

2317310 Report

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Electrical and Electronic Principles Report
Stefan-Cristian Daitoiu 2317310

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In this report, we are going to delve into the differences between a virtual RLC bandpass filter (built using Proteus) and a physical one built on a breadboard. The virtual circuit has been built and tested first; the physical breadboard circuit has been built and tested afterwards. After thoroughly looking at the differences in attenuation values, the findings were interesting at first, however, after looking into why those differences potentially arose, the findings painted a clearer picture.

Introduction

An RLC bandpass filter is an electronic circuit that allows a range of frequencies to pass through it, blocking out any frequencies outside of said range. They are mainly used in wireless transmitters and receivers to ensure that different transmitters don't interfere with other transmitters or receivers.

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As stated above we will have a look at simulating the circuit in proteus, then building the circuit on a breadboard in order to compare the resonant frequency and Q factor between the two.

Simulation setups

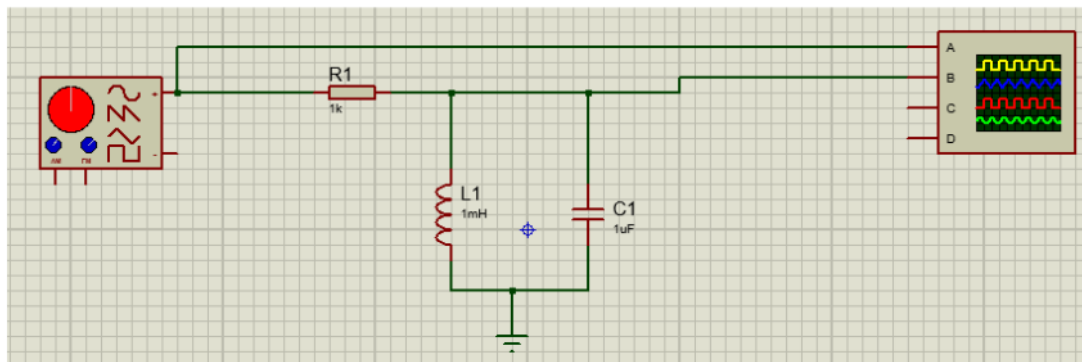


Figure 1 – Circuit simulation in Proteus, with signal generator and oscilloscope

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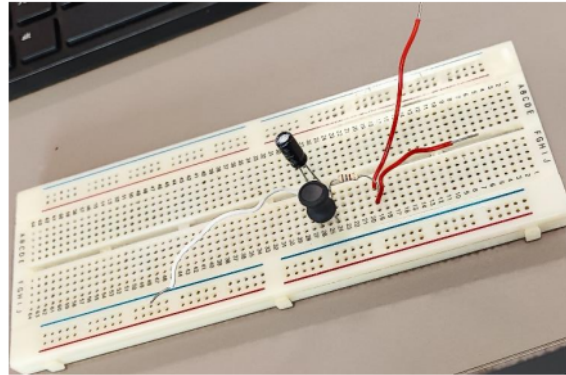


Figure 2 – Physical breadboard circuit



Figure 3 – Virtual and physical signal generator and oscilloscope

As shown in figure 1, the signal generator is connected to both channel A and B of the oscilloscope. Channel A is used for the input reading, channel B is used for the output reading. The circuit consists of a resistor that is 1K Ohms, inductor that is 1 millihenry and a capacitor that is 1 microfarad. You can observe the physical circuit in figure 2 and physical connection in figure 3.

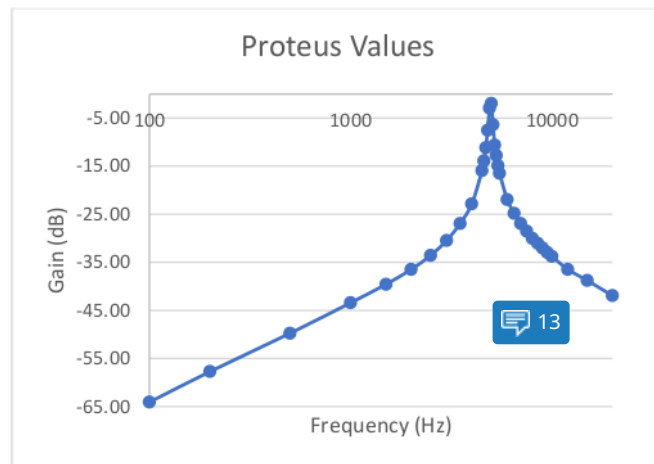
The generators will be outputting 2-volt sine wave signal, with frequencies ranging from 100Hz to 20Khz. The purpose behind this is to measure the attenuation of the circuits and find out what the peak value of the circuits are. I will be measuring the range of frequencies in a logarithmic scale; to calculate the attenuation I will use the following formula [1]:

$$A = 20 \times \log_{10} \frac{V_L}{V_{in}}$$

I will also calculate the Q factor of both circuits and compare the results. I will be using the following formula [2]:

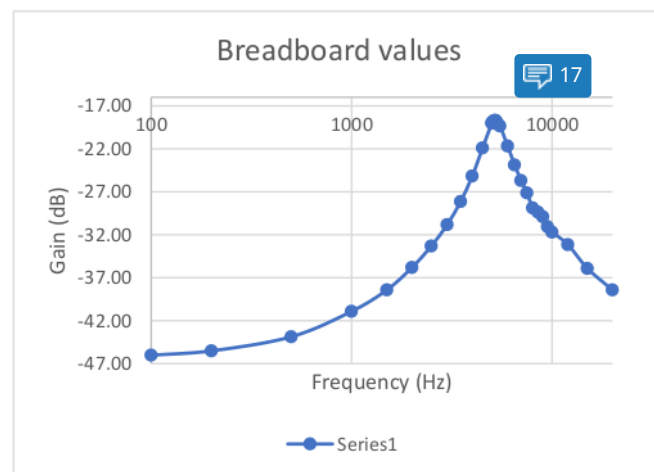
$$Q = \frac{F_0}{F_{-3dB}}$$

Results



Graph 1 — gain against frequency (on a logarithmic scale)

One thing to note on this graph is that the gain peaks at -1.93dB, then the circuit dramatically increases in attenuation. The resonant frequency is about 4900Hz. The Q factor is 0.39.



Graph 2 — physical circuit; gain against frequency

Note how on the physical circuit, the gain peaks at about -18.71 decibels, which is significantly lower than the simulated circuit in Proteus. The resonant frequency is about 5400Hz. The Q factor is 0.39.

Discussion

The results reveal noteworthy differences between the resonant frequency and Q factor between the simulated circuit and physical breadboard circuit. One of the reasons behind that is that simulations typically utilise unnaturally perfect models of components like capacitors and inductors, ignoring any real-world imperfections. For example, an ideal inductor in the simulation lacks the innate resistance present in a real world one. Such differences can lead to significant variations between the simulated and physical circuits. Furthermore, physical circuits work under external factors that are not usually programmed into a simulation. Factors such as temperature fluctuations and humidity can influence the behaviour of the components, which lead to the results being different.  21 These aspects are usually overlooked in simulations, leading to a discrepancy between simulations and real-world performance.

Manufacturing tolerances are also a factor as to why there are discrepancies between the two circuits. The components used in physical circuits are subject to manufacturing tolerances, meaning their actual values can be a little bit different from the values they are supposed to be. Furthermore, the physical layout of a circuit introduces elements such as stray resistance that arise from the breadboard connections. These elements are often overlooked in simulations, hence why, once again, the Q factor and resonant frequency between the simulated circuit and physical circuit are different.

Conclusion

In this experiment, it has been determined that the performance and quality of a simulated circuit and a physical one will usually differ, since external factors that affect the physical ones, are not typically considered in a simulated circuit.

Therefore, at a large manufacturing level, it is important to make a simulated circuit as realistic as possible so that there are not unexpected consequences when it comes to the production stage of a circuit.

References

[1] – Formula used in assignment brief.

[2] – https://www.electronics-notes.com/articles/basic_concepts/q-quality-factor/basics-tutorial-formula.php, Q factor formula.

2317310 Report

GRADEMARK REPORT

FINAL GRADE

GENERAL COMMENTS

49/100

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.

PAGE 2



Comment 2

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



Comment 3

It would
have been better if table of content is included for figures



Comment 4

It is
better to number each heading



Comment 5

The
citation should be mentioned before the full stop



Comment 6

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



Comment 7

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

PAGE 3



Comment 8

Good work



Comment 9

Compose
the report from a third-person perspective.



Comment 10

Compose
the report from a third-person perspective.



Comment 11

what is F0, FI, F-3db?



Comment 12

It is better to number each page

PAGE 4



Comment 13

It would have been better if Fr, FI and Fu were mentioned in the graph.



Comment 14

It would have been better if the results were tabulated



Comment 15

Figure 4:



Comment 16

It would have been better if the results were tabulated



Comment 17

It would have been better if Fr, FI and Fu were mentioned in the graph.



Comment 18

Figure 5:



Comment 19

There is deviation in the values



Comment 20

The theoretical Fr and Q are missing

PAGE 5



Comment 21

It would have been better if the actual values were included in the discussion.



Comment 22

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

GRADING FORM: GRADING

STEFAN DAITOIU

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

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.

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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

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context of the application. Good evidence of different approaches to identify errors in circuit design and output generated is appropriate.

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.

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