

ACDA 4006 EEP course work

by Rhys Jones

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ACDA 4006

Electrical And Electronic Principles

Course Work

Student Number: 2317422

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Abstract

For this exercise I had to design a circuit with an inductor, capacitor and a resistor connected to a signal generator and a oscilloscope. Firstly, I did the circuit on a suitable software and then I created the same circuit on a breadboard and compared the results.

Introduction

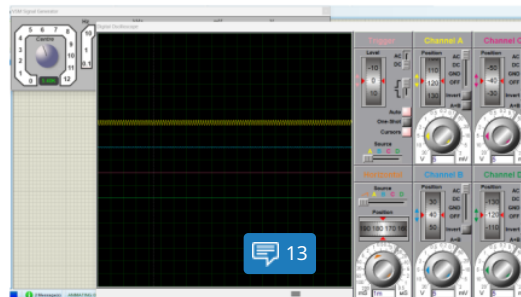
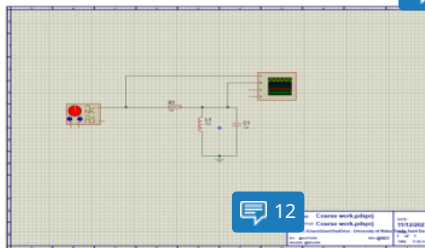
The circuit required to design is a resonant circuit. A resonant circuit is used in order to have one peak frequency, where the current flow resonates the strongest. These circuits are generally used for radio and television tuners to pick out signals of certain frequencies to avoid more than one channel playing at the same time. [1] In the following report I will compare the results from the software and breadboard and note the similarities and differences.

Simulation setups

Software simulation

Firstly, I will be simulating a resonant circuit in proteus. The capacitor is 1 nano farad, resistor 33 ohm and the inductor is 33 micro henrys. The readings will be done on a 1000Hz signal input and 2V peak to peak up to 12kHz output frequency. I'll be measuring the output results every 500Hz up until 6000Hz and then every 1000Hz up until 12KHz. I will also get more readings wherever the peak results are in order to work out the peak output. Once I get the results I will put them into a table on excel

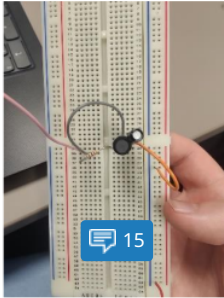
and work out the attenuation with the formula $A = 20 \times \log_{10} \frac{V_L}{V_{In}}$. Where A is attenuation in dB, V_L is the peak-to-peak voltage measured across the inductor, and V_{In} is the peak-to-peak input voltage as set on the signal generator.



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Breadboard Simulation

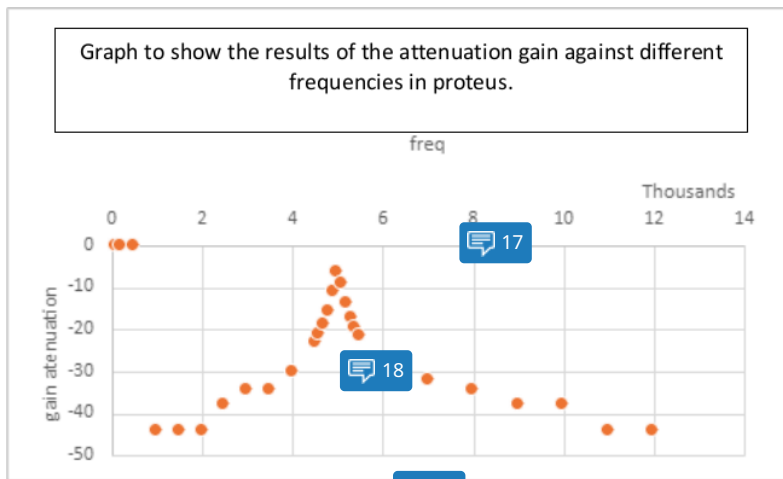
When doing the simulation with physical components I used a breadboard as it can provide accurate results without the need for a pcb and soldering. It also takes much less time to get results on a



breadboard. Before putting the components on the breadboard, I designed it on paper first in order to get it right the first time and not break any components. To connect the components to the oscilloscope and signal generator, I used crocodile clips for a secure connection to the wires. Once again I used the same scale in order to compare results actually.

Results

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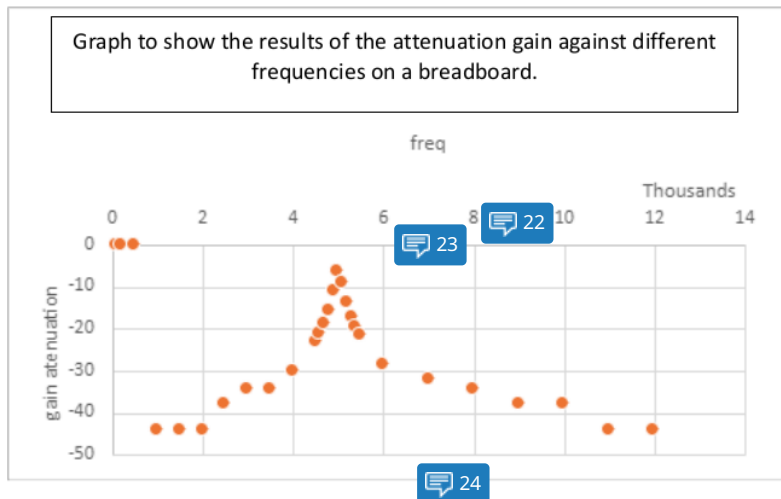


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This graph has had its results from proteus. This can give us a good understanding of what we can expect to see in our physical circuit as well. It can give us a good estimate of what to expect as the simulation won't take into account any tolerance within any of the components which may have an affect in the other simulation. The peak for this simulation is 5032Hz. In order to get the peak as accurate as possible I took many readings around this area in order to make sure I don't make a mistake. I also used this formula ($f_r = 1/(2\pi\sqrt{LC})$) to make sure that the peak was correct. I can tell by the null answer at 100, 200 and 500Hz that there was not enough power, presumably because of the DC capacitor limiting the low end. Another reason could be that the readings were so small that the program was not advanced enough to show that level of detail as the readings would have maximum value of $\times 10^{-5}$. I can also see that the most notable points are between 4000 and 6000Hz, where

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the results are closely spaced together further proving that the max attenuation being at 5032Hz is most likely correct as it lies close to the middle of the range. After 6000Hz the attenuation starts to gradually decrease until it fall flats at 9000Hz where the value doesn't change any more. The low end and high end share the same values but the lower end has a steeper gradient due to the fact that there is less frequency to go through.



This graph has had its results from the breadboard simulation. This graph can give us a better understanding of the tolerances within each component. There are many factors that can contribute to varied results with a breadboard such as, component tolerances, breadboard tolerances, and how well the clips work in order to connect the wires to the signal generator and oscilloscope. We can definitely see the similarities between the two graphs as they both have similar cutoff points, such as the biggest jump in attenuation is between 4 and 6KHz. This shows that despite the tolerances of the components there isn't a massive difference in answers which proves that proteus is a good software to run simulation. Not only does it save time and money compared to a physical alternative, it also provides accurate results aslong as there isn't a massive tolerance where results could massively vary.

Discussion

In this part of the report I am going to deeply analyse the two readings and note the similarities and differences of them. The attenuation of the online simulation is 5032Hz, whereas the max attenuation of the breadboard is 5049Hz. This can be due to a number of factors such as, the tolerance, With a difference in tolerance can lead to different results. It is therefore important to make sure that when using these in real world situations such as radio channels to check them before they go live to make sure that everything flows smoothly and nothing crosses over into another channel. Something that has been implemented to stop this is to use low tolerance components and equipment, and keep a gap in frequencies between channels in order to allow any errors that may be made accidentally. The more accurate readings of proteus can be attainable due to it being online and have no tolerance allowing perfect readings. Also having a mouse to get more accurate readings compared to simply looking at an oscilloscope. With this proteus takes away the risk of human error when reading by providing the results for you. By using Excel I am easily able to get accurate results for the attenuation by putting all the data in a table and using the formula

$A=20\log_{10}(V_{in}/V_{out})$. This gives me accurate results up to 5 decimal places providing very accurate results much better than using a calculator. By using Excel I'm also able to clearly label my results and keep all my data tidy allowing other people to easily access the data. By using a lower voltage you are able to keep all the other components low and be able to do the experiment in a safe environment.

Proteus results

freq	vin	vout	attenuation
100	2	0	#NUM!
200	2	0	#NUM!
500	2	0	#NUM!
1000	2	0	-44.0824
1500	2	0.0125	-44.0824
2000	2	0.0125	-44.0824
2500	2	0.025	-38.0618
3000	2	0.0375	-34.539975
3500	2	0.0375	-34.539975
4000	2	0.0625	-30.103
4500	2	0.1375	-23.254546
4600	2	0.175	-21.159839
4700	2	0.225	-18.97695
4800	2	0.325	-15.782933
4900	2	0.55	-11.213346
5000	2	0.9625	-6.3525851
5100	2	0.7	-9.1186391
5200	2	0.4	-13.9794
5300	2	0.275	-17.233946
5400	2	0.2125	-19.473421
5500	2	0.1625	-21.803533
6000	2	0.075	-28.519375
7000	2	0.05	-32.0412
8000	2	0.0375	-34.539975
9000	2	0.025	-38.0618
10000	2	0.025	-38.0618
11000	2	0.0125	-44.0824
12000	2	0.0125	-44.0824

Breadboard results

frequency	Vin	vout	attenuation
100	2	0	#NUM!
200	2	0	#NUM!
500	2	0	#NUM!
1000	2	0.01	-46.0206
1500	2	0.01	-46.0206
2000	2	0.01	-46.0206
2500	2	0.02	-40
3000	2	0.03	-36.478175
3500	2	0.04	-33.9794
4000	2	0.06	-30.457575
4500	2	0.125	-24.0824
4600	2	0.175	-21.159839
4700	2	0.225	-18.97695
4800	2	0.3	-16.478175
4900	2	0.5	-12.0412
5000	2	0.96	-6.3751753
5100	2	0.7	-9.1186391
5200	2	0.4	-13.9794
5300	2	0.25	-18.0618
5400	2	0.2	-20
5500	2	0.15	-22.498775
6000	2	0.06	-30.457575
7000	2	0.05	-32.0412
8000	2	0.03	-36.478175
9000	2	0.025	-38.0618
10000	2	0.02	-40
11000	2	0.01	-46.0206
12000	2	0.01	-46.0206

As we can see with the tables, Proteus provides more accurate results at the cost of not being able to use the components and not taking into account the tolerances of each component, Each of which can vary by different amounts. Because of this proteus should only be used as a guide and then followed up by a breadboard comparison before going further in depth in order to avoid damaging anything and making sure the components work as intended. Proteus can give us a good understanding of how components were to react if we'd use them in real world applications aswell.

Conclusion

In this experiment it has been determined that the max attenuation of this circuit is around 5032-5049Hz. It isn't possible to give an exact number as there isn't enough proof of an exact result. In order to get a better result, I would have to run the same test multiple times with the exact same component tolerances and give an average of all those results instead. I could also speed up this process by comparing with my peers to see their max attenuation as well. It is possible to see that the components do not work at a low enough frequency to work until a 1000Hz as we can see the

0Vout until 1000Hz. Next time I do a project like this I will make sure to take many more readings in order to get a better comparison of where the big change happens and have a better understanding of the difference in Physical and software simulations. I will also go to higher frequencies to find out if there is an upper limit like there is with low frequencies or if it goes on forever at very low attenuations.

Bibliography

- [1] "resonant circuit," analog, [Online]. Available: <https://www.analog.com/en/design-center/glossary/resonant-circuit.html>. [Accessed 12 january 2024].

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GRADEMARK REPORT

FINAL GRADE

GENERAL COMMENTS

51 /100

PAGE 1



Comment 1

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.



Comment 2

It would have been better if table of content is included.



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

It would be preferable to include a concise
description of the anticipated results in the abstract for better clarity.



Comment 7

Compose
the report from a third-person perspective.



Comment 8

It is
better to number each heading



Comment 9

Compose
the report from a third-person perspective.



Comment 10

The values are not correct



Comment 11

Compose
the report from a third-person perspective.



Comment 12

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 document and understand the significance of the visual representation.



Comment 13

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 document and understand the significance of the visual representation.

PAGE 2



Comment 14

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



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 document and understand the significance of the visual representation.



Comment 16

It would have been better if the picture of oscilloscope output is included in the report



Comment 17

The axis should be in a logarithmic scale



Comment 18

It would have been better if the resonance frequency, f_l and f_u , were mentioned in the graph



Comment 19

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 document and understand the significance of the visual representation.



Comment 20

It is better to use the equation editor within MS word. It will allow you to produce equations that look better than this.



Comment 21

It is better to use the equation editor within MS word. It will allow you to produce equations that look better than this.



Comment 22

It would have been better if the resonance frequency, f_l and f_u , were mentioned in the graph



Comment 23

The axis should be in a logarithmic scale



Comment 24

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 document and understand the significance of the visual representation.



Comment 25

The theoretical f_r and Q were not mentioned.

PAGE 4



Comment 26

It is better to use the equation editor within MS word. It will allow you to produce equations that look better than this.



Comment 27

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 28

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 29

It would have been better, if Q factor was calculated.

PAGE 5



Comment 30

Compose
the report from a third-person perspective.



Comment 31

It is advisable to include more
references from peer-reviewed journals, book and articles

GRADING FORM: GRADING

RHYS JONES

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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.



Poor engagement with essential reading. No
evidence of wider reading. Reliance on

2

inappropriate sources, and/or indiscriminate use of sources. Heavily reliant on information gained through class contact. Inconsistent and weak use of referencing.

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.



Competent knowledge of the basic underlying concepts and principles. Exhibits good understanding of the Electrical and Electronic Engineering, which is evident through the description on the experimental setups, calculations and theoretical explanation.

18

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.

13

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.

16

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 exhibits some attempts at structure and coherence, but there are inconsistencies. Presentation requires refinement to enhance overall quality. Consider organising information more effectively for better coherence.

2