of said circuit to our liking. The circuit design is displayed in Fig.1.

Fig.1.



10

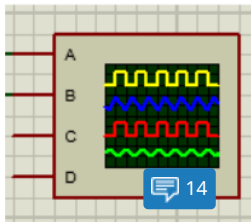
11

As displayed in Fig.1, there is an Oscillator, shown in Fig.2, and a Signal Generator, shown in Fig.3. These are the devices that will allow us to read the voltage and change the frequency when testing this circuit.

12

13

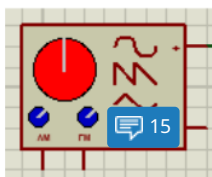
Fig.2.



In fig.2 you can see the oscillator, it is a device that allows us to view the outputs and inputs of a circuit, it will be very useful to us in this report for displaying the data that we will be recording.

14

Fig.3.



In Fig.3 there is a signal generator, it typically goes hand in hand with an oscillator. It allows for the changing of frequency that we will need in this report to get plenty of data results, it is particularly useful when more concise results are wanted, such as finding the very peak of the voltage output.

15

For the simulation, the resistor, capacitor and inductor will not change their values, the input voltage will also stay the same, standing at 2V throughout the entire experiment. However, the frequency will be change, so that we can measure the different output voltages displayed, we can do this using the signal generator from fig.3 to change the frequencies. The frequencies we will be measuring will be anywhere from 100Hz up to a maximum of 20kHz, as to not collect too many results, we will be measuring in intervals of 1,2,5 for example, 100Hz, 200Hz, 500Hz and repeat up to 20kHz. This should give some a good range of results, if more concise data is needed to find the peak for example, then we can narrow the frequency down, for example, if the frequency is highest at 2kHz with the 1,2,5 method, then we can investigate it further by adjusting the frequency to 2.1kHz or 2.2kHz.

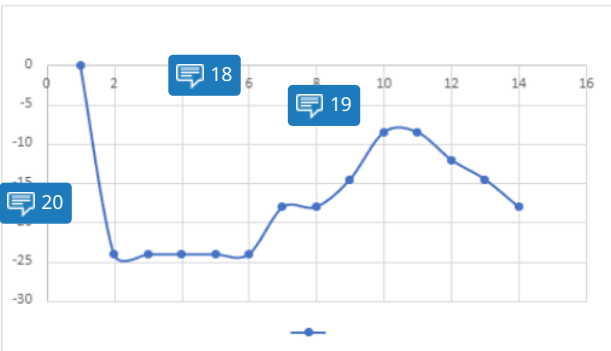
Results

The testing yielded some interesting results. There are two result types that I collected, one of which is the simulated circuit, the other is a more practical and accurate depiction, Bread Board. As mentioned earlier in the report, the simulation will give clear results as it will assume perfect conditions from the components and outside forces that may change results. In Fig.4 a set of results from the simulated circuit is shown, Fig.6 is the graph of these results. I will discuss all the results in the explanation and discussion.

Fig.4

Simulation	Frequency	Vin	VL	A
	100	2	0	0
	200	2	0	0
	500	2	0	0
	1000	2	0	0
	2000	2	0	0
	5000	2	0.75	-8.51937
	10000	2	0	0
	20000	2	0	0
	50000	2	0	0

Fig.5



Discussion of Results

As shown in Fig.4, the only frequency that yielded a result was 5000Hz. This is not nearly enough data, therefore a more in-depth investigation was taken. The results of which is shown on Fig.6.

Fig.6

More for you Sim	Frequency	Vin	VL	A
	4000	2	0.125	-24.0824
	4200	2	0.125	-24.0824
	4300	2	0.125	-24.0824
	4400	2	0.125	-24.0824
	4500	2	0.125	-24.0824
	4600	2	0.25	-18.0618
	4700	2	0.25	-18.0618
	4800	2	0.375	-14.54
	4900	2	0.75	-8.51937
	5000	2	0.75	-8.51937
	5100	2	0.5	-12.0412
	5200	2	0.375	-14.54
	5300	2	0.25	-18.0618

These results allowed for a more detailed graph, displayed in Fig.5. The attenuation is in the minuses throughout the entirety of the results, this makes sense considering the VL was never above 1 and attenuation is the reduction in strength of a signal. However, in order to get a good comparison and another set of results, another test was done, but with physical components and real devices such as the real versions of a signal generator and Oscillator from the simulator. This was done using a breadboard, giving us a way of testing a circuit without the effort and material use of designing and creating an actual board ourselves, the results from which seemed to yield slightly rather interesting results. As depicted in Fig.7, the range of frequencies at which a result was actually seen is far wider than the simulation, all the way from 1000Hz and onward there were many results, cutting a fine difference between the two immediately, we will have to discuss the differences and similarities between these two in far more detail, it is a great point of interest that holds some importance and relevance in the experiments.

Fig.7

BreadBoard	Frequency	Vin	VL	A
	1000	2	0.186	-20.6303
	2000	2	0.336	-15.4938
	5000	2	2.4	1.583625
	10000	2	0.496	-12.111
	20000	2	0.224	-19.0156
	50000	2	0.112	-25.0362
	100000	2	0.08	-27.9588
	200000	2	0.06	-30.4576
	500000	2	0.05	-32.0412

In order to look into this further, a more in-depth investigation was also done for this test, just like what is seen in Fig.6 for the simulated board. The results from this further investigation went on quite far, it seemed as if it would yield results for quite some length, as such, the testing was stopped with more than enough and possibly excessive yields. This can be seen in Fig.8. The breadboard circuit even produced positive results, in complete opposite of the simulated board that didn't even seem to come close to producing a positive attenuation. Although it only happened once at 5000Hz, it is worth mentioning, considering that it never happens again in the results collected. For context, on the results table of Fig.8, "More focused BB", can be read, "BB" refers to and means breadboard.

Fig.8

More focused BB	Frequency	Vin	VL	A
	24	2	0.44	-13.1515
	3000	2	0.59	-10.6036
	3200	2	0.66	-9.62972
	3500	2	0.8	-7.9588
	4000	2	1.13	-4.95903
	4200	2	1.3	-3.74173
	4500	2	1.48	-2.61537
	5000	2	2.4	1.583625
	5200	2	1.8	-0.91515
	5500	2	1.72	-1.31003
	6000	2	1.45	-2.79324
	6200	2	1.36	-3.34982
	6500	2	1.24	-4.15217
	7000	2	1	-6.0206
	7200	2	0.92	-6.74484
	7500	2	0.84	-7.53501
	8000	2	0.72	-8.87395
	8200	2	0.69	-9.24362
	8500	2	0.64	-9.897
	9000	2	0.57	-10.9031

As can be seen in my results, the attenuation is at its highest point around 5000Hz, but reaches a lowest point at around 2500Hz and 9000Hz. It reaches a similar point of -10.6 and -10.9 respectively, showing that the attenuation seems to fluctuate up and down in one large curve. You can see part of this pattern in fig.5. However, it is important to note that the breadboard may have shown these results, but the simulation does not reach the points of the breadboard, in fact, it does not come anywhere near the positives and reaches its highest point with -8.5 attenuation at about 5000Hz. A notable thing to point out here is that they both have their peaks at the same frequency, showing that the only difference between them is the numbers that they display, the pattern is the same. Even though the patterns are the same, the simulation has quite extreme low points that hold consistently across a lot of frequencies, as seen in fig.6, 4000Hz through to 4500Hz are all the same value of -24 attenuation. These similarities are most likely due to them being the same initial circuit

design with the same component values, with the only difference being that one is a simulation and assumes perfect conditions and the other is made of physical components that are not perfect.

To clarify, it seems as if there is a curve in the results, typically reaching a peak at 5000Hz regardless of what platform you decide to use to run the circuit, so long as the components and the Voltage input is the same and the only changing aspect of the experiment is the Frequency, then the pattern of the results will be the same or very similar. As discussed earlier, the breadboard results and simulation results had some definitive differences, to reiterate once more, these differences are likely due to the simulation being a perfect rendition of the circuit and the breadboard being a rough testing board that will always have varied or imperfect results. It is also worth mentioning that the resonance frequency of these two sets of results will also look similar or, that is to say, their highest amplitude will land around the same area, proven by my previous statement of their peaks being around the same point as well. It is important to know the resonant frequency and be able to predict it, as it is used to ensure a stable frequency in a circuit, specifically for AC signals, this is backed up and spoken about in [1] in a more detailed manner.

In fact, it may also be worth talking about how the nature and results of my experiments most definitely changed the outcome of the resonant frequency, in [2] it is stated that as attenuation takes effect, the peak amplitude of resonance decreases resulting in a less responsive circuit and the resonant frequency has less gain as a result. As well as this, the width of the resonance will increase, both of these effects can actually be seen in my results in fig.5, typically a graph of this kind will have one smooth line, starting flat, raising to a point and then falling at a similar or at the same rate that it raised. At the time of testing and experimentation, I did not fully realize this, it is only during my further research and learning that I realized these things. This realization has motivated me to consider these things more seriously in future experiments and tests, for example, finding points of interest such as the aspects that can change or impact the resonance in this experiment and how they change them will help me have a clearer understand and view of my results. To expand on my reference of [2], what they are talking about is not necessarily about the resonance of an electrical circuit, however, it is to be kept in mind that resonance is essentially the same in every aspect it appears in. Or, at the very least, it will act and appear the same in any subject and scenario where an oscillator is involved, for the oscillation is what allows us to view and see the resonant frequency in the first place, hopefully that clarifies the point.



Conclusion

In this experiment it has been found that regardless of what platform is used to imitate this circuit with the same components and layout, it will always follow the same or a similar pattern on a graph and in data. It was also found that the attenuation will almost always stay in the negatives, reaching very low points of -24 and lower. It was also found that the difference between the extremes of the results between a breadboard and simulation can be quite drastic and large, for example, the breadboard does manage to get a positive result, where as the simulation gets its closest positive result when it peaks with -8.5. These differences seem unrelatable until you realize that both examples reach this point at 5000Hz of frequency, making them far more similar than previously thought. It was also found that due to how low our attenuation got, it caused our resonant frequencies to get very unordinary, this is in reference to how the resonant frequency gets wider and smaller as attenuation becomes more severe, being particularly severe in our experiments as can be seen in figures 4 through to 8, where the vast majority of the results are in the negatives.

Another notable point is that the simulated circuit seemed far more reactive and spontaneous in its results. To highlight this, the breadboard results had a gradual rise and fall in attenuation, whereas the simulation results would rise and fall in a far steeper fashion, this is why the in depth investigation of the simulation was so needed, if we had kept it at its base results, we would not have much in the way of something to talk about, as all the frequencies yielded nothing except for 5000Hz, which, in fact, further reinforces my statement of 5000Hz being the peak of these circuits, defining a very clear and definitive relation between the two experiments, 5000Hz is a very important point of frequency for these circuits. Obviously, it is an area where both circuits peak, but would other circuit examples be the same? And what other importance does it hold that we cannot see with just the results from this experiment alone?

Moving on, that concludes the experiment and the discussion of its results, hopefully this report will provide great insight and information to those who take the time to read it.

References



[T. R. Kuphaldt, "Alternating Current, Application of Resonance," All About Circuits, 1996. [Online].
1 Available: <https://www.allaboutcircuits.com/textbook/alternating-current/chpt-6/applications-of-resonance/#:~:text=One%20use%20for%20resonance%20is,exchanging%20energy%20between%20each%20other..> [Accessed 7 January 2024].

[J. P. Lee, "ScienceDirect," October 1996. [Online]. Available:
2 <https://www.sciencedirect.com/science/article/abs/pii/0041624X96000753#:~:text=Material%20attenuation%20results%20in%20a,on%20the%20types%20of%20modes..> [Accessed 7 January 2024].

Electrical and Electronic Principles Assignment - 2219605 - William Mills

GRADEMARK REPORT

FINAL GRADE

GENERAL COMMENTS

53/100

PAGE 1



Comment 1

B.Eng. Electrical and Electronics Engineering



Comment 2

Good

Attempt, the first page or the title page of the report should have the name, student ID, Module Name, Module code, Title of the Coursework, programme of study. Most of these are in the title page, but however few are missing.

PAGE 2



Comment 3

Start the answers
from a fresh page and not from the title page.



Comment 4

It is
better to number each heading



Comment 5

Compose
the report from a third-person perspective.



Comment 6

Abstract is missing



Comment 7

Compose
the report from a third-person perspective.



Comment 8

Compose
the report from a third-person perspective.



Comment 9

It is better to number each page

PAGE 3



Comment 10

It is better to add
figure title for each figure Eg: Figure 1: [Brief Description of the figure] is
appropriate and effectively communicates the content and purpose of the figure.
It provides readers with a clear reference point, making it easier for them to
navigate through the



Comment 11

It would have been better if the
screenshot of simulated outputs are included in the report



Comment 12

It would have been better if the picture of the
circuit designed in Breadboard and Oscilloscope output is included in the report



Comment 13

Line
spacing between heading and para, between lines, between paragraphs should be
uniform.



Comment 14

It is better to add
figure title for each figure Eg: Figure 1: [Brief Description of the figure] is
appropriate and effectively communicates the content and purpose of the figure.
It provides readers with a clear reference point, making it easier for them to
navigate through the



Comment 15

It is better to add
figure title for each figure Eg: Figure 1: [Brief Description of the figure] is
appropriate and effectively communicates the content and purpose of the figure.
It provides readers with a clear reference point, making it easier for them to
navigate through the

PAGE 4



Comment 16

Compose
the report from a third-person perspective.



Comment 17

Compose
the report from a third-person perspective.



Comment 18

It is better to add figure title for each figure Eg: Figure 1: [Brief Description of the figure] is appropriate and effectively communicates the content and purpose of the figure. It provides readers with a clear reference point, making it easier for them to navigate through the



Comment 19

It should be a semi logarithmic graph



Comment 20

It is better to label X and Y axis

PAGE 5



Comment 21

Line spacing between heading and para, between lines, between paragraphs should be uniform.



Comment 22

It is better to provide a title for the table with number. The title provides a clear indication of the table's content and purpose, making it easier for readers to understand the context and relevance of the presented in the table.



Comment 23

It is better to provide a title for the table with number. The title provides a clear indication of the table's content and purpose, making it easier for readers to understand the context and relevance of the presented in the table.

**Comment 24**

It is better to provide a title for the table with number. The title provides a clear indication of the table's content and purpose, making it easier for readers to understand the context and relevance of the presented in the table.

**Comment 25**

Compose the report from a third-person perspective.

**Comment 26**

Line spacing between heading and para, between lines, between paragraphs should be uniform.

**Comment 27**

The Q factor calculation is missing

**Comment 28**

It is better to have reference in a fresh page

ENGAGEMENT WITH LITERATURE

Marks for engagement with literature skills will be gained through the use of information collected from appropriate reference material embedded in mainly the introduction, but also in the discussion and conclusion sections of your report. This reference material should be used to explain concepts and to support arguments in the discussion of your results.



Engagement with a limited range of mostly relevant and credible sources but with some reliance on information gained through class contact. Some omissions and minor errors. Referencing conventions evident though not always applied accurately or consistently.

2**KNOWLEDGE AND UNDERSTANDING**

Marks for knowledge and understanding skills will be given for the accuracy of your description of the concepts and principles of resonance and how this relates to the experimental setup used.



Knowledge of the basic underlying concepts and principles is accurate with a good understanding of Electrical and Electronics Engineering but lacks depth and/or breadth.

19**COGNITIVE AND INTELLECTUAL**

Marks for cognitive and intellectual skills will be given for the quality and validity of your interpretation of the experimental results gathered. You should consider the differences between the simulated and experimental and explain possible causes for them.



Limited attempt at evaluation of the underlying concepts and principles, tending towards description. Can interpret data, but with some errors. Some evidence to support emerging arguments but these may be underdeveloped or with a little inconsistency / mis-interpretation which is evident from the description.

12

PRACTICAL SKILLS

Marks for practical skills will be given for your use of the available tools, models and techniques to explain your results and their relationship to the theory of the concepts.



An appropriate application of basic methods, materials, simulation tools and/or techniques in designing RLC circuit. Clear appreciation of the context of the application. Good evidence of different approaches to identify errors in circuit design and output generated is appropriate.

18

TRANSFERABLE SKILLS FOR LIFE

Marks for transferable skills for life and professional practice will be given for the structure, coherence, presentation and overall quality of your report.



The report demonstrates a basic level of structure and coherence. Presentation is somewhat clear, but improvements are needed for a higher overall quality. Work on refining the organisation and enhancing the report's flow.

2