

## Code

```
clc;
close all;
im = (imread('tire.tif'));
[m n]=size(im);
im2=zeros(2*m,2*n);
for i=1:m
for j=1:n
im2(i,j)=im2(i,j)+im(i,j);
end
end
[r c]=size(im2);
[X,Y] = meshgrid(-n:n-1,-m:m-1);
Z = 100*sin(2*pi*50*X/(2*m)+2*pi*40*Y/(2*n)) +
100*sin(2*pi*150*X/(2*m)+2*pi*120*Y/(2*n));
imn = im2 + Z;
figure,
subplot(2,4,1);
imshow(im,[]);
title('original image');
subplot(2,4,2);
imshow(Z);
title('periodic sinusoidal noise');
subplot(2,4,3);
imshow(im2,[]);
title('padded image');
subplot(2,4,4);
imshow(log(1+abs(fftshift(fft2(im2)))),[]);
title('fft of padded image');
subplot(2,4,5);
imshow(imn,[]);
title('padded noisy image');
Fimn = abs(fftshift(fft2(imn)));      %-----fftshift for centralizing the
frequency and log for contrast stretching----%
logFimn = log(1+Fimn);
subplot(2,4,6);
```

```

imshow(logFimn,[]);
title('fft of the noisy image');
maxval = max(logFimn(:));
[yy,xx] = find(logFimn >= floor(maxval));
% ideal notch filter which allows all frequencies except the selected
frequencies
H = ones(2*m,2*n);
for i=1:length(yy)
for j=1:length(xx)
H(yy(i)-1:yy(i)+1,xx(i)-1:xx(i)+1) = 0; %Notch Reject%
H1=1-H; %Notch pass%
end;
end

Fim_restored = H.*fftshift(fft2(imn));
im_restored = abs(ifft2(ifftshift(Fim_restored)));
subplot(2,4,7);
imshow(im_restored,[]);
title('notchpass filter restored image');
subplot(2,4,8);
I=fftshift(fft2(im_restored));

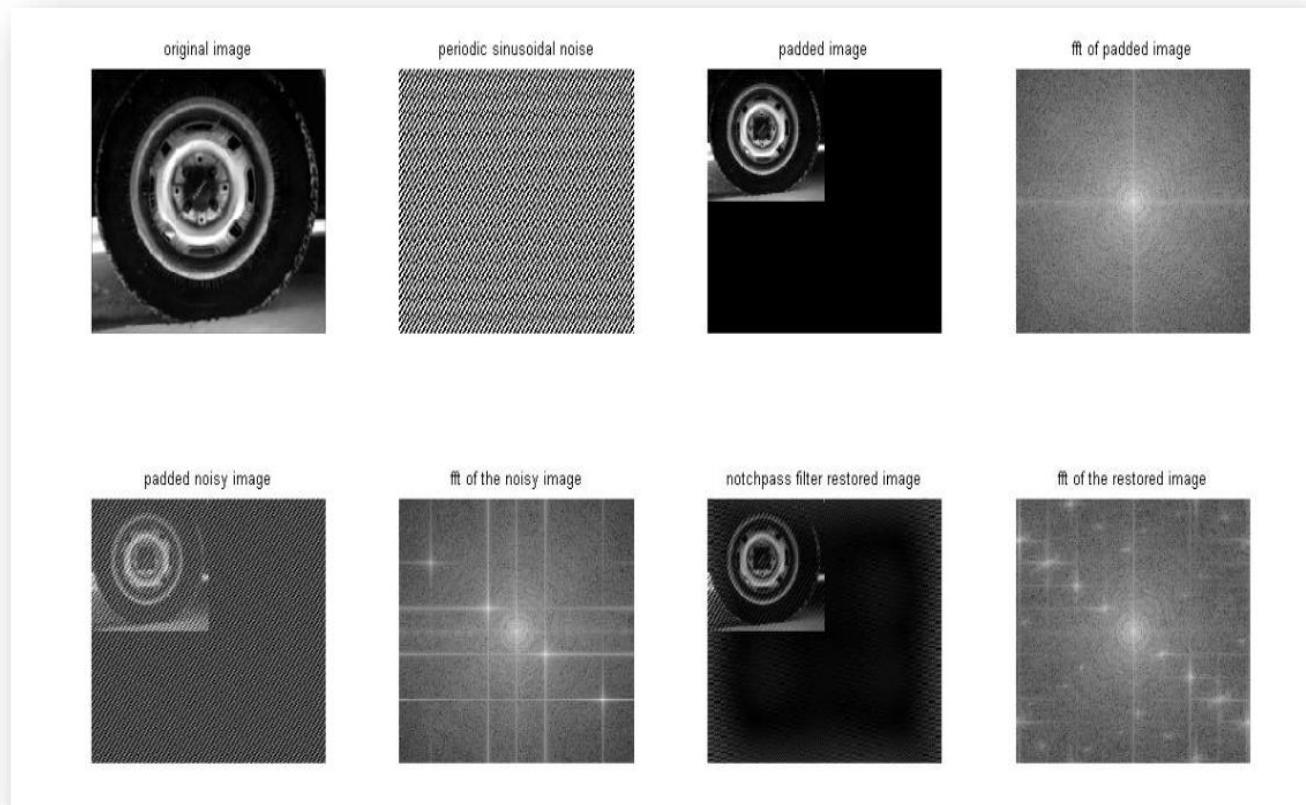
imshow(log(1+abs(I)),[]);
title('fft of the restored image');

m1(:,:,)=mean(Z(:,:,));
m2(:,:,)=mean(imn(:,:,));
m3(:,:,)=mean(imn(:,:,).*Z(:,:,));
m4(:,:,)=mean(imn(:,:,).*imn(:,:,));
m5(:,:,)=m1.^2;
w(:,:,)=(m3-m1*m2)./(m4-m5)
f=imn(:,:,)-w.*Z(:,:,);
figure;
subplot(2,2,1);
imshow(im2,[])
title('padded image');
subplot(2,2,2);
imshow(Z,[])
title('periodic sinusoidal noise');
subplot(2,2,3);
imshow(imn,[])
title('noisy image');

```

```
subplot(2,2,4);
imshow(f,[]);
title('noisy image after optimum filtering');
figure;
surf(H);
title('notch reject filter in 3D');
figure;
imshow(H);
title('notch reject filter in 2-D');
```

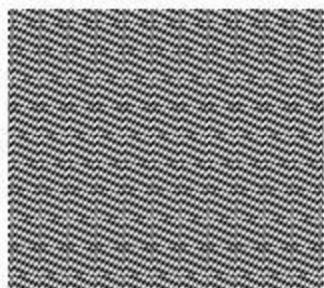
### Output-----'tire.tif'



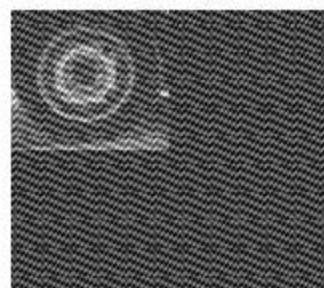
padded image



periodic sinusoidal noise



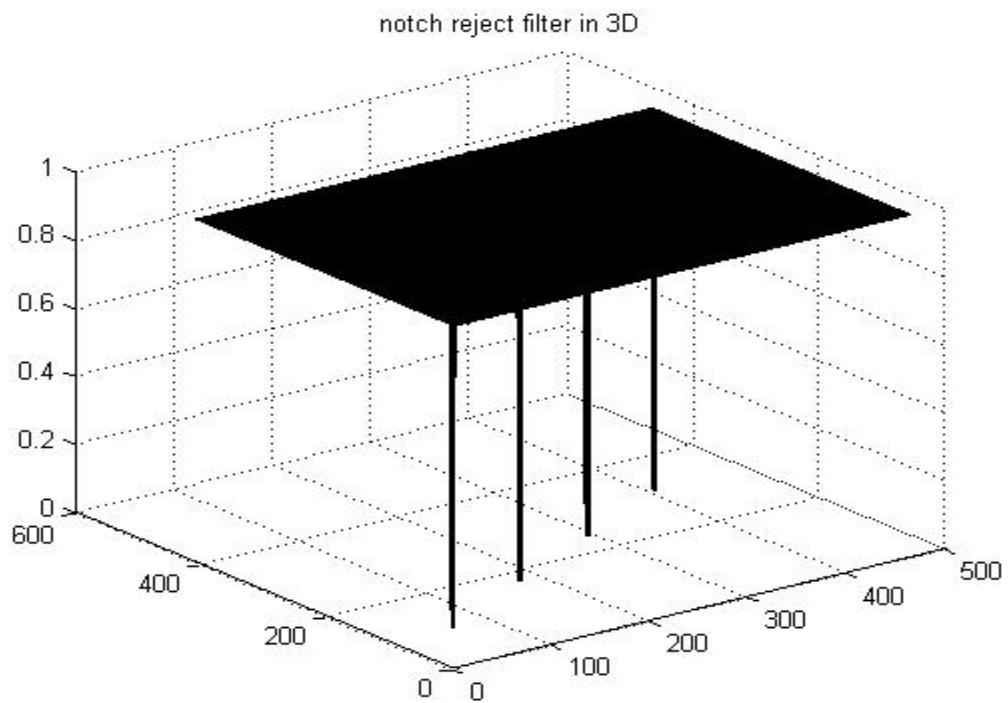
noisy image



noisy image after optimum filtering



notch reject filter in 2-D



$Z = 100 \cdot \sin(2\pi \cdot 50 \cdot X/512 + 2\pi \cdot 40 \cdot Y/512) + 100 \cdot \sin(2\pi \cdot 150 \cdot X/512 + 2\pi \cdot 120 \cdot Y/512)$   
 W=0.8165----- (Optimum Filter)

## Discussion

Lets Analyze Different Sinusoids, Optimum Weight and noise expression

$$Z = 50 \cdot \sin(2\pi \cdot 50 \cdot X/512)$$

$$w = 0.2181$$

$$\begin{aligned}
 Z &= 100 \cdot \sin(2\pi \cdot 50 \cdot X/512) + 100 \cdot \sin(2\pi \cdot 150 \cdot Y/512); \\
 w &= 0.6894
 \end{aligned}$$

notch reject filter in 2-D

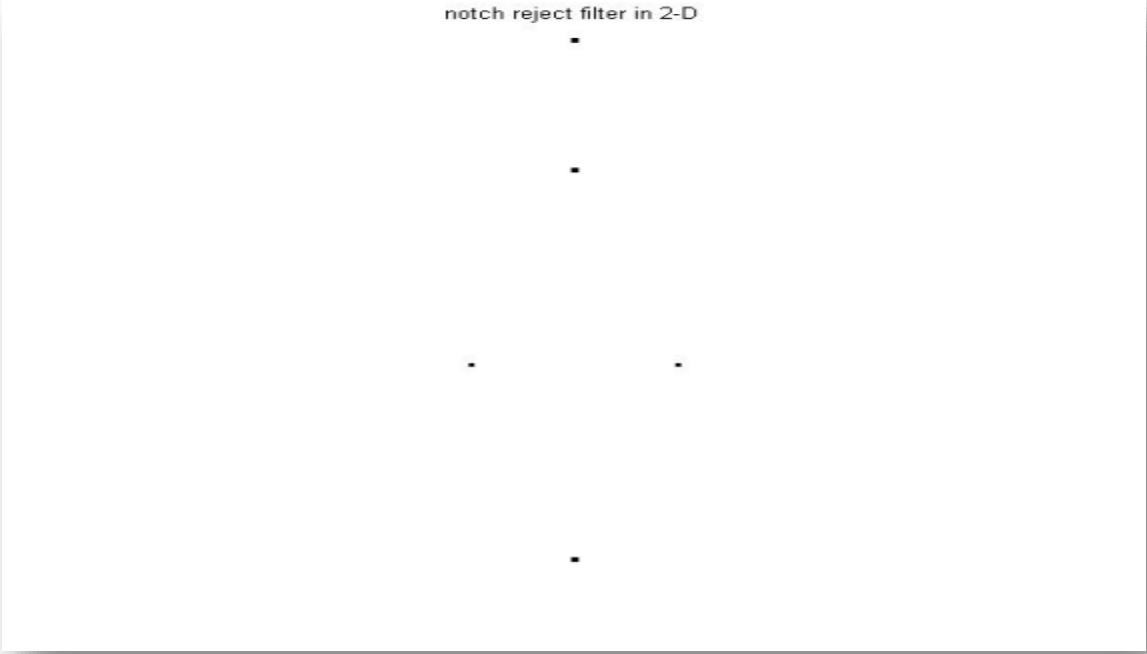
Z= 100\*sin(2\*pi\*50\*X/512 )+100\*sin (2\*pi\*150\*Y/512)+100\*sin(2\*pi\*250\*Y/512);  
w =0.7691

notch reject filter in 2-D

Z = 100\*sin(2\*pi\*50\*X/512+2\*pi\*120\*Y/512 );

w = 0.5266

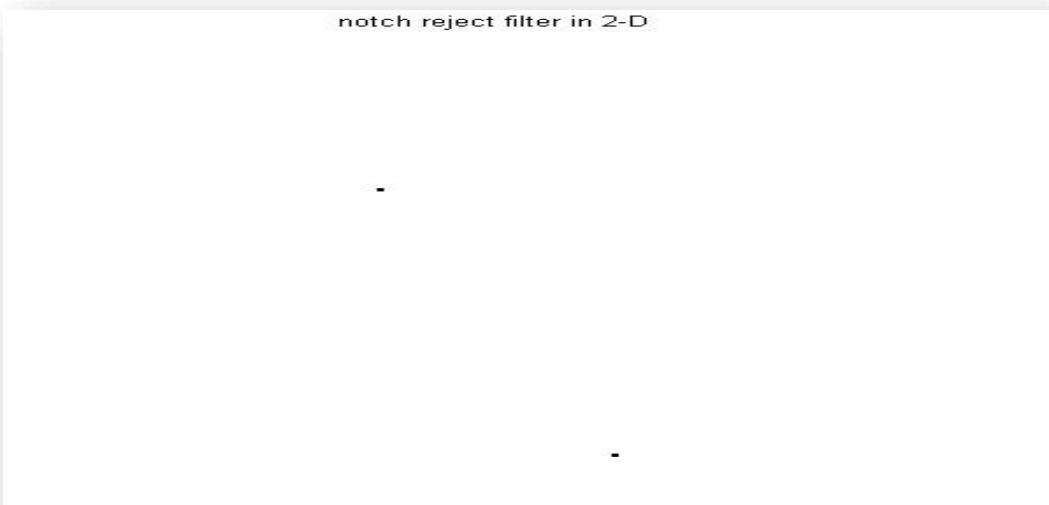
notch reject filter in 2-D



Z = 100\*sin(2\*pi\*50\*X/512+2\*pi\*120\*Y/512 )+ 100\*sin(2\*pi\*150\*X/512 + 2\*pi\*80\*Y/512);

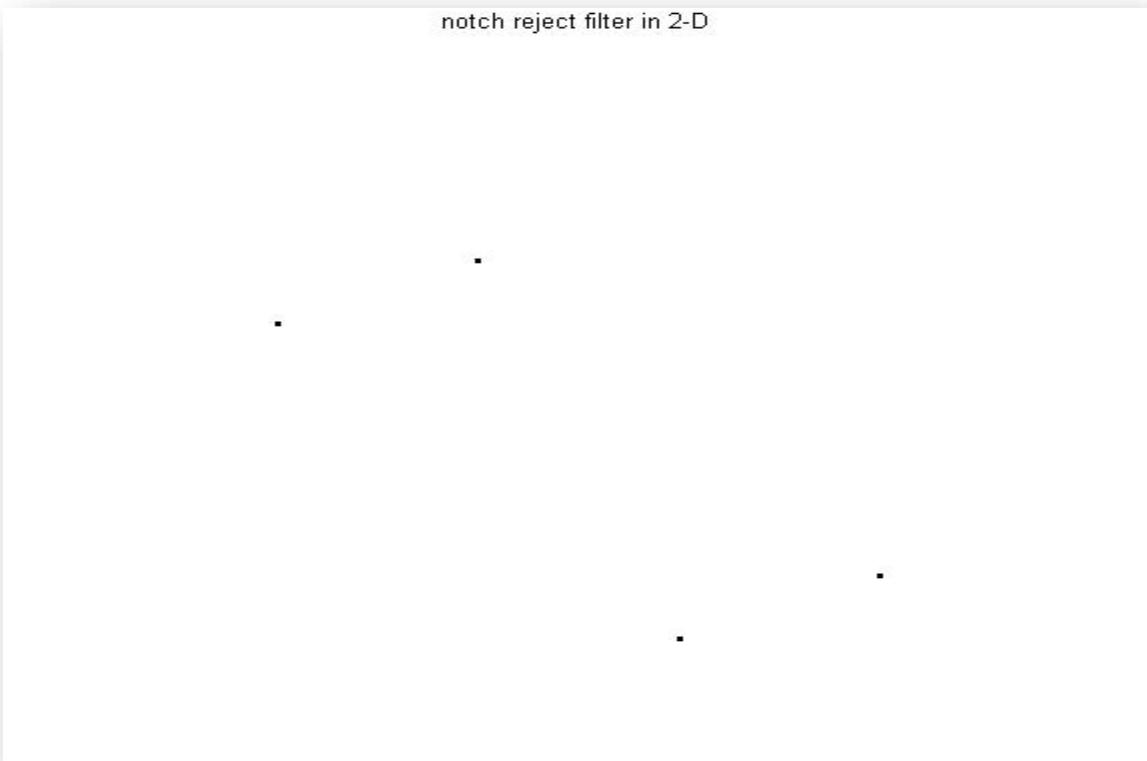
w = 0.6899

notch reject filter in 2-D



$Z = 100 \cdot \sin(2\pi \cdot 50 \cdot X/512 + 2\pi \cdot 120 \cdot Y/512) + 100 \cdot \sin(2\pi \cdot 150 \cdot X/512 + 2\pi \cdot 80 \cdot Y/512) + 100 \cdot \sin(2\pi \cdot 250 \cdot X/512 + 2\pi \cdot 40 \cdot Y/512)$   
 $w = 0.7694$

notch reject filter in 2-D



Thank you