

Part 1

```
function lab5_wave_EAK(A,the,lam)

%OPT211 Lab 5
%Ezra Alcon-Kirshman
%wave generator

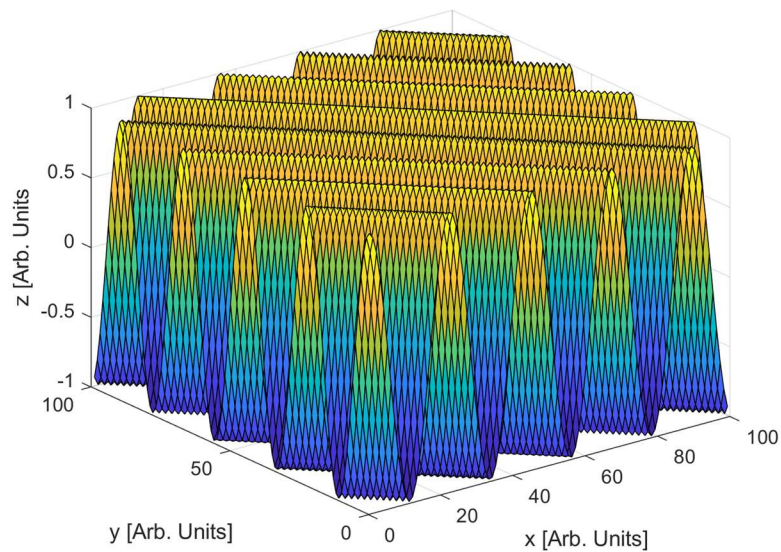
x=linspace(0,2*pi,100);
y=linspace(0,2*pi,100);

[x1,y1]=meshgrid(x,y);

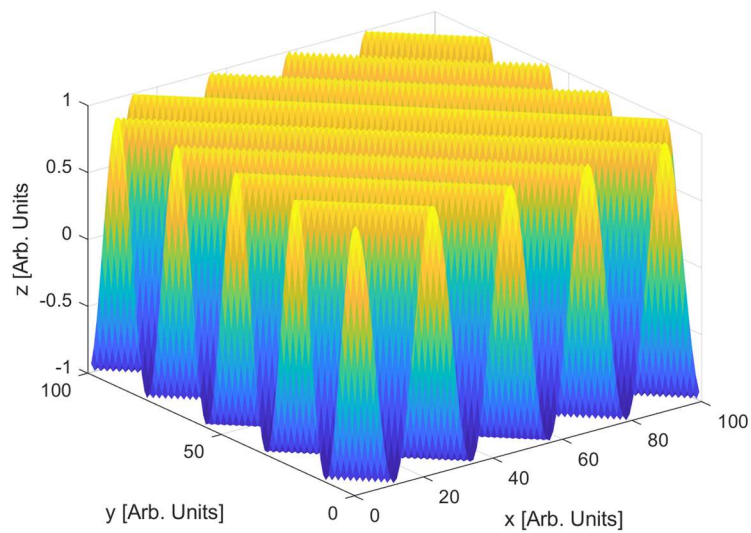
z1 = A*cos(((2*pi)/lam)*(x1*cosd(the)+y1*sind(the)));
```

Part 2

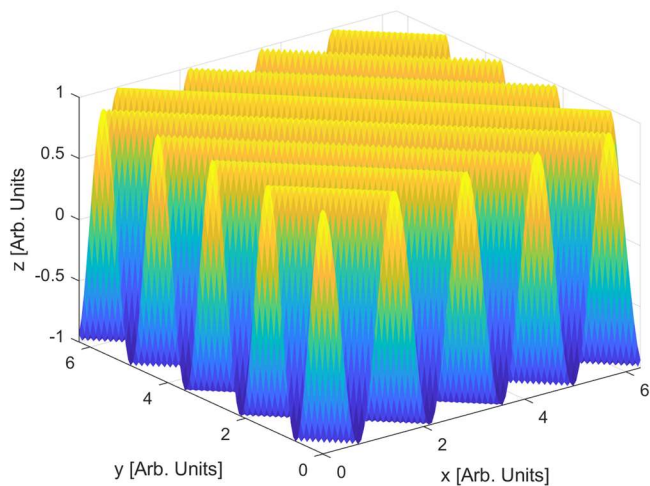
```
figure(1)
surf(z1) %Surface Plot
xlabel('x [Arb. Units]')
ylabel('y [Arb. Units]')
zlabel('z [Arb. Units]')
```



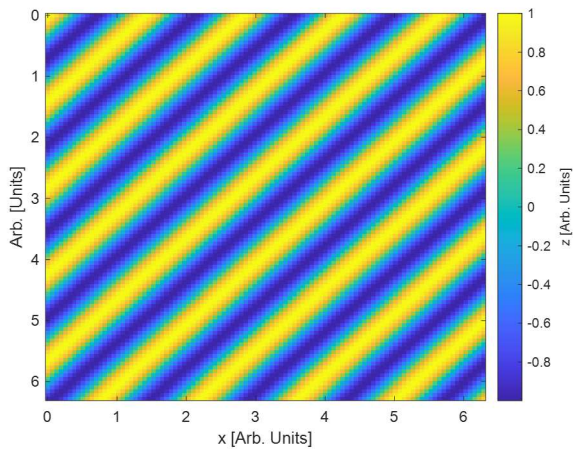
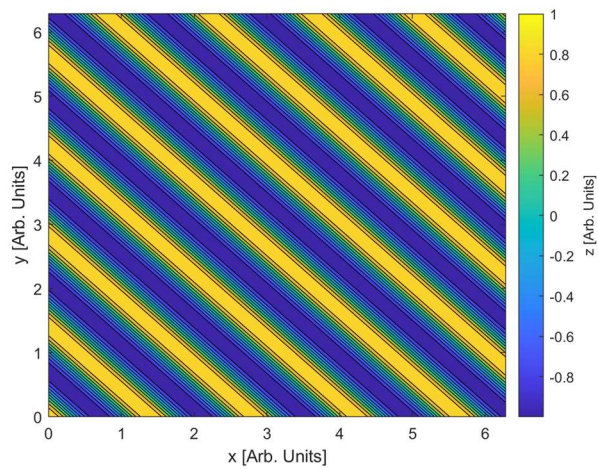
```
figure(2)
surf(z1, 'MeshStyle', 'none') %Surface Plot with no mesh
xlabel('x [Arb. Units]')
ylabel('y [Arb. Units]')
zlabel('z [Arb. Units]')
```



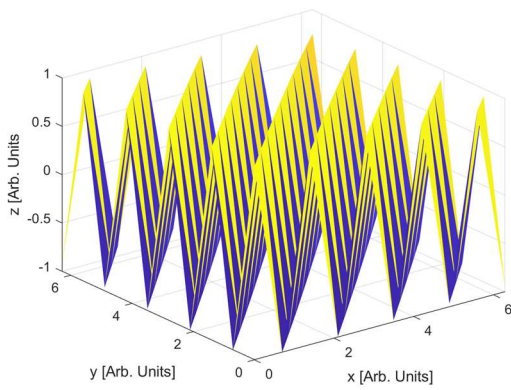
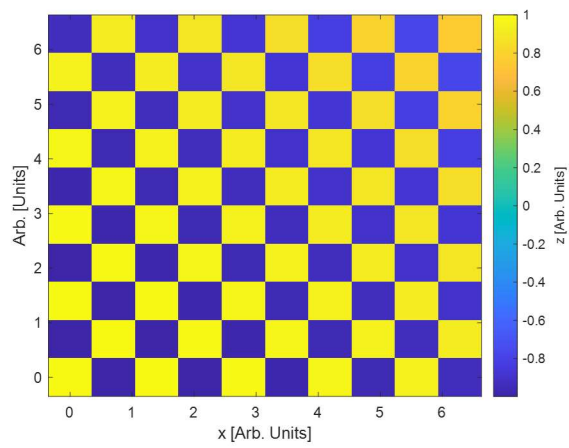
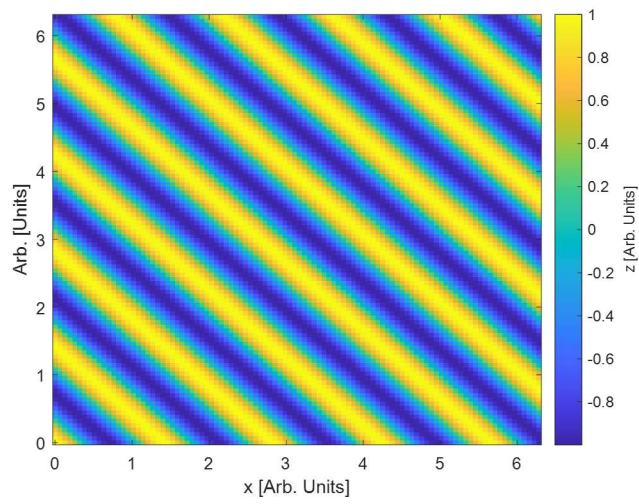
```
figure(3)
surf(x,y,z1,'MeshStyle','none') %Surface Plot with no mesh
xlabel('x [Arb. Units]')
ylabel('y [Arb. Units]')
zlabel('z [Arb. Units]')
```

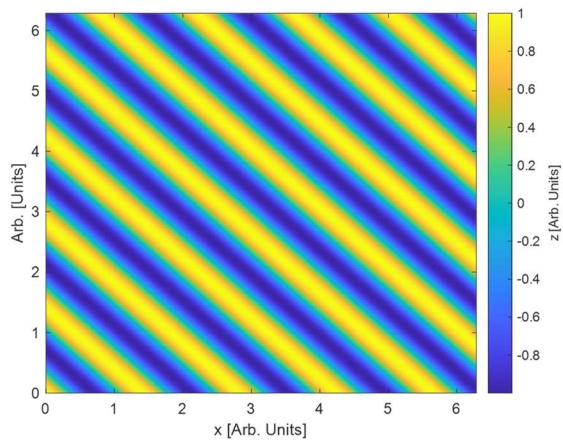
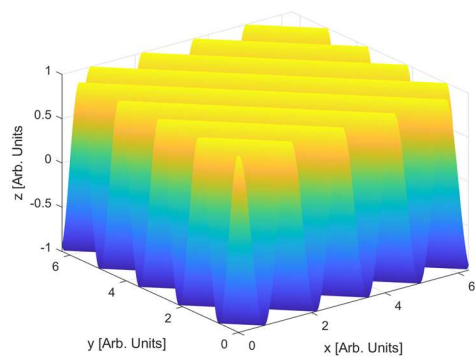
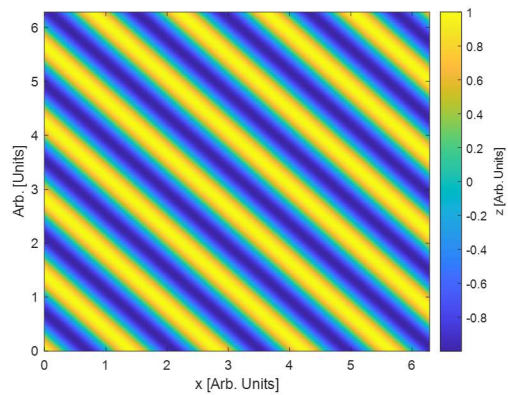


```
figure(4)
contourf(x,y,z1) %filled in contour plot
xlabel('x [Arb. Units]')
ylabel('y [Arb. Units]')
cl=colorbar; %show color bar
cl.Label.String='z [Arb. Units]'; %Label color bar
```



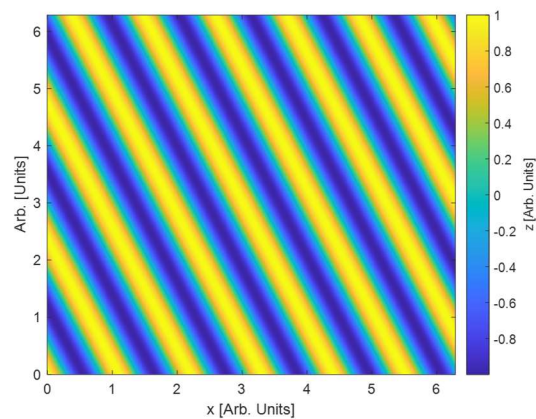
```
figure(5)
imagesc(x,y,z1) %create image
xlabel('x [Arb. Units]')
ylabel('Arb. [Units]')
c2=colorbar; %show color bar
c2.Label.String='z [Arb. Units]'; %Label color bar
set(gca,'Ydir','normal') %Get current axis and change direction of y-axis
```



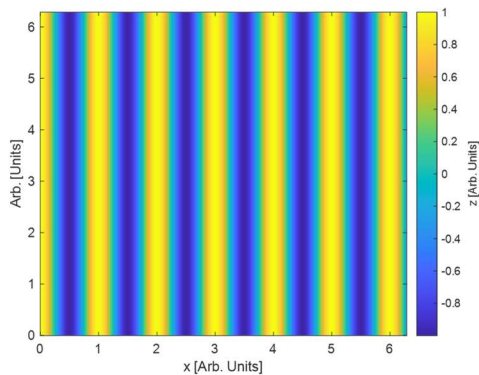


Varying angles

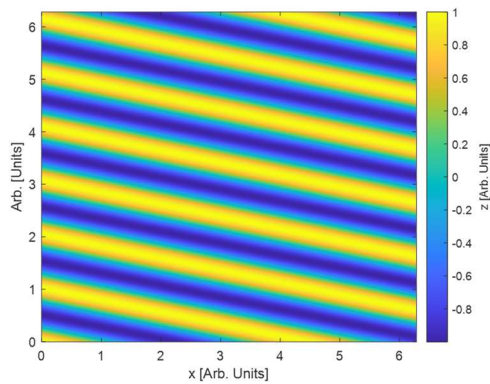
25



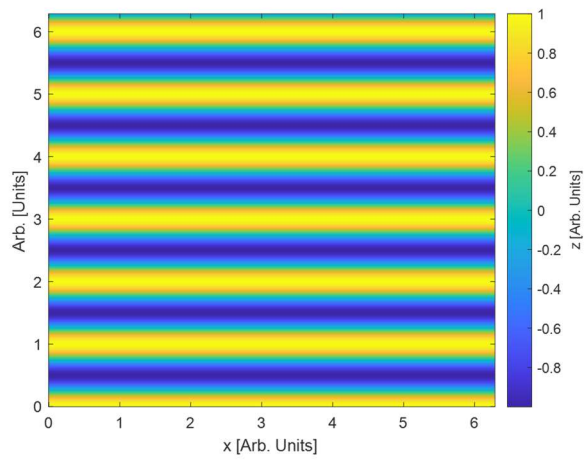
0



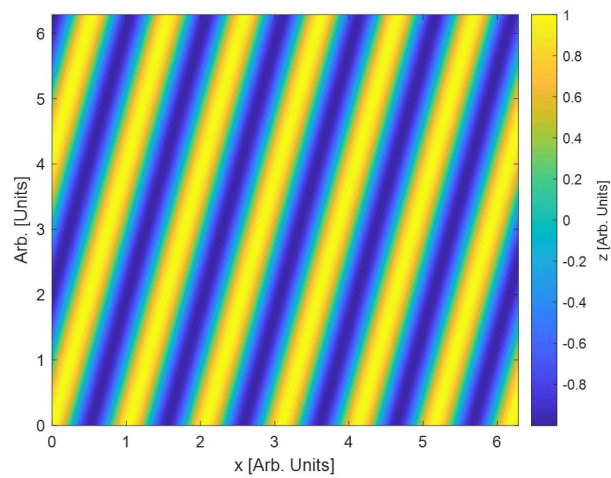
77



90



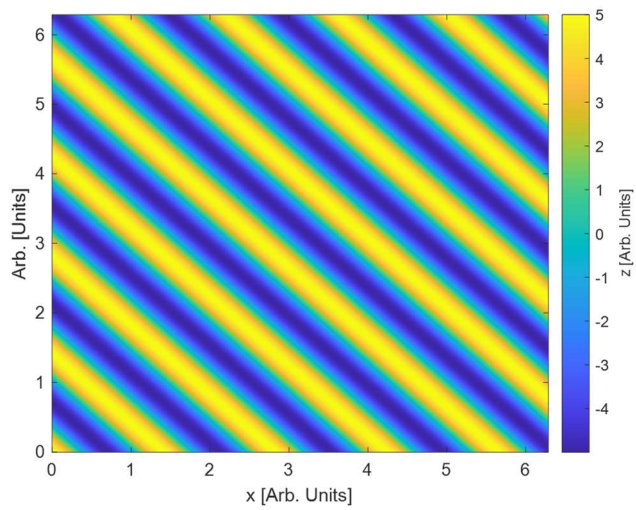
-14



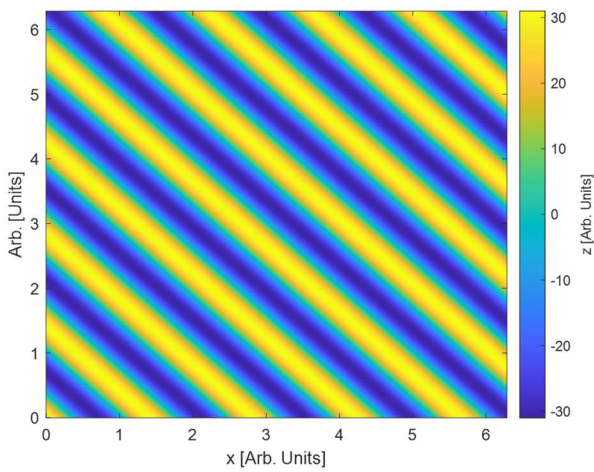
Changing the angle changes the angle of the bars with 0 being vertical and 90/-90 being horizontal.

Varying amplitude/wavelength

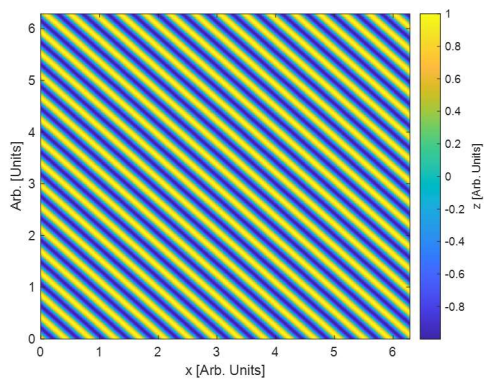
Amplitude = 5



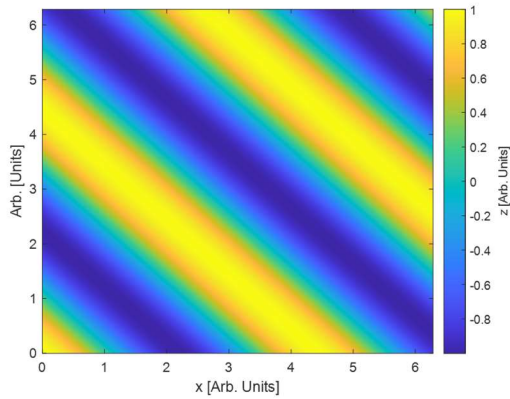
Amplitude = 31



wavelength = .3

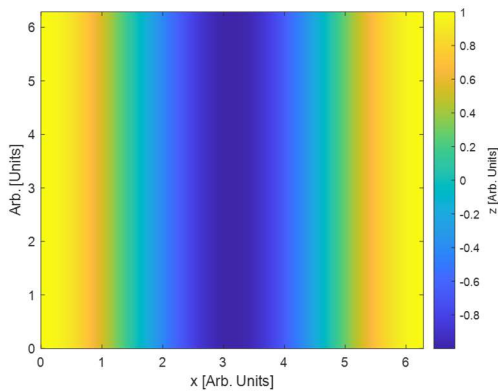


wavelength = π



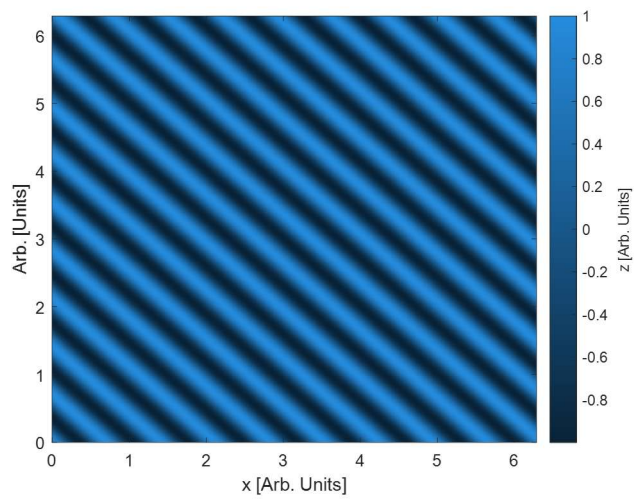
Changing the amplitude changes the scaling of the color bar and changing the wavelength changes the number of color bars.

Single wavelength

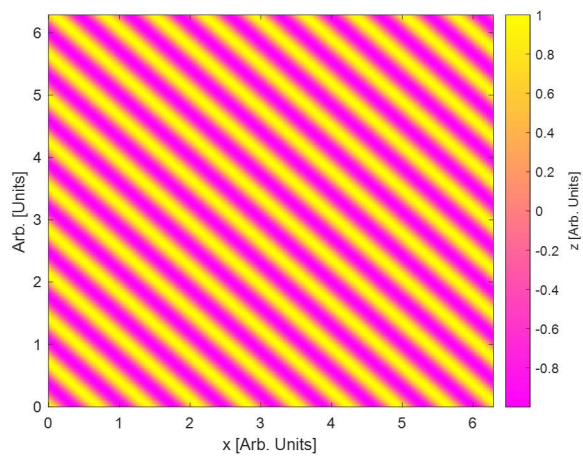


You can tell it is a single wavelength because there is only one blue color band with two yellow color bands on either side indicating a dip with two peaks on either side or one period.

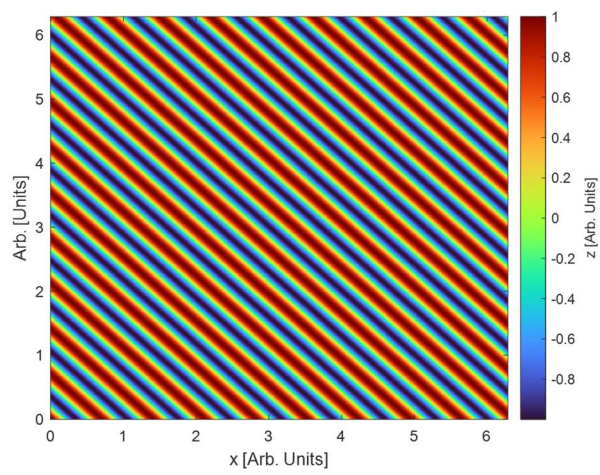
Varying color map



Abyss

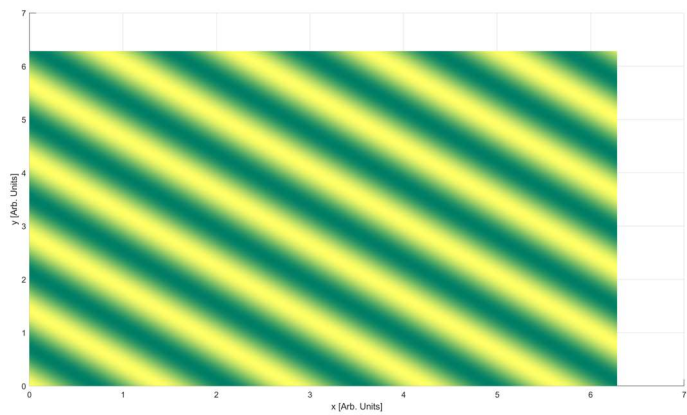
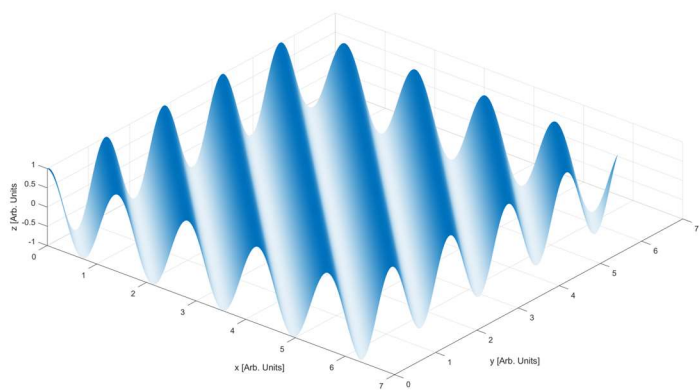
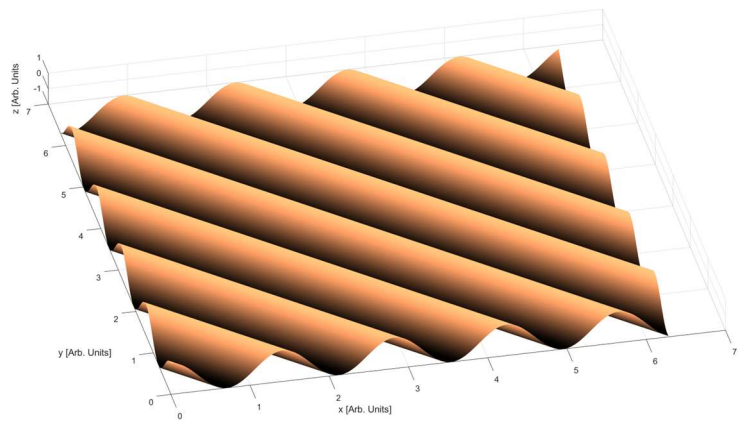


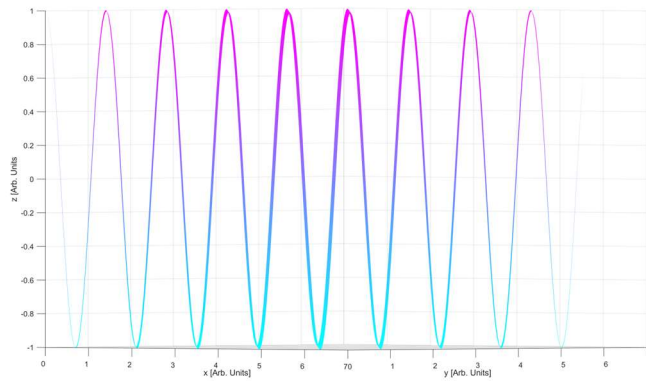
Spring



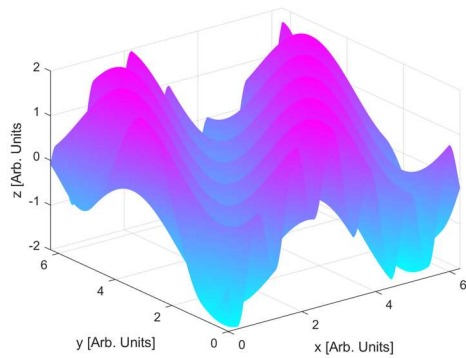
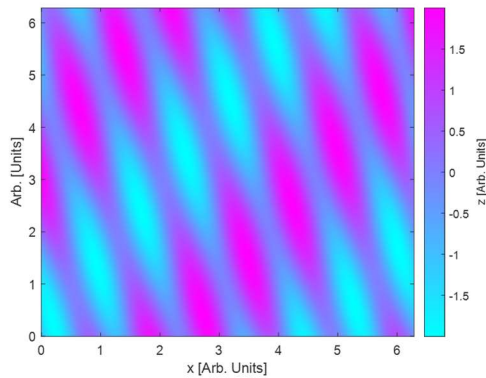
Turbo

Varying camera





Part 2



Part 5

```
% Define Aperture field
apl=5000; % Size of the aperture field
ap=zeros(apl); % Define actual aperture plane

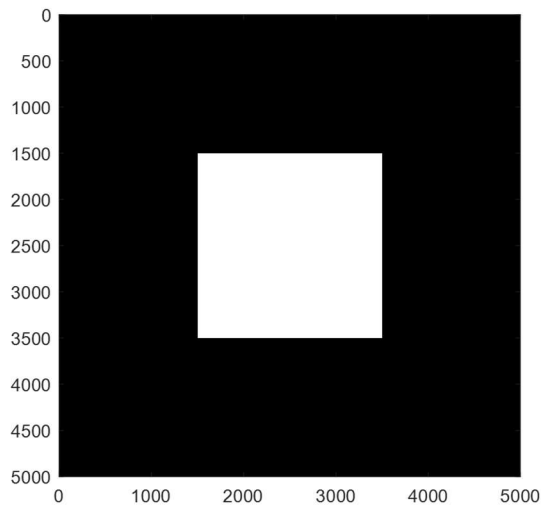
% Define square aperture
sql=2000; % Define square length
ap(round(1+apl/2-sql/2):round(1+apl/2+sql/2),round(1+apl/2-
sql/2):round(1+apl/2+sql/2))=1;

% Plot the aperture field
```

```

figure
imagesc(ap) % Plot image of the aperture field
colormap gray % Set the color of the aperture field plot
axis equal % Set the display scale of the axes
axis([0 ap1 0 ap1]) % Set axes limits to size of aperture field

```



Post Lab

```

function lab5_wave_EAK %(A1,the1,lam1,phi1,A2,the2,lam2,phi2)

%OPT211 Lab 5
%Ezra Alcon-Kirshman
%wave generator

x=linspace(0,2*pi,1000);
y=linspace(0,2*pi,1000);

[x1,y1]=meshgrid(x,y);

A1 = input('Enter Amplitude one ');
the1 = input('Enter angle one ');
lam1 = input('Enter wavelength one ');
phi1 = input('Enter phase shift one ');
z1 = A1*cos(((2*pi)/lam1)*(x1*cosd(the1)+y1*sind(the1))+phi1);

A2 = input('Enter Amplitude two ');
the2 = input('Enter angle two ');
lam2 = input('Enter wavelength two ');
phi2 = input('Enter phase shift two ');
z2 = A2*cos(((2*pi)/lam2)*(x1*cosd(the2)+y1*sind(the2))+phi2);
zt=z1+z2;

% figure(1)
% surf(z1) %Surface Plot with no mesh
% xlabel('x [Arb. Units]')
% ylabel('y [Arb. Units]')

```



```

% xlabel('x [Arb. Units]')
% ylabel('y [Arb. Units]')
% zlabel('z [Arb. Units]')

figure(2)
% surf(z1,'MeshStyle','none') %Surface Plot with no mesh
% xlabel('x [Arb. Units]')
% ylabel('y [Arb. Units]')
% zlabel('z [Arb. Units]')

figure(3)
surf(x,y,zt,'MeshStyle','none') %Surface Plot with no mesh
xlabel('x [Arb. Units]')
ylabel('y [Arb. Units]')
zlabel('z [Arb. Units]')
colormap cool

% figure(4)
% contourf(x,y,z1) %filled in contour plot
% xlabel('x [Arb. Units]')
% ylabel('y [Arb. Units]')
% cl=colorbar; %show color bar
% cl.Label.String='z [Arb. Units]'; %Label color bar

figure(5)
imagesc(x,y,zt) %create image
xlabel('x [Arb. Units]')
ylabel('Arb. [Units]')
c2=colorbar; %show color bar
c2.Label.String='z [Arb. Units]'; %Label color bar
set(gca,'Ydir','normal') %Get current axis and change direction of y-axis
colormap cool

lab5_wave_EAK
Enter Amplitude one 1
Enter angle one 15
Enter wavelength one 1
Enter phase shift one pi/2
Enter Amplitude two 1
Enter angle two -35
Enter wavelength two 4
Enter phase shift two pi
>>

```

Question 2

```

>> lab5_wave_EAK
Enter Amplitude one 1
Enter angle one 0
Enter wavelength one 1
Enter phase shift one 0
Enter Amplitude two 1
Enter angle two 0
Enter wavelength two 1
Enter phase shift two 0
>>
>> lab5_wave_EAK
Enter Amplitude one 1

```

```

Enter angle one 0
Enter wavelength one 1
Enter phase shift one 0
Enter Amplitude two 1
Enter angle two 0
Enter wavelength two 1
Enter phase shift two pi
>>
>> lab5_wave_EAK
Enter Amplitude one 1
Enter angle one 25
Enter wavelength one 0.5
Enter phase shift one 0
Enter Amplitude two 1
Enter angle two 25
Enter wavelength two 0.6
Enter phase shift two 0
>>
>> lab5_wave_EAK
Enter Amplitude one 1
Enter angle one 35
Enter wavelength one 1
Enter phase shift one 0
Enter Amplitude two 1
Enter angle two 42
Enter wavelength two 1
Enter phase shift two 0
>>
>> lab5_wave_EAK
Enter Amplitude one 1
Enter angle one 45
Enter wavelength one 1
Enter phase shift one 0
Enter Amplitude two 1
Enter angle two -45
Enter wavelength two 1
Enter phase shift two 0
>>
>> lab5_wave_EAK
Enter Amplitude one 5
Enter angle one -15
Enter wavelength one 0.2
Enter phase shift one  $3\pi/2$ 
Enter Amplitude two 3
Enter angle two 25
Enter wavelength two 1.1
Enter phase shift two  $\pi/2$ 
>>

```

I have no idea how long this all took, I don't think it was that long...