实验一：典型连续时间信号描述及运算

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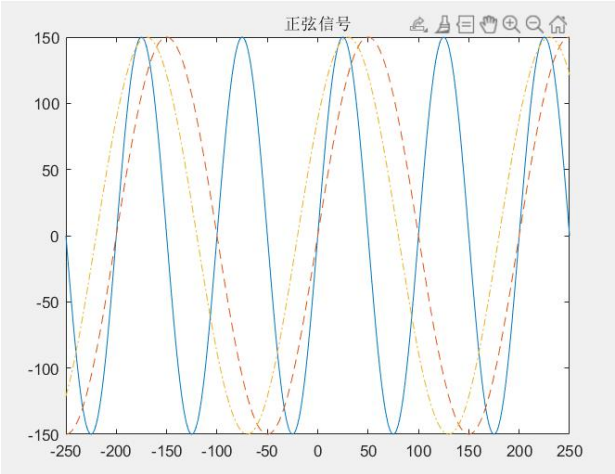
1 报告要求

1. 典型连续时间信号波形绘制:正弦信号、衰减正弦信号、钟型信号
2. 奇异信号波形绘制：符号函数、阶跃信号、单位冲激信号
3. 利用信号运算，完成 6 个小题
4. 按照实验要求，求解如下信号的直流/交流分量并显示在同一图中

2 实验过程

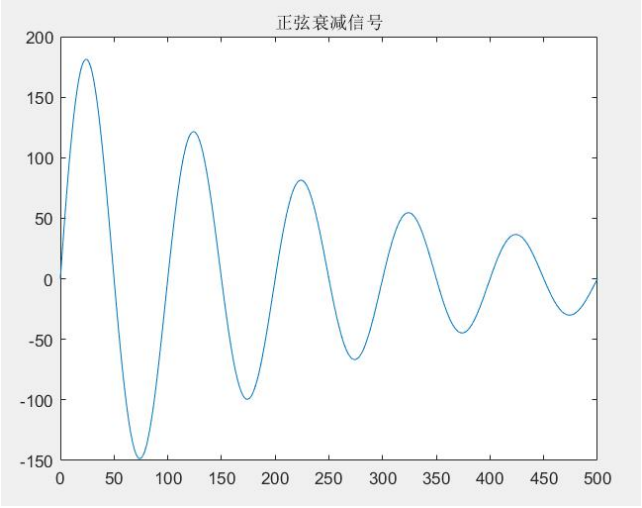
2.1 时间信号波形绘制

<1>正弦信号



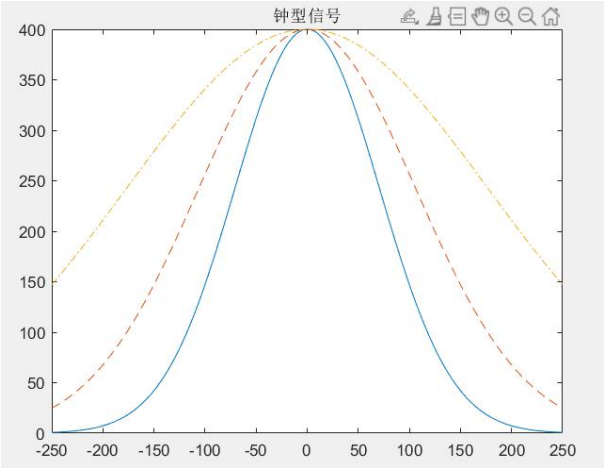

```
t = -250:1:250;
f1 = 150.0 * sin(2.0*pi*t./100+0);
f2 = 150.0 * sin(2.0*pi*t./200+0);
f3 = 150.0 * sin(2.0*pi*t./200+pi/5.0);
plot(t,f1,'-',t,f2,'--',t,f3,'-.');
title('正弦信号')
```

<2> 衰减正弦信号




```
t = 0:1:500;
f = 200.0 * sin(2.0*pi*t/100.00).*exp(-1*t/250.0);
plot(t,f);
title('正弦衰减信号')
```

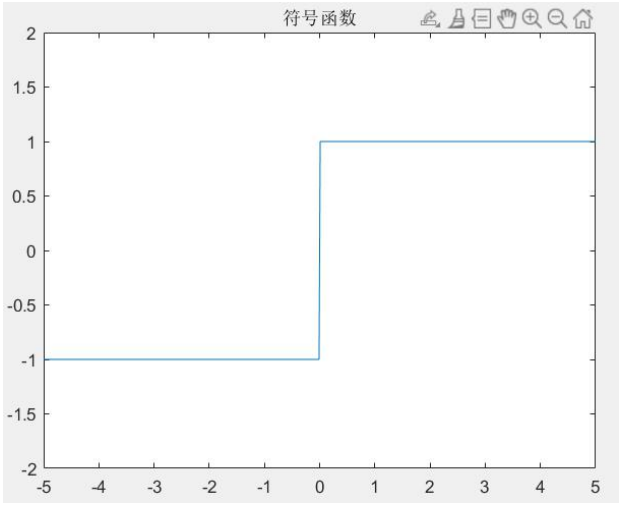
<3> 钟型信号




```
t = -250:1:250;
f1 = 400.0 * exp(-1*t.^2/100.0^2);
f2 = 400.0 * exp(-1*t.^2/150.0^2);
f3 = 400.0 * exp(-1*t.^2/250.0^2);
plot(t,f1,'-',t,f2,'--',t,f3,'-.');
title('钟型信号')
```

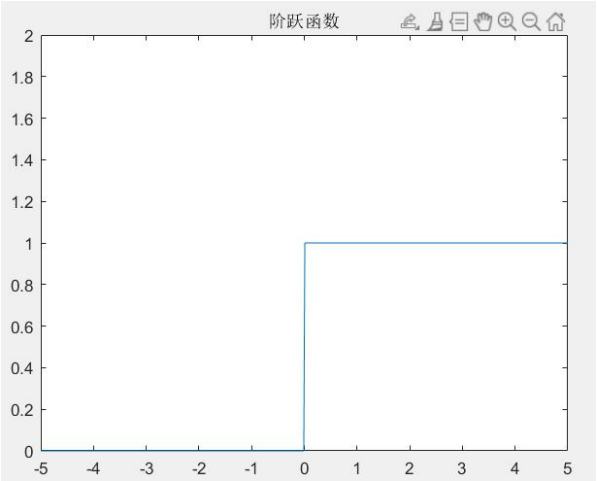
2.2 奇异信号波形绘制：

<1> 符号函数



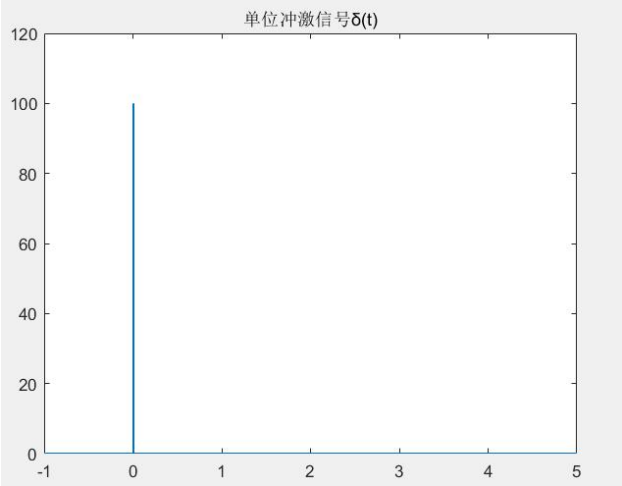

```
t = -5:0.01:5;
f = sign(t);
plot(t,f);
ylim([-2,2])
title('符号函数')
```

<2> 阶跃函数




```
t= -5:0.01:5;
f = 1/2 + 1/2 * sign(t);
plot(t,f)
ylim([0,2])
title('阶跃函数')
```

<3>单位脉冲信号

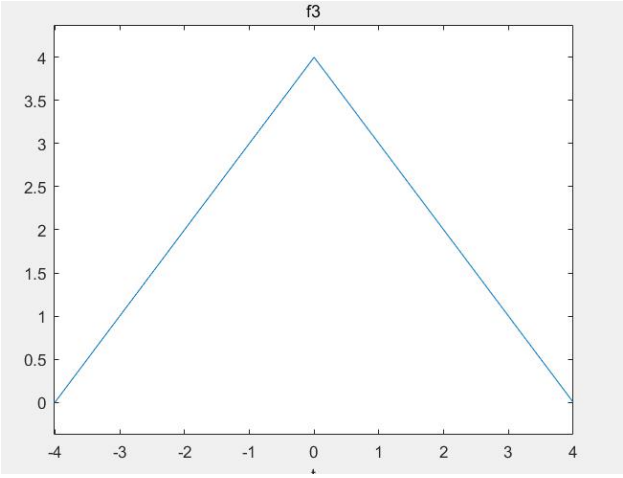



```
% 引用函数
y = first_func1(-1,5,0);
```

```
function y = first_func1(t1,t2,t0) % 文件名和函数名相同
dt = 0.01;
t = t1:dt:t2;
n = length(t);
x = zeros(1,n);
x(1,(-t0-t1)/dt+1)= 1/dt; % 定位+赋值
y = stairs(t,x);
axis([t1,t2,0,1.2/dt]);
title('单位脉冲信号');
```

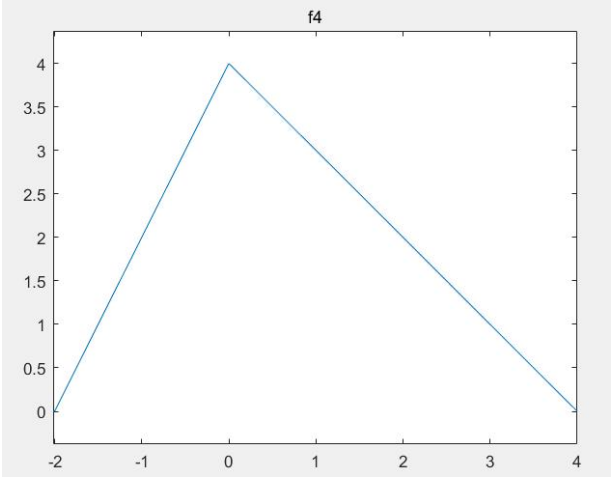
2.3 信号运算

<1> $f_3(t) = f_1(-t) + f_1(t)$



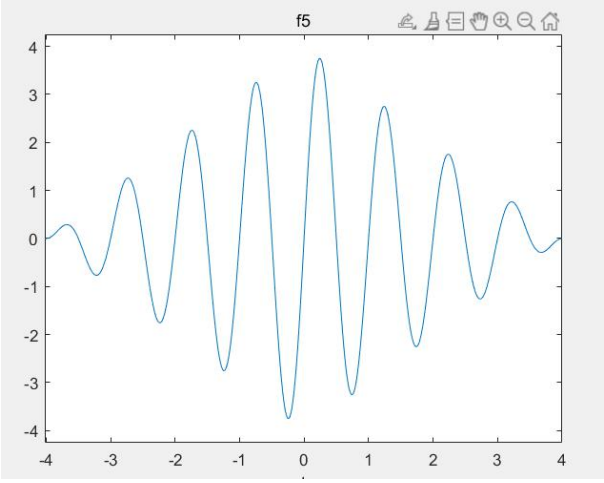

```
syms t
f1 =
str2sym('(-t+4)*(heaviside(t)-heaviside(t-4))');
y1 = subs(f1,-t);
f3 = f1+y1;
ezplot(f3)
```

<2> $f_4(t) = -[f_1(-2t) + f_1(t)]$



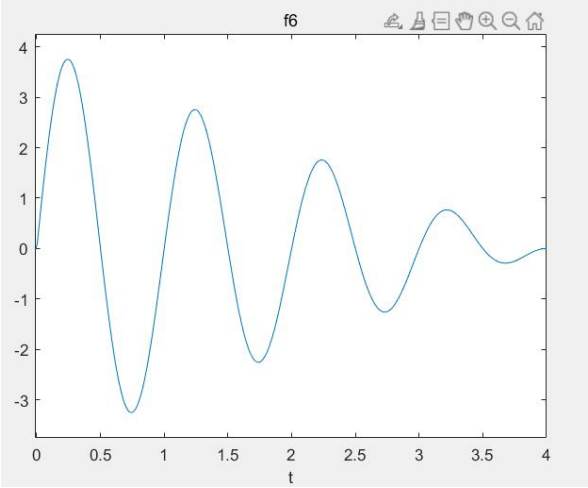

```
syms t
f1 =
str2sym('(-t+4)*(heaviside(t)-heaviside(t-4))');
f2 = subs(f1,-2*t);
f4 = f2+f1;
ezplot(f4)
```

<3> $f_5(t) = f_2(t) \times f_3(t)$



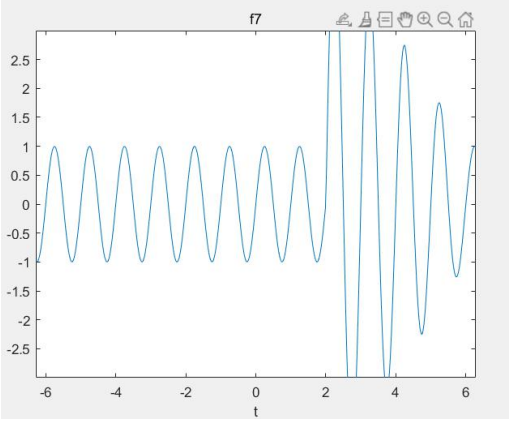

```
syms t
f1 =
str2sym('(-t+4)*(heaviside(t)-he
aviside(t-4))');
y1 = subs(f1,-t);
f3 = f1+y1;
f2 = str2sym('sin(2*pi*t)');
f5 = f2*f3;
ezplot(f5)
title('f5')
```

<4> $f_6(t) = f_1(t) \times f_2(t)$



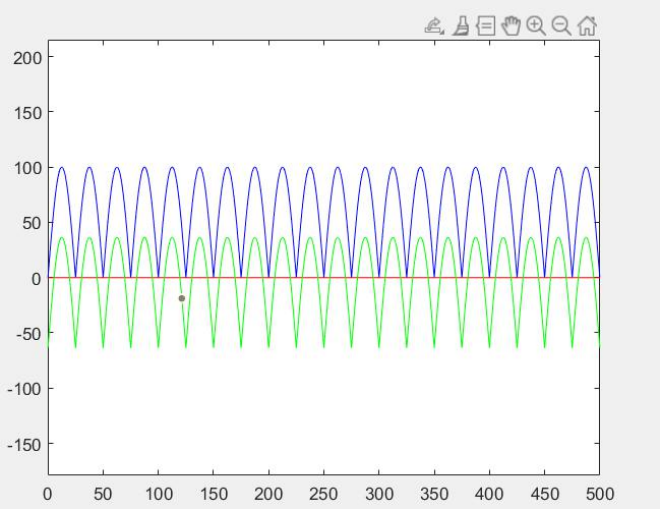

```
syms t
f1 =
str2sym('(-t+4)*(heaviside(t
)-heaviside(t-4))');
f2 = str2sym('sin(2*pi*t)');
f6 = f2*f1;
ezplot(f6);
title('f6')
```

<5> $f_7(t) = f_6(t-2) + f_2(t)$




```
syms t
f1 =
str2sym('(-t+4)*(heaviside(t)
-heaviside(t-4))');
f2 = str2sym('sin(2*pi*t)');
f6 = f2*f1;
f7 = subs(f6,t-2)+f2;
ezplot(f7);
title('f7')
```

2.4 绘制信号直流/交流分量并显示在同一张图




```
t = 0:0.1:500;
f1 = 100 * abs(sin(2*pi*t./50));
f2 = fDC(f1);
n = length(t);
f2_new = zeros(1,n);
f3 = fAC(f1,f2);
plot(t,f1,'b',t,f2_new,'r',t,f
3,'g');
axis equal;
```

```
function fA = fAC(f,fD)
fA = f-fD;
```

```
function fD = fDC(f)
fD = mean(f);
```