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## Laboratory 5:

**Analogue Filter Design**

Part 1:Experimental equipment and devices

1. A signal generator

2. Oscilloscope

3. Breadboard (bring your own one)

4. Resistors and capacitors

5. LM741

Part 2:Experimental content

I construct two circuits to implement and analyze two analogue low pass filters.

Part 3:Experimental procedure and results

**Task 1**

1. Procedure

**I build the circuit and check the Vout and Vin. I increase the frequency to 100 kHz from 0.1 kHz. Then add up the numbers and form a conclusion.**

(2)Results

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| **Task 1: Graph**  电脑屏幕的照片  低可信度描述已自动生成  **Task 2:Explain why fc is called 3dB cutoff frequency.**  **Because the Vpp becomes () times the original Vpp when I change the frequency to fc. As a result, I refer to the frequency as fc 3dB cutoff frequency.**  图形用户界面  描述已自动生成  Task 3:   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | ***Input(KHz)*** | ***Vin(V)*** | ***Vout(V)*** | ***Vout/vin*** | ***20log10(Vout/Vin)*** | ***phase*** | | ***0.1*** | ***10.2*** | ***10*** | ***0.980432*** | ***-0.1720035*** | ***-2.29°*** | | ***1*** | ***10.2*** | ***8.10*** | ***0.792123*** | ***-2.023772*** | ***-36.3°*** | | ***10*** | ***10.2*** | ***1.62*** | ***0.156842*** | ***-16.089608*** | ***-78.20°*** | | ***100*** | ***10.2*** | ***0.23*** | ***0.023429*** | ***-32.56776*** | ***-90.0°*** | | ***1.59*** | ***10.2*** | ***6.84*** | ***0.670582*** | ***-3.4708811*** | ***-44.73°*** |   图片包含 图表  描述已自动生成  Task 4:  As I change the sine signal to square wave, and f=4fc, I get the output which meets our expectation  图表, 折线图  描述已自动生成  Task 5:  As I change the sine signal to triangle wave, and f=4fc, I get the output which meets our expectation with just small error. |

***Comment:***

As I increase the frequency of input, the Gain decreases, and 20log10(Vout/Vin) decreases at the same time. The phase difference between output and input voltage shrinks as well.

Part2

1. Procedure

I construct the circuit, and measure the Vout and Vin. I change the frequency from 0.1Khz to 100Khz. Then calculate the data and draw the conclusion.

(2)Results

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| Task 6:  电子设备  中度可信度描述已自动生成  Task 7:  图片包含 游戏机, 激光, 灯光  描述已自动生成   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | ***input*** | ***vin*** | ***vout*** | ***vout/vin*** | ***20log10(vout/vin)*** | ***phase*** | | ***0.1*** | ***10.2*** | ***10.2*** | ***1*** | ***0*** | ***7.21°*** | | ***1*** | ***10.2*** | ***6.88*** | ***0.67451*** | ***-3.420234671*** | ***66.23°*** | | ***10*** | ***10.2*** | ***0.6*** | ***0.058824*** | ***-24.60897843*** | ***190°*** | | ***100*** | ***10.2*** | ***2.23*** | ***0.218627*** | ***-13.20590617*** | ***280°*** | | ***1.5915*** | ***10.2*** | ***4.68*** | ***0.458824*** | ***-6.767086374*** | ***88.3°*** |   电脑萤幕画面  中度可信度描述已自动生成  As I change the sine signal to square wave, and f=4fc, I get the output which meets our expectation  电脑萤幕画面  低可信度描述已自动生成  As I change the sine signal to square wave, and f=4fc, I get the output which meets our expectation with just small error |

***Comment:***

As I increase the frequency of input, the Gain decreases, and 20log10(Vout/Vin) decreases at the same time. The phase difference between output and input voltage shrinks as well. However, if I increase the frequency too much, the output will not satisfy our expectations, and the data would be useless.

Part 4: Summary

In lab 5, To create and analyze two analogue low pass filters, I built two circuits.

I now have a better grasp of low pass filters and am more knowledgeable about their qualities as a result of this lab.

*That’s all, thank you for your patient examination！*

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