Anhang

1.1 Quellcode

1.1.1 Quellcode Versuch 1

```python
# -*- coding: utf-8 -*-
"""
Spyder Editor

This is a temporary script file.
"""

import TekTDS2000 as tds
import numpy as np
import matplotlib.pyplot as plt
scope = tds.TekTDS2000()

x,y=scope.getData(1)
#np.savetxt("v1.csv", np.asarray([x,y]).T, delimiter=",")

dt=scope.getSamplingInterval()
spec=np.abs(np.fft.fft(y))

f=np.zeros(len(spec))

for i in range(0,len(spec)):
    f[i]=i/(len(spec)*dt)
```

```python
fig, ax = plt.subplots(figsize=(800/100, 600/100), dpi=100)
ax.plot(f[0:len(spec)/2], spec[0:len(spec)/2]/len(spec))
ax.set_xlabel('Frequency [$Hz$]')
ax.set_ylabel('$|Y(f)|$')
ax.set_title('Mundharmonika Spektrum $f_s$: '+str(np.ceil(1/dt)))
plt.savefig('v1_fft.png', dpi=100)

print('Grundfrequenz: '+str(np.argmax(spec[0:len(spec)/2])/(len(spec)*d

amp = spec[np.argmax(spec[0:len(spec)/2])]/len(spec)
print('Amplitude: ' +str(amp))
```

1.1.2 Quellcode Versuch 2

```python
# -*- coding: utf-8 -*-
"""
Created on Wed May 13 11:47:30 2015

@author: dakubatz
"""

import numpy as np
import matplotlib.pyplot as plt
pg1 = []
pg2 = []

freq=[100,200,300,400,500,700,850,1000,1200,
      1500,1700,2000,3000,4000,5000,6000,10000]
amp1=[27.2,80,52,38.4,29.6,22.4,25.6,27.2,23.6,
      21.6,23.2,31.6,21.6,27.6,19.6,18.4,17.2]
ph1=[4.5,4.4,3.49,2.78,2.3,1.66,1.35,1.21,1.02,
     0.86,0.77,0.67,0.47,0.34,0.24,0.19,0.16]

amp2=[3.36,9.68,16.6,32.2,66.8,30.4,26.8,24.4,
      20.4,18.8,17.6,19.2,21,7.2,18.6,2.8,7.2,]
```

```python
ph2 =[3.4 ,2.64 ,2.32 ,1.84 ,2.12 ,1.65 ,1.33 ,1.18 ,1.03 ,
     0.85 ,0.79 ,0.68 ,0.49 ,0.41 ,0.37 ,0.29 ,0.15]

for i in range (0 ,17):
    pg1 . append(-1* ph1 [ i ]/1000* freq [ i ]*360)
    pg2 . append(-1* ph2 [ i ]/1000* freq [ i ]*360)

fig , ax = plt . subplots ( figsize =(800/100 , 600/100) , dpi =100)
ax . semilogx ( freq ,20* np . log10 ( amp1 ))
ax . set_xlabel ( 'Kreisfrequenz ')
ax . set_ylabel ( 'Amplitudengang [$dB$] ')
ax . set_title ( 'Amplitudengang : gro er Lautsprecher ')

fig , ax = plt . subplots ( figsize =(800/100 , 600/100) , dpi =100)
ax . semilogx ( freq , pg1 )
ax . set_xlabel ( 'Kreisfrequenz ')
ax . set_ylabel ( 'Phasenwinkel [ $Grad$ ] ')
ax . set_title ( 'Phasengang : gro er Lautsprecher ')

fig , ax = plt . subplots ( figsize =(800/100 , 600/100) , dpi =100)
ax . semilogx ( freq ,20* np . log10 ( amp2 ))
ax . set_xlabel ( 'Kreisfrequenz ')
ax . set_ylabel ( 'Amplitudengang [$dB$] ')
ax . set_title ( 'Amplitudengang : kleiner Lautsprecher ')

fig , ax = plt . subplots ( figsize =(800/100 , 600/100) , dpi =100)
ax . semilogx ( freq , pg2 )
ax . set_xlabel ( 'Kreisfrequenz ')
ax . set_ylabel ( 'Phasenwinkel [ $Grad$ ] ')
ax . set_title ( 'Phasengang : kleiner Lautsprecher ')
```
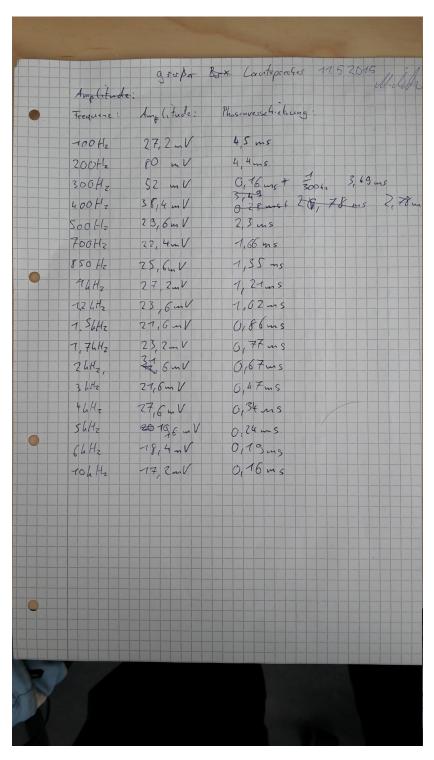
1.2 Messergebnisse

Abbildung 1.1: messprotokoll1

Kleines Lautsprecher

Frequenz	Amplitude	Phasenverschiebung
100	3,36 mV	3,4 ms
200	9,68 mV	2,64 ms
300	16,6 mV	2,32 ms
400	32,2 mV	1,84 ms
500	66,8 mV	0,12 ms 2,12 ms
700	30,4 mV	1,65 ms
850	26,8 mV	1,33 ms
1	24,4 mV	1,18 ms
1,2	20,4 mV	1,03 ms
1,5	18,8 mV	0,85 ms
1,7	17,6 mV	0,79 ms
2	19,2 mV	0,68 ms
3	21 mV	0,49 ms
4	7,2 mV	0,41 ms
5	18,6 mV	0,37 ms
6	2,8 mV	0,29 ms
10	7,2 mV	0,15 ms

Abbildung 1.2: messprotokoll2