Matlab Homework week 8

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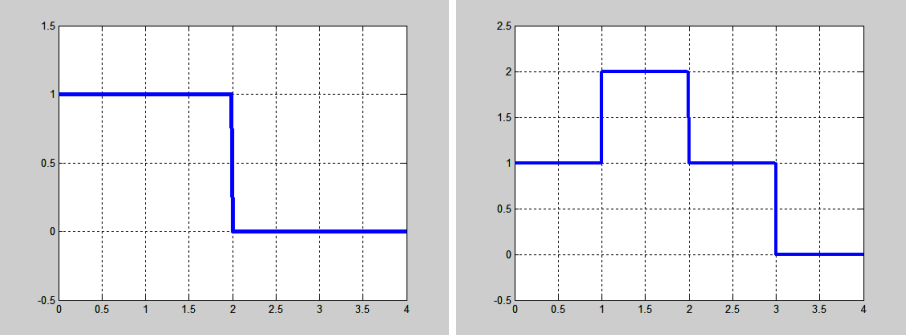
1 Convolution

1.1 Description

Calulate the Convolution of two signals in two methods as follow:



Signals f_1, f_2

1.2 Codes and result

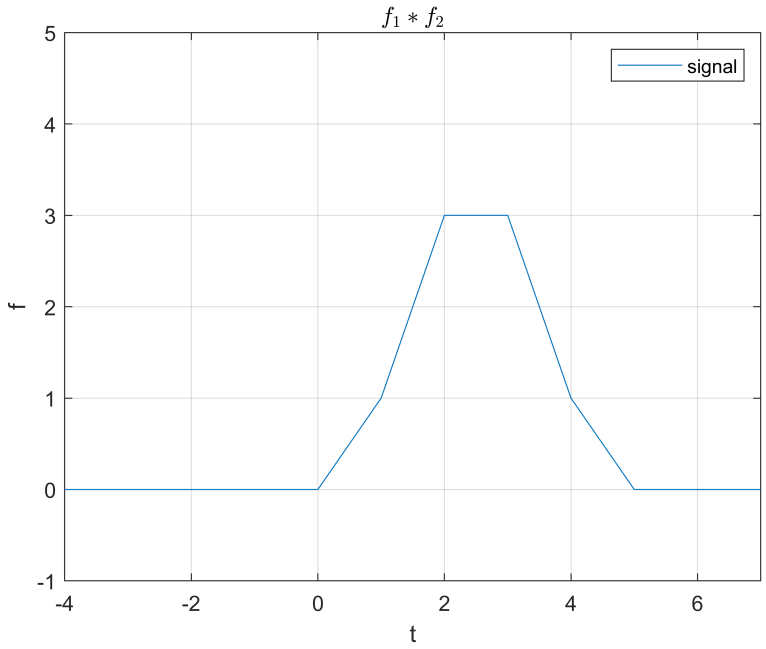
symbolic method

```
syms t tao;
y1=heaviside(-t+2);
y2=heaviside(t-1)-heaviside(t-2)+heaviside(-t+3);
f=subs(y1,t,tao)*subs(y2,t,t-tao);
ft=int(f,tao,0,t);
fplot(ft);
hold on;
grid on;
axis([-4,7,-1,5])
title('f_1 * f_2','Interpreter','Latex')
xlabel('t');
ylabel('f');
legend('signal')
```

numberical method

```
1
2       clear all
3       dt=0.01;
4       t1=0:dt:5;
5       t2=0:dt:5;
6       f1=heaviside(-t1+2);
7       f2=heaviside(t2-1)-heaviside(t2-2)+heaviside(-t2+3);
8       f=conv(f1,f2)*dt;
9       t0=t1(1)+t2(2);
10      t3=length(t1)+length(t2)-2;
11      t=t0:dt:t3*dt+t0;
12      plot(t,f);
13      hold on;
14      grid on;
15      axis([-4,7,-1,5])
16      title('$f_1 * f_2$','Interpreter','Latex')
17      xlabel('t');
18      ylabel('f');
19      legend('signal')
```

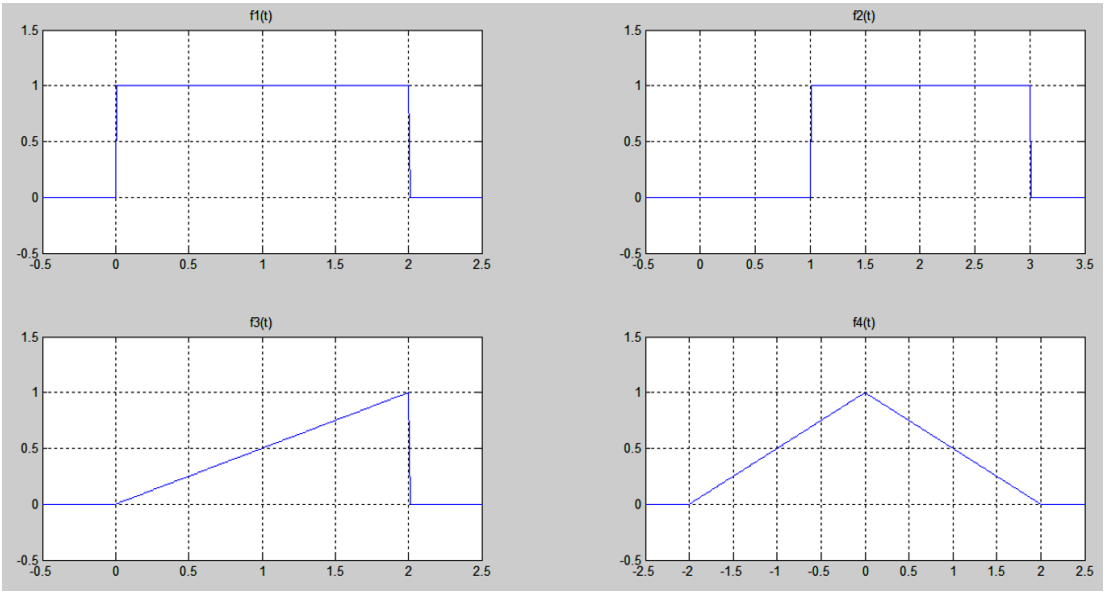
result



2 Convolution two

2.1 Description

Calulate the Convolution of four signals in two methods as follow:



Signals $f_1 - f_4$

$$f_1(t) * f_2(t), f_1(t) * f_3(t), f_1(t) * f_4(t)$$
$$f_2(t) * f_3(t), f_2(t) * f_4(t), f_3(t) * f_4(t)$$

2.2 Codes and result

symbolic method

```
1
2  syms t tao;
3  y1=heaviside(t)-heaviside(t-2);
4  y2=heaviside(t-1)-heaviside(t-3);
5  y3=1/2*t*(heaviside(t)-heaviside(t-2));
6  y4=(1/2*t+1)*(heaviside(t+2)-heaviside(t))+(-1/2*t+1)*(
       heaviside(t)-heaviside(t-2));
7  figure(2)
8  subplot(2,2,1)
9  fplot(y1);
10 subplot(2,2,2)
11 fplot(y2);
```

```
subplot(2,2,3)
fplot(y3);
subplot(2,2,4)
fplot(y4);
figure(1)
f=subs(y1,t,tao)*subs(y2,t,t-tao);
ft=int(f,tao,-inf,t);
subplot(3,2,1)
fplot(ft);
axis([-8,8,-1,5]);
grid on;
title('$f_1(t)*f_2(t)$','Interpreter','Latex');
subplot(3,2,2);
f=subs(y1,t,tao)*subs(y3,t,t-tao);
ft=int(f,tao,-inf,t);
fplot(ft);
grid on;
title('$f_1(t)*f_3(t)$','Interpreter','Latex');
subplot(3,2,3);
grid on;
f=subs(y1,t,tao)*subs(y4,t,t-tao);
ft=int(f,tao,-inf,t);
fplot(ft);
title('$f_1(t)*f_4(t)$','Interpreter','Latex');
subplot(3,2,4);
f=subs(y2,t,tao)*subs(y3,t,t-tao);
ft=int(f,tao,-inf,t);
fplot(ft);
grid on;
title('$f_2(t)*f_3(t)$','Interpreter','Latex');
subplot(3,2,5);
f=subs(y2,t,tao)*subs(y4,t,t-tao);
ft=int(f,tao,-4,t);
fplot(ft);
title('$f_2(t)*f_4(t)$','Interpreter','Latex');
grid on;
subplot(3,2,6);
f=subs(y3,t,tao)*subs(y4,t,t-tao);
ft=int(f,tao,-inf,t);
fplot(ft);
grid on;
```

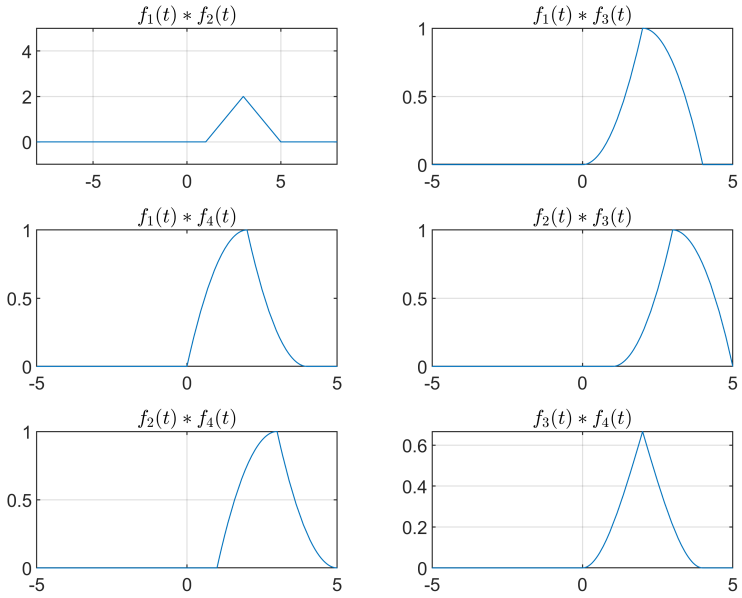
```
53 title('f_3(t) * f_4(t)','Interpreter','Latex');
```

numberical method

```
1     clear all;
2     dt=0.01;
3     t=0:dt:3;
4     f1=heaviside(t)-heaviside(t-2);
5     f2=heaviside(t-1)-heaviside(t-3);
6     f3=1/2*t.*(heaviside(t)-heaviside(t-2));
7     f4=(1/2*t+1).*(heaviside(t+2)-heaviside(t))+(-1/2*t+1).*(
          heaviside(t)-heaviside(t-2));
8     subplot(3,2,1)
9     f=conv(f1,f2)*dt;
10    t=0:dt:6;
11    plot(t,f);
12    grid on;
13    title('f_1(t) * f_2(t)','Interpreter','Latex');
14    subplot(3,2,2)
15    f=conv(f1,f3)*dt;
16    t=0:dt:6;
17    plot(t,f);
18    grid on;
19    title('f_1(t) * f_3(t)','Interpreter','Latex');
20    subplot(3,2,3)
21    f=conv(f1,f4)*dt;
22    t=0:dt:6;
23    plot(t,f);
24    grid on;
25    title('f_1(t) * f_4(t)','Interpreter','Latex');
26    subplot(3,2,4);
27    f=conv(f2,f3)*dt;
28    t=0:dt:6;
29    plot(t,f);
30    grid on;
31    title('f_2(t) * f_3(t)','Interpreter','Latex');
32    subplot(3,2,5)
33    f=conv(f2,f4)*dt;
34    t=0:dt:6;
35    plot(t,f);grid on;
36    title('f_2(t) * f_4(t)','Interpreter','Latex');
37    subplot(3,2,6)
```

```
f=conv(f1,f2)*dt;
t=0:dt:6;
plot(t,f);
title('f_3(t)*f_4(t)','Interpreter','Latex');
```

result



3 Convolution Three

3.1 Description

Calulate the Convolution of two signals in two methods as follow:

$$f_1(t) = u(t) - u(t-2)$$
$$f_2(t) = e^{-3t}\ (0 < t < 7)$$

3.2 Codes and result

symbolic method

```
clear all;
syms t tao;
f1=heaviside(t)-heaviside(t-2);
f2=exp(-3*t)*(heaviside(t)-heaviside(t-7));
```

```
5       f=int(subs(f1,t,tao)*subs(f2,t,t-tao),tao,-inf,t);
6       fplot(f)
```

numberical method

```
1       clear all;
2       dt=0.01;
3       t=0:dt:7;
4       f1=heaviside(t)-heaviside(t-2);
5       f2=exp(-3*t).*(heaviside(t)-heaviside(t-7));
6       f=dt*conv(f1,f2);
7       t=0:dt:14;
8       plot(t,f)
```

result