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BIOE420 - HW2 March 3, 2015

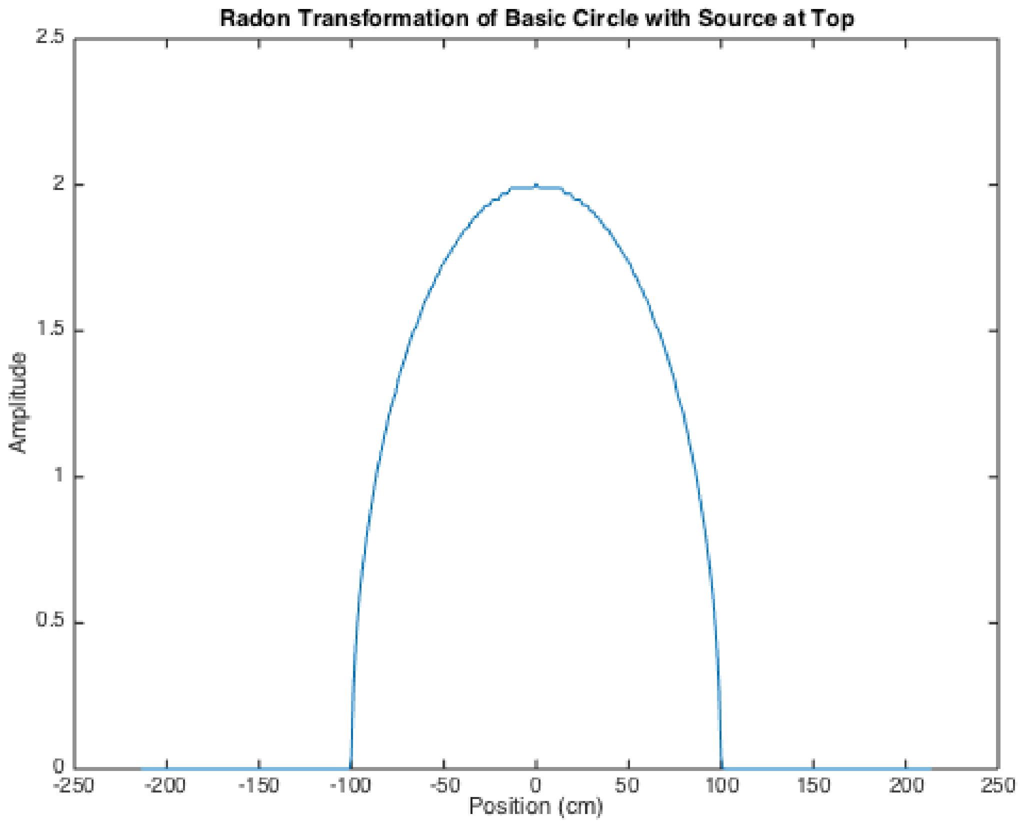
## Contents

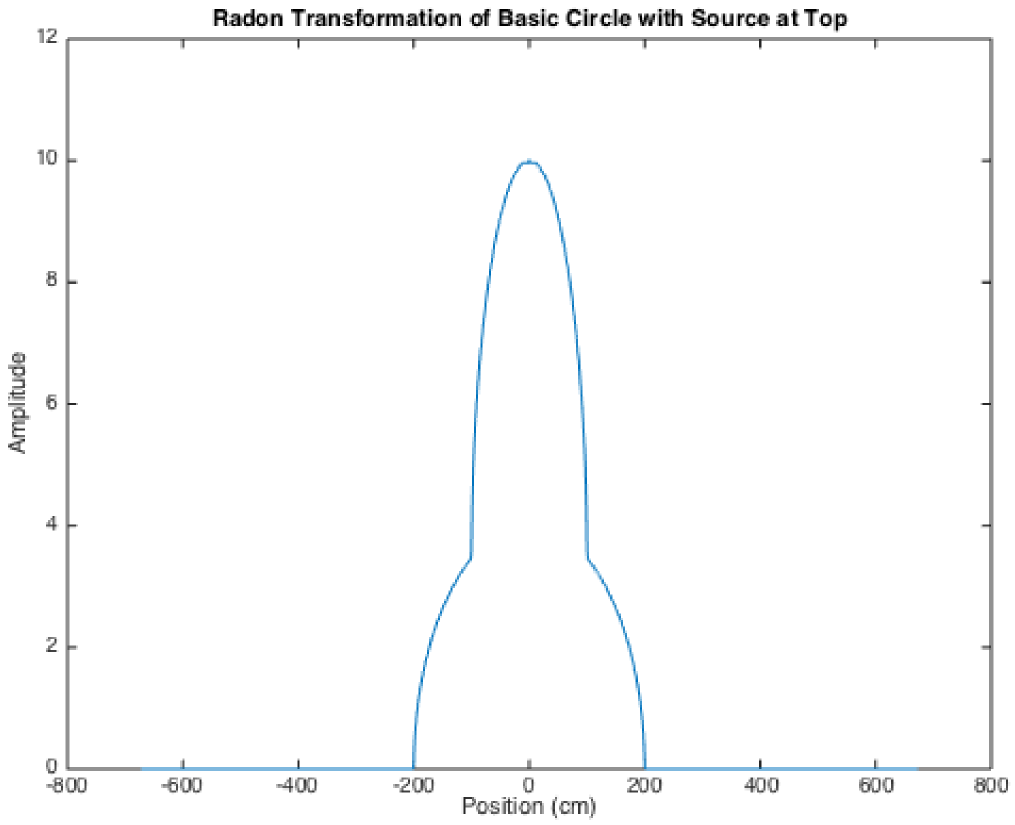
## Question 1

```
clc, close all
clear all
disp(['Question 1'])

step = 0.01; % index of image quality

% Set circle parameters
radius0 = 1; coefficient0 = 1;
maxCoord = radius0 + 0.5;

% Create two matrices with values for each coordinate of the matrix
[X0, Y0] = meshgrid(-maxCoord:step:maxCoord, -maxCoord:step:maxCoord);
% Calculate the comlpex magnitude from center coordinate
I0 = abs([X0 + Y0*i]);
% Find all complex magintudes within the radius of desired circle
I0(find(I0 <= radius0)) = coefficient0;
I0(find(I0 > radius0)) = 0;
% Take the radon transform
[R0, xp0] = radon(I0, 0); % 0 - directly from above
% Show the created image, then plot the transform
figure,
% subplot(2,1,1), imshow(I0)
% subplot(2,1,2),
plot(xp0, step*R0);
title('Radon Transformation of Basic Circle with Source at Top'),
xlabel('Position (cm)'), ylabel('Amplitude')

% Set circle parameters
radius = [1,2]; coefficient = [3,1];
maxCoord = radius(2) + 1; % Match the dimensions of each matrix
% Account for when radius < coefficient by creating an arbitrary scalar value
arbit = 10;

% Create two matrices with values for each coordinate of the matrix
[X1, Y1] = meshgrid(-maxCoord:step:maxCoord, -maxCoord:step:maxCoord);
% Calculate the comlpex magnitude from center coordinate
I1 = abs([X1 + Y1*i]);
% Find all complex magintudes within the radius of desired circle and account for when radius < coefficient
I1(find(I1 > radius(1))) = radius(1)*arbit;
```

```
I1(find(I1 <= radius(1))) = coefficient(1);
I1(find(I1 == radius(1)*arbit)) = 0;

% Repeat for the second circle
[X2, Y2] = meshgrid(-maxCoord:step:maxCoord, -maxCoord:step:maxCoord);
I2 = abs([X2 + Y2*i]);
I2(find(I2 > radius(2))) = radius(2)*arbit;
I2(find(I2 <= radius(2))) = coefficient(2);
I2(find(I2 == radius(2)*arbit)) = 0;

% figure, subplot(1,2,1), imshow(I1), subplot(1,2,2), imshow(I2)
I = [I1, I2]; % combine the two circles side-by side with aligned center coordinate
% figure, imshow(I)
[R, xp] = radon(I, 90); % 0 - directly from above (believe this is ccw)
figure, plot(xp, step*R);
title('Radon Transformation of Basic Circle with Source at Top'),
xlabel('Position (cm)'), ylabel('Amplitude')
```

Question 1

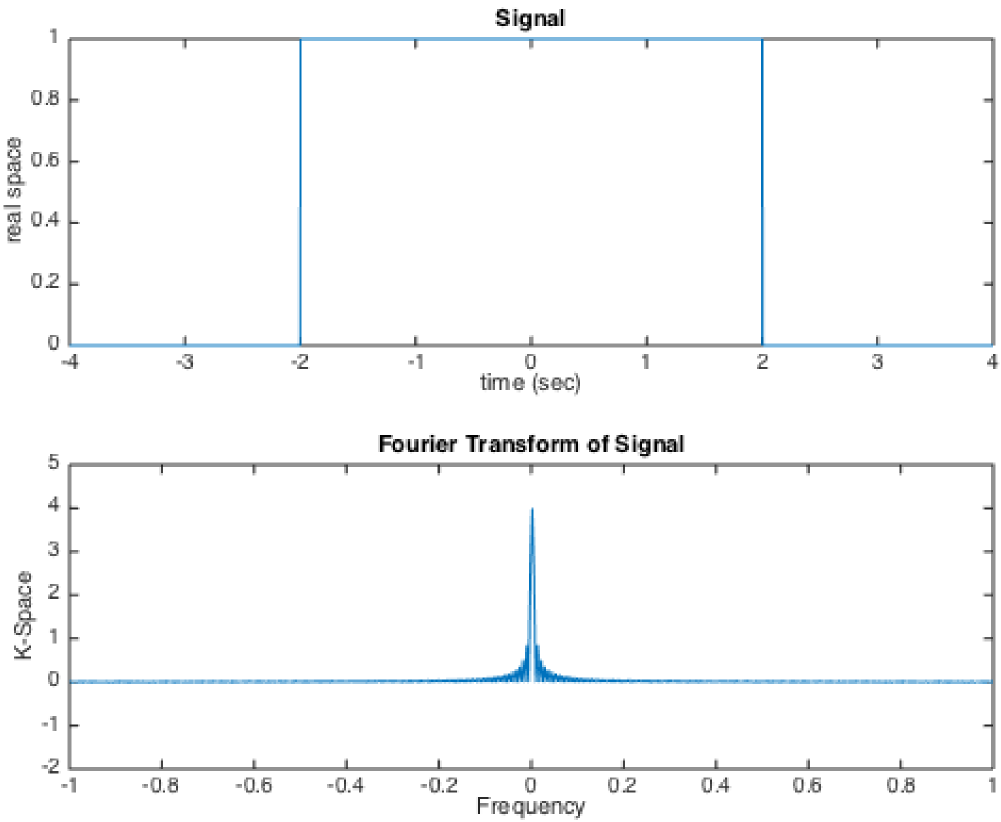




## Question 3

```
clear all
disp(['Question 3'])

Fs = 2^8;
L = 8*Fs;
t = linspace(-4, 4, L);
y = zeros(1, L);
for i = 1:L
  if (t(i) >= -2 && t(i) <= 2)
    y(i) = 1;
  end
end
figure, subplot(2,1,1), plot(t, y)
title('Signal')
xlabel('time (sec)'), ylabel('real space')

Y = fftshift(fft(y),2);
subplot(2,1,2), plot(t, abs(Y/Fs))
axis([-1 1 -2 5])
title('Fourier Transform of Signal')
xlabel('Frequency'), ylabel('K-Space')
```

```
Question 3
```



## Question 4

```
clear all
disp(['Question 4'])

% Part a:
% Proton - Neutron - Electron
MassT = 6*1.007276 + 6*1.008665 + 6*0.000548; % (u - unified atomic mass units)
MassActual = 12; % (u)
MassDefect = abs(MassActual - MassT); % (u)
disp(['The Mass Defect = ', num2str(MassDefect), 'u'])
% Part b:
% c = 299792458; % (m/s)
% E = MassDefect*c^2; % (u*c^2)
conversionFactor = 931; % (MeV/u*c^2)
BindingEnergy = MassDefect*conversionFactor; % (MeV)  [E = mc^2]
disp(['The Binding Energy = ', num2str(BindingEnergy), ' MeV'])
```

```
Question 4
The Mass Defect = 0.098934u
The Binding Energy = 92.1076 MeV
```

## Question 5

```
clear all
disp(['Question 5'])
```

```
% N = N0*exp(-lambda*t)
% Half life is where: N/N0 = 1/2
% Solve for Lambda = -t*log(1/2)
% X:
lambdaX = -log(.5)/28; % hr^-1
disp(['lambdaX = ', num2str(lambdaX), ' per hour'])
% Y:
lambdaY = -log(.5)/68; % day^-1
disp(['lambdaY = ', num2str(lambdaY), ' per day'])
```

```
Question 5
lambdaX = 0.024755 per hour
lambdaY = 0.010193 per day
```

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