CECS 463 System On Chip II
FALL 2020

Kuldeep Gohil

Assignment #00 – The Complex Plane

09/01/2020

```
%Kuldeep Gohil
%CECS 463 Fall20
%Assignment #00 Due: 9/1/2020

clear all; close all; clc; format compact;



disp('Problem 1')
xmax=0.75;
xmin=-2.75;
p=0.04;
x0=-2.5;
f=1/p;
w=2*pi*f;
A=(xmax-xmin)/2;
dcOffset=(xmax+xmin)/2;
t0=0.037;
theta=((acos((xmin-dcOffset)/A))-w*t0)*180/pi;


%t0=0.0;
theta=((acos((x0-dcOffset)/A))-w*t0)*180/pi;

%acos maybe negative
fprintf('  DC offset=%4.2f, A=%4.2f, w=%4.2f radians/sec, theta=%4.2f degrees\n',...
    dcOffset,A,w,theta);


t=0;
xchk=A*cos(w*t+theta*pi/180)+dcOffset;
%Check the theta value at t=0
fprintf('  Check: x(t=0)= %4.2f (should be about -2.5)\n',xchk);
t=0.037;
xchk=A*cos(w*t+theta*pi/180)+dcOffset;
%Check the theta value at t=0.037
fprintf('  Check: x(t=0.037)= %4.2f (should be about -2.75)\n',xchk);
fprintf(' \n');



disp('Problem2(a)')
x=1-2j;
y=1+1j;
a=x+y;
b=x-y;
c=x*y;
d=x/y;

e=x^y;fprintf('x=(%5.2f) + (%5.2f)j \n',real(x),imag(x));
fprintf('y=(%5.2f) + (%5.2f)j \n',real(y),imag(y));
fprintf('  (1)a=x+y=(%5.2f) + (%5.2f)j \n',real(a),imag(a));
fprintf('  (2)b=x-y=(%5.2f) + (%5.2f)j \n',real(b),imag(b));
fprintf('  (3)c=x*y=(%5.2f) + (%5.2f)j \n',real(c),imag(c));
fprintf('  (4)d=x/y=(%5.2f) + (%5.2f)j \n',real(d),imag(d));
fprintf('  (5)e=x^y=(%5.2f) + (%5.2f)j \n',real(e),imag(e));
fprintf(' \n');
```

```
disp('Problem 2(b)')
fprintf('  See Figure 1 for plot of results\n');
fig=figure();
hold on;
grid on;
set(fig,'defaultLegendAutoUpdate','off');
%...so legend will work right here
xlabel('REAL AXIS');
ylabel('IMAGINARY AXIS');
title('1(b) Complex Points');
axis([-8,8,-8,8]);
plot(real(x),imag(x),'k*');
plot(real(y),imag(y),'y*');
plot(real(a),imag(a),'b*');
plot(real(b),imag(b),'g*');
plot(real(c),imag(c),'r*');
plot(real(d),imag(d),'c*');
plot(real(e),imag(e),'m*');
pause(2);
fprintf(' \n');


disp('Problem 2(c)')
fprintf('  (1)a=x+y=(%5.2f) magnitude at angle (%5.2f)
degrees\n',abs(a),angle(a)*180/pi);
fprintf('  (2)b=x+y=(%5.2f) magnitude at angle (%5.2f)
degrees\n',abs(b),angle(b)*180/pi);
fprintf('  (3)c=x+y=(%5.2f) magnitude at angle (%5.2f)
degrees\n',abs(c),angle(c)*180/pi);
fprintf('  (4)d=x+y=(%5.2f) magnitude at angle (%5.2f)
degrees\n',abs(d),angle(d)*180/pi);
fprintf('  (5)e=x+y=(%5.2f) magnitude at angle (%5.2f)
degrees\n',abs(e),angle(e)*180/pi);
plot([0,real(x)],[0,imag(x)],'k');plot([0,real(y)],[0,imag(y)],'y');plot([0,real(a)],[
0,imag(a)],'b');
plot([0,real(b)],[0,imag(b)],'g');plot([0,real(c)],[0,imag(c)],'r');plot([0,real(d)],[
0,imag(d)],'c');
plot([0,real(e)],[0,imag(e)],'m');title('1(b) Complex Points as Vectors');
legend('x=1-2j','y=1+1j','a=x+y=2-1j','b=x-y=0-3j','c=x*y=3-1j','d=x-y=(-
1+3j)/2','e=x^y=6.46-2.02j');
hold off;
pause(2);
fprintf(' \n');


disp('Problem 3')
fig=figure();
hold on;
axis([-5,5,-5,5]);
grid on;
set(fig,'defaultLegendAutoUpdate','off');
%...so legend will work right here
x=3*exp(1j*45*pi/180);
y=2*exp(1j*(-150-90)*pi/180);
xmag=abs(x);
xang=angle(x);
ymag=abs(y);
yang=angle(y);
fprintf('  x=(%5.2f) + (%5.2f)j = ',real(x),imag(x));
fprintf('(%5.2f) magnitude at angle (%5.2f) degrees\n',abs(x),angle(x)*180/pi);
fprintf('  y=(%5.2f) + (%5.2f)j = ',real(y),imag(y));
fprintf('(%5.2f) magnitude at angle (%5.2f) degrees\n',abs(y),angle(y)*180/pi);
fprintf(' \n');
```

```
disp('Problem 4');
s=x+y;
plot(real(x),imag(x),'b*');
plot(real(y),imag(y),'r*');
plot(real(s),imag(s),'g*');
legend('x=3cos(25t+45)','y=2sin(25t-150)','s=4cos(25t+74)');
plot([0,real(y)],[0,imag(y)],'r');
plot([0,real(x)],[0,imag(x)],'b');
plot([0,real(s)],[0,imag(s)],'g');
xlabel('REAL AXIS');
ylabel('IMAGINARY AXIS');
title('4. Sum of 2 Phasors in Complex Plane');
fprintf('  s=(%5.2f) + (%5.2f)j = ',real(s),imag(s));
fprintf('(%5.2f) magnitude at angle (%5.2f) degrees\n',abs(s),angle(s)*180/pi);
hold off;
disp('  See Figure 2 for phasors x, y and s');
fprintf(' \n');
```

```
Problem 1

  DC offset=-1.00, A=1.75, w=157.08 radians/sec, theta=-184.00 degrees

  Check: x(t=0)= -2.75 (should be about -2.5)

  Check: x(t=0.037)= -2.50 (should be about -2.75)



Problem2(a)

x=( 1.00) + (-2.00)j

y=( 1.00) + ( 1.00)j

  (1)a=x+y=( 2.00) + (-1.00)j

  (2)b=x-y=( 0.00) + (-3.00)j

  (3)c=x*y=( 3.00) + (-1.00)j

  (4)d=x/y=(-0.50) + (-1.50)j

  (5)e=x^y=( 6.46) + (-2.02)j




Problem 2(b)

  See Figure 1 for plot of results
```

Problem 2(c)

(1)a=x+y=(2.24) magnitude at angle (-26.57) degrees

(2)b=x+y=(3.00) magnitude at angle (-90.00) degrees

(3)c=x+y=(3.16) magnitude at angle (-18.43) degrees

(4)d=x+y=(1.58) magnitude at angle (-108.43) degrees

(5)e=x+y=(6.77) magnitude at angle (-17.33) degrees

Problem 3

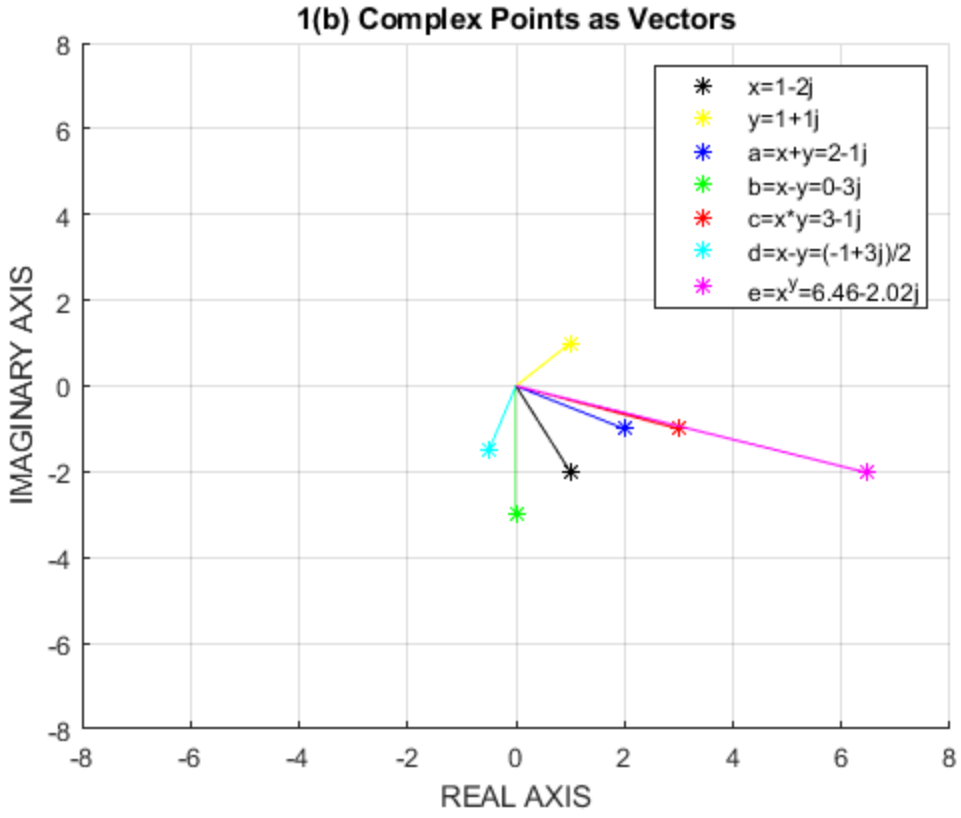
x=(2.12) + (2.12)j = (3.00) magnitude at angle (45.00) degrees

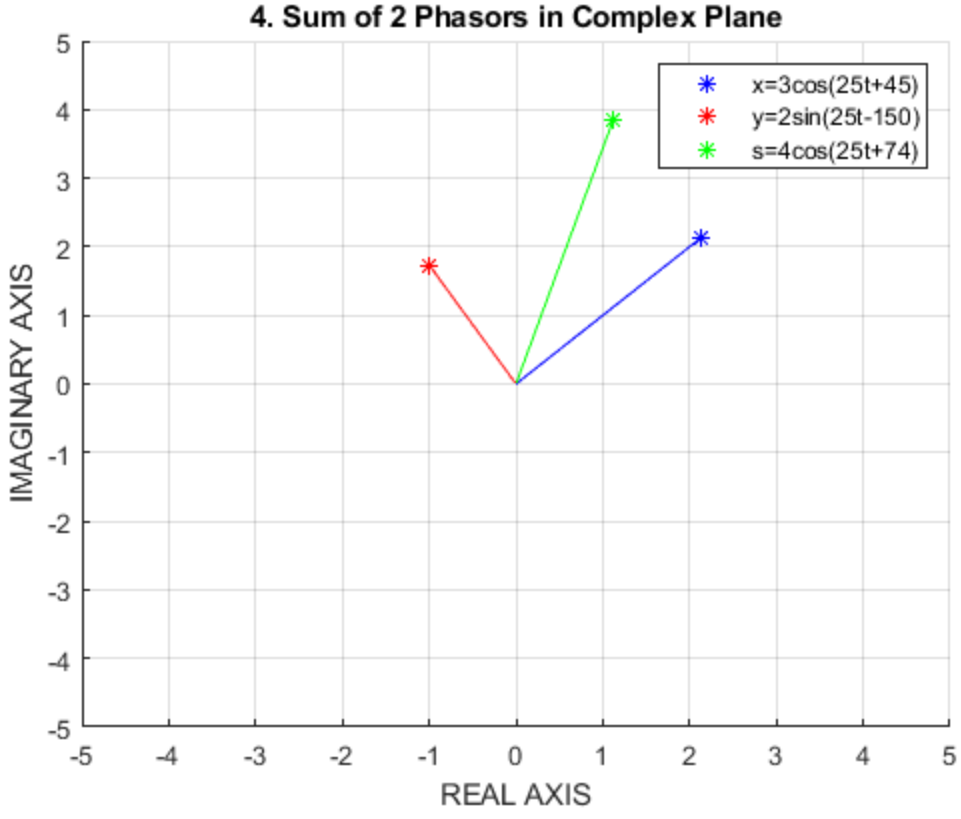
y=(-1.00) + (1.73)j = (2.00) magnitude at angle (120.00) degrees

Problem 4

s=(1.12) + (3.85)j = (4.01) magnitude at angle (73.78) degrees

See Figure 2 for phasors x, y and s


1(b) Complex Points as Vectors
x=1-2j
y=1+1j
a=x+y=2-1j
b=x-y=0-3j
c=x*y=3-1j
d=x-y=(-1+3j)/2
e=x^y=6.46-2.02j
IMAGINARY AXIS
REAL AXIS
8
6
4
2
0
-2
-4
-6
-8


4. Sum of 2 Phasors in Complex Plane
x=3cos(25t+45)
y=2sin(25t-150)
s=4cos(25t+74)
IMAGINARY AXIS
REAL AXIS
5
4
3
2
1
0
-1
-2
-3
-4
-5