ECE 351 - SECTION 52 #

LAB 3 REPORT

Lab3

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Contents

1   Introduction

In lab 3, we were introduced with convolutions. The purpose of this lab is to
understand /learn about convolutions .

2   Part 1

In part one we were asked to use the previous step and ramp functions from the
previous lab, Which has been developed, edited and used in this lab.

```python
def step(t):
    y = np.zeros((len(t),1))
    for i in range(len(t)):
        if t[i] >= 0:
            y[i] = 1
        else:

            y[i]= 0

    return y

steps = 1e-4

t = np.arange(-5, 10 + steps, steps)
y = step(t)

def ramp(t):

    y = np.zeros((len(t),1))

    for i in range(len(t)):

        if t[i]>=0:

            y[i] = t[i]

        else:

            y[i] = 0

    return y

y = ramp(t)

def f1(t):
```

```
38
39      y = step(t- 2) - step(t - 9)
40
41      return y
42
43
44 def f2(t):
45
46      y = np.exp(-t)
47
48      return y
49
50 def f3(t):
51
52      y =  ramp(t - 2)*(step(t - 2) - step(t - 3)) + ramp(4 - t)*(
     step(t - 3) - step(t - 4))
53
54
55      return y
56
57 steps = 1e-2
58
59 t = np.arange(0, 20 + steps, steps)
60
61 plt.figure(figsize = (10, 7))
62 plt.subplot(3, 1, 1)
63 plt.plot(t, f1(t))
64 plt.ylabel('f1(t)')
65 plt.title('User Defined Function ')
66 plt.ylim([0, 1.2])
67 plt.grid()
68 plt.show()
69 plt.subplot(3, 1, 2)
70 plt.plot(t, f2(t))
71 plt.ylabel('f2(t)')
72 plt.ylim([0, 1.2])
73 plt.grid()
74 plt.show()
75 plt.subplot(3, 1, 3)
76 plt.plot(t, f3(t))
77 plt.ylabel('f3(t)')
78 plt.ylim([0, 1.2])
79 plt.grid()
80 plt.xlabel('t(s)')
81 plt.show()
```

I tried attaching the plots here but it did not work for some reason. I used the
following commands with including ' ' but it would not work. includegraphics[]1.png

includegraphics[]2.png includegraphics[]3.png

3   Part 2

In the second part, we were asked to create a convulsion functions for f1 and f2,f2 and f3,and f1 and f3. During the time I was creating the code, I faced a problem which was the size of f1 and f2 is different for some reason so it is not working.

```
1  def con(fu1, fu2):
2      conf1=len(fu1)
3      conf2=len(fu2)
4      f1E = np.append(fu1, np.zeros((1, conf2-1)))
5      f2E = np.append(fu2, np.zeros((1, conf1-1)))
6      Value = np.zeros(f1E.shape)
7      for i in range (conf2 + conf1 - 2):
8          Value[i] = 0
9          for j in range(conf1):
10             if(i - j + 1 > 0):
11                 try:
12                     Value[i] += f1E[i]*f2E[i - j + 1]
13                 except:
14                     print(i,j)
15     return Value
16
17 steps = 1e-2
18 t = np.arange(0, 20 + steps, steps)
19 Num = len(t)
20 tE = np.arange(0, 2*t[Num - 1], steps)
21
22 fu1 = f1(t)
23 fu2 = f2(t)
24 fu3 = f3(t)
25
26
27 con12 = con(fu1, fu2)*steps
28 # con12Check = sig.convolve(fu1, fu2)*steps
29 # size of f1 and f2 is differnt for some reason so it is not
       working.
30
31 plt.figure(figsize = (10, 7))
32 plt.plot(tE, con12, label = ".fined Conv")
33 # plt.plot(tE, con12Check, '-', label = 'Built in Conv')
34 plt.ylim([0, 1.2])
35 plt.grid()
36 plt.legend()
37 plt.xlabel('t(s)')
38 plt.ylabel('fun1(t) * fun2(t)')
```

```
39 plt.title('Conv of fun1 , fun2')
40 plt.show()
41
42 con23 = con(fu2, fu3)*steps
43 # con23Check = sig.convolve(fu2, fu3)*steps
44
45 plt.figure(figsize = (10, 7))
46 plt.plot(tE, con23, label = 'User defined Conv')
47 # plt.plot(tE, con23Check, '-', label = 'Built in Conv')
48 plt.ylim([0, 0.2])
49 plt.grid()
50 plt.legend()
51 plt.xlabel('t [s]')
52 plt.ylabel('f_2(t) * f_3(t)')
53 plt.title('Convolution of f_2 and f_3')
54 plt.show()
55
56 con13 = con(fu1, fu3)*steps
57 con13Check = sig.convolve(fu1, fu3)*steps
58
59 plt.figure(figsize = (10, 7))
60 plt.plot(tE, con13, label = 'User defined Conv')
61 plt.plot(tE, con13Check, '-', label = 'Built in Conv')
62 plt.ylim([0, 1.2])
63 plt.grid()
64 plt.legend()
65 plt.xlabel('t [s]')
66 plt.ylabel('f_1(t) * f_3(t)')
67 plt.title('Convolution of f_1 and f_3')
68 plt.show()
```

I tried attaching the plots here but it did not work for some reason. I used the following commands with including ' ' but it would not work. includegraphics[]4.png includegraphics[]5.png includegraphics[]6.png

4   Questions

1. Did you work alone or with classmates on this lab? If you collaborated to get to the solution, what did that process look like? 2. What was the most difficult part of this lab for you, and what did your problem-solving process look like? 2 3. Did you approach writing the code with analytical or graphical convolution in mind? Why did you chose this approach? 4. Leave any feedback on the clarity of lab tasks, expectations, and deliverables.

1. I worked with my classmates in how we can create the code for the convolution. 2. The most difficult part was creating the code for f1 and f2,f2 and f3, f1 and f3. 3.

5   conclusion

Overall, the main idea of this lab to introduce new things such as convolution. Also, sometimes there is always an easier way for creating codes, which depends on the ability/skills that can be developed during labs.