Experimental General Physics for Engineers II

Laboratory Report PHYS 194 summer 2022

Section: __L01___

Experiment name: High pass filters

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Table of results (1.25 pt)	
Graph (1.25 pt)	
Data analysis (2 pts)	
Discussion (0.5 pt)	
References	
Others	
Report Grade (5 pts)	

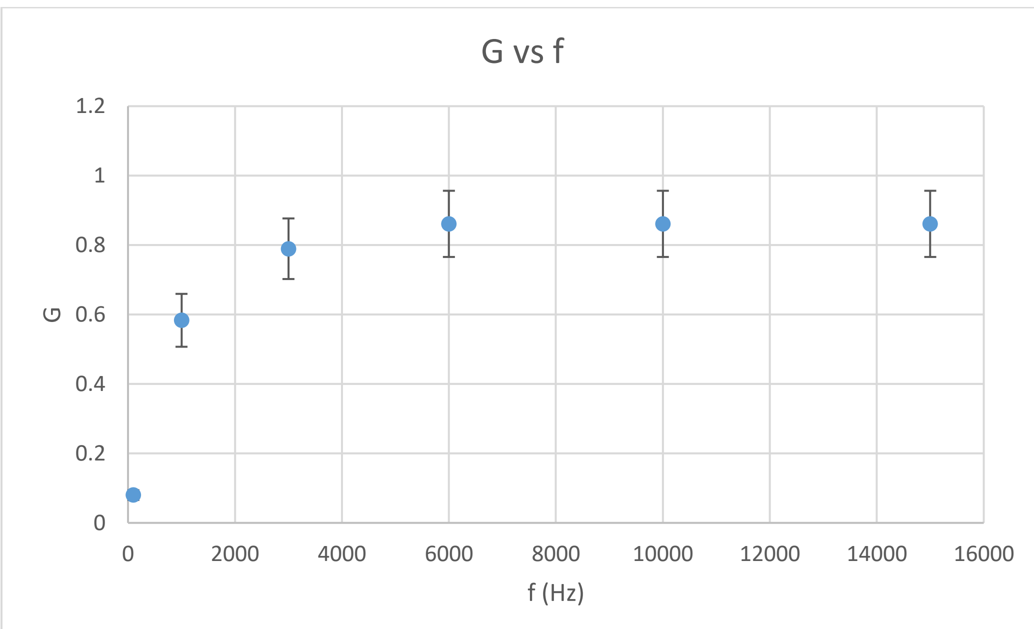
1. Table of results (fill in the table below and Put correct units in the table)

f (Hz)	u(f) (Hz)	V_{in} (volt)	$u(V_{in})$ (volt)	V_{out} (volt)	$u(V_{out})$ (volt)	G	u(G)	$\Delta\phi$	$u(\Delta\phi)$
100	±10	4	±0.45	0.32	±0.043	0.080	±0.014	1.507	±0.302
1000	±10	2.4	±0.23	1.4	±0.122	0.583	±0.076	1.005	±0.256
3000	±10	1.9	±0.14	1.5	±0.125	0.790	±0.087	0.377	±0.189
6000	±10	1.8	±0.13	1.55	±0.126	0.861	±0.095	0.226	±0.076
10000	±10	1.8	±0.13	1.55	±0.126	0.861	±0.095	0.126	±0.063
15000	±10	1.8	±0.13	1.55	±0.126	0.861	±0.095	0.009	±0.009

2. Graphs

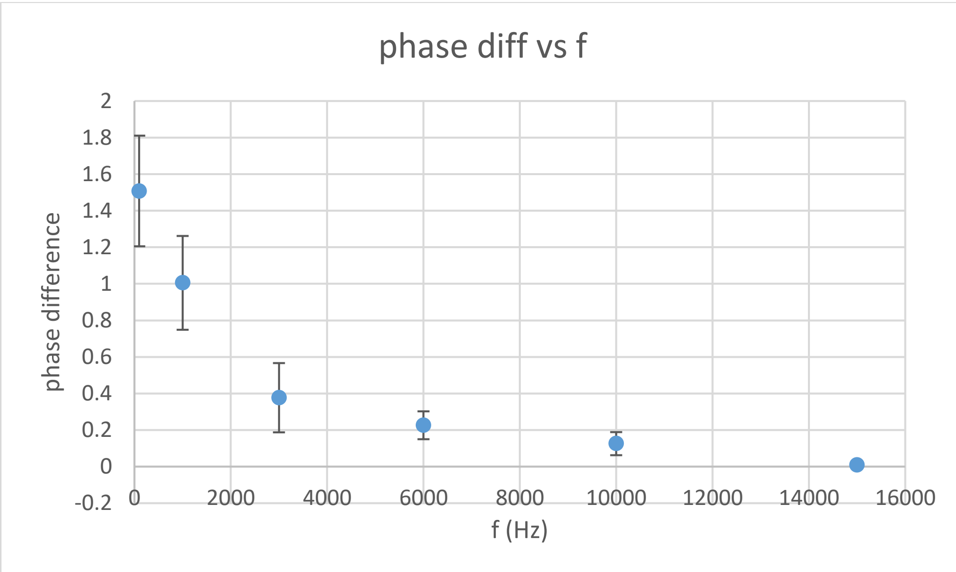
2.1. Graph of G vs. f

Plot G vs f in Excel with error bars.



2.2. Graph of $\Delta\phi$ vs. f

Plot $\Delta\phi$ vs f in Excel with error bars



3. Data analysis

3.1. Uncertainties on V_{in} and V_{out}

Show how you calculate $u(V_{in})$ and $u(V_{out})$

S=Vertical scale D=Value on the Oscilloscope

U(Vin)= sqrt((S*U(D)) ^2+(D*U(S)) ^2)

= sqrt ((2*0.05*2) ^2+(2*0.2) ^2) = ±0.447 volt

U(Vout) = sqrt ((S*U(D)^2+(D*U(S)) ^2)

= sqrt ((1.6*0.05*0.2) ^2+(0.2*0.2) ^2) = ±0.043 volt

3.2. Gain and phase difference

Show how you calculate G and $\Delta\phi$

G =Vout/Vin =0.043/0.447 = 0.08

$\Delta\phi = 2\pi\Delta t$*f

= 2 *3.14*100*0.0024 =1.507

3.3. Uncertainties on gain and on phase difference

Show how you calculate u(G) and u($\Delta\phi$)

U(f) = ±10 Hz

U(G) = sqrt((d(Vout/Vin)/d(Vout) * U(Vout)) ^2+(d(Vout/Vin)/d(Vin) * U(Vin)) ^2)

= sqrt (U(Vout)/Vin) ^2+(Vout*Vin^-2*U(Vin)) ^2)

= sqrt (0.043/4) ^2+(4*0.32^-2*0.447) ^2) = ± 0.014

U($\Delta\phi$) = sqrt (d(2*pi*f*d(t))/d(f) *u(f))^2+(d(2*pi*f*d(t))/d(d(t)*u(d(t))^2)

=sqrt ((2*pi*0.0024*10) ^2+(2*pi*100*0.0004) ^2))
= ± 0.3026

4. Discussion of the results

Discuss if $\Delta\phi$ and G have the expected behavior for a high pass filter.

The results were as expected and is satisfying the theory part. As noticeable the gains are below 1 and is as expected with low error percentages. Also from the table, we notice that G value increases and then after some time becomes consistent, thus satisfying the condition for the High pass filter.

Overall, the experiment was successful with overall low percentages of error and agrees with the expected behavior for a high pass filter.

5. References