
MyMainScript

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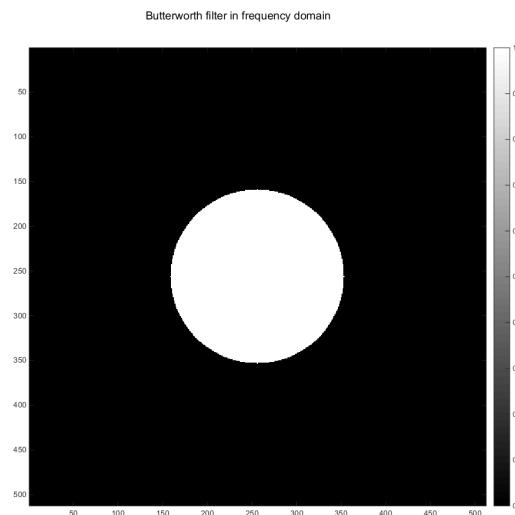
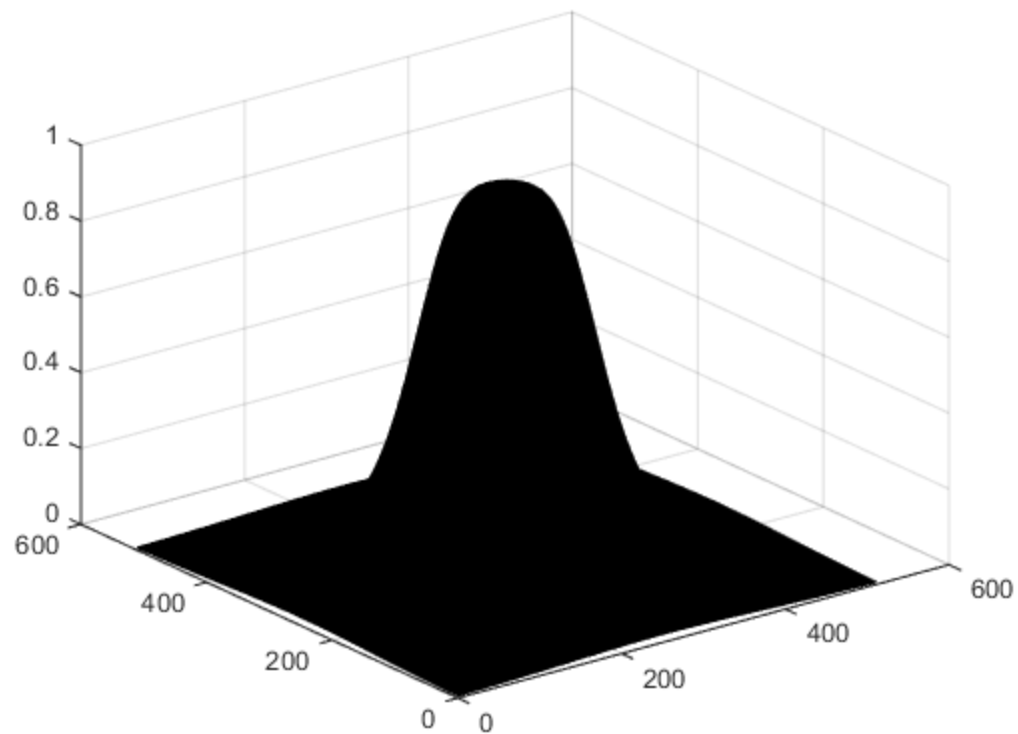
Fourier Analysis

Initialization

```
addpath('.../common/');  
load './data/boat.mat';  
D0 = 97;  
noisy_image = myGaussianNoiser(imageOrig, 0.10);  
fourier = fft2(noisy_image);  
fourier_shifted = fftshift(fourier);  
[rows, cols] = size(imageOrig);
```

Butterworth filter

```
filter = myButterworthFilter(D0, 2, size(fourier_shifted));  
threeD_filter = surf(filter);  
  
images = zeros(rows, cols, 1);  
images(:, :, 1) = filter;  
myShowImages(images, 'Butterworth filter in frequency domain');
```



Images comparison

```
display(sprintf('Optimal D0 is %f', D0));  
  
filtered_image = myButterworthFiltering(noisy_image, D0, 2);  
rmsd = myRMSDofImage(imageOrig, filtered_image);  
display(sprintf('RMSD of filtered image with optimal D0 is %f', rmsd));
```

```
filtered_image = myButterworthFiltering(noisy_image, 0.95*D0, 2);
rmsd = myRMSDofImage(imageOrig, filtered_image);
display(sprintf('RMSD of filtered image with 0.95*D0 is %f', rmsd));

filtered_image = myButterworthFiltering(noisy_image, 1.05*D0, 2);
rmsd = myRMSDofImage(imageOrig, filtered_image);
display(sprintf('RMSD of filtered image with optimal 1.05*D0 is %f',...
    rmsd));

images = zeros(rows, cols, 3);
images(:, :, 1) = imageOrig;
images(:, :, 2) = noisy_image;
images(:, :, 3) = filtered_image;

myShowImages(images, 'Butterworth Smoothened Boat');

images = zeros(rows, cols, 1);
images(:, :, 1) = imageOrig;
myShowImages(images, 'Butterworth Original Image');

images = zeros(rows, cols, 1);
images(:, :, 1) = noisy_image;
myShowImages(images, 'Butterworth Noisy Image');

images = zeros(rows, cols, 1);
images(:, :, 1) = filtered_image;
myShowImages(images, 'Butterworth Smoothened Boat');

Optimal D0 is 97.000000
RMSD of filtered image with optimal D0 is 11.235622
RMSD of filtered image with 0.95*D0 is 11.270972
RMSD of filtered image with optimal 1.05*D0 is 11.241272
```

Butterworth Smoothened Boat

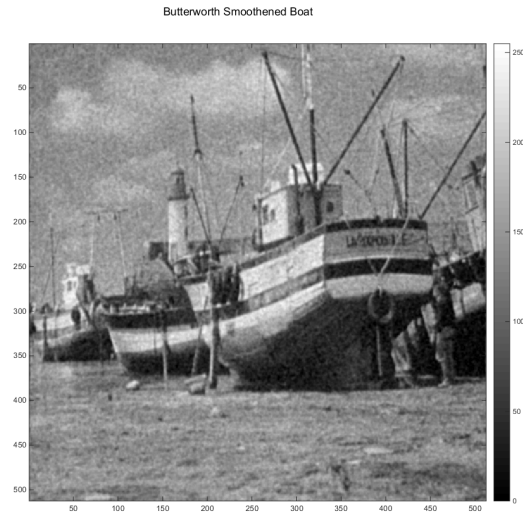


Butterworth Original Image



Butterworth Noisy Image





Part 2 : Energy

```
display('The maximum intensity is at 256, 256 after fftshift');
fourier = fft2(imageOrig);
s_fourier = fftshift(fourier);
display(sprintf('Fourier transform is %f at 256, 256',...
    s_fourier(256, 256)));
```

```
display('Energy closest to 88% at R = 1.42');
myFourierEnergyRadii(imageOrig, 1.42)
```

```
display('Energy closest to 91% at R = 2.0');
myFourierEnergyRadii(imageOrig, 2.0)
```

```
display('Energy closest to 94% at R = 4.3');
myFourierEnergyRadii(imageOrig, 4.3)
```

```
display('Energy closest to 97% at R = 13.9');
myFourierEnergyRadii(imageOrig, 13.9)
```

```
display('Energy closest to 99% at R = 55.98');
myFourierEnergyRadii(imageOrig, 55.98)
```

```
The maximum intensity is at 256, 256 after fftshift
Fourier transform is 446926.062500 at 256, 256
Energy closest to 88% at R = 1.42
```

```
ans =
```

```
0.9059
```

```
Energy closest to 91% at R = 2.0
```

```
ans =
```

0.9072

Energy closest to 94% at R = 4.3

ans =

0.9402

Energy closest to 97% at R = 13.9

ans =

0.9700

Energy closest to 99% at R = 55.98

ans =

0.9898

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