

Image Processing-2

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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);
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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

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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');

```

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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');

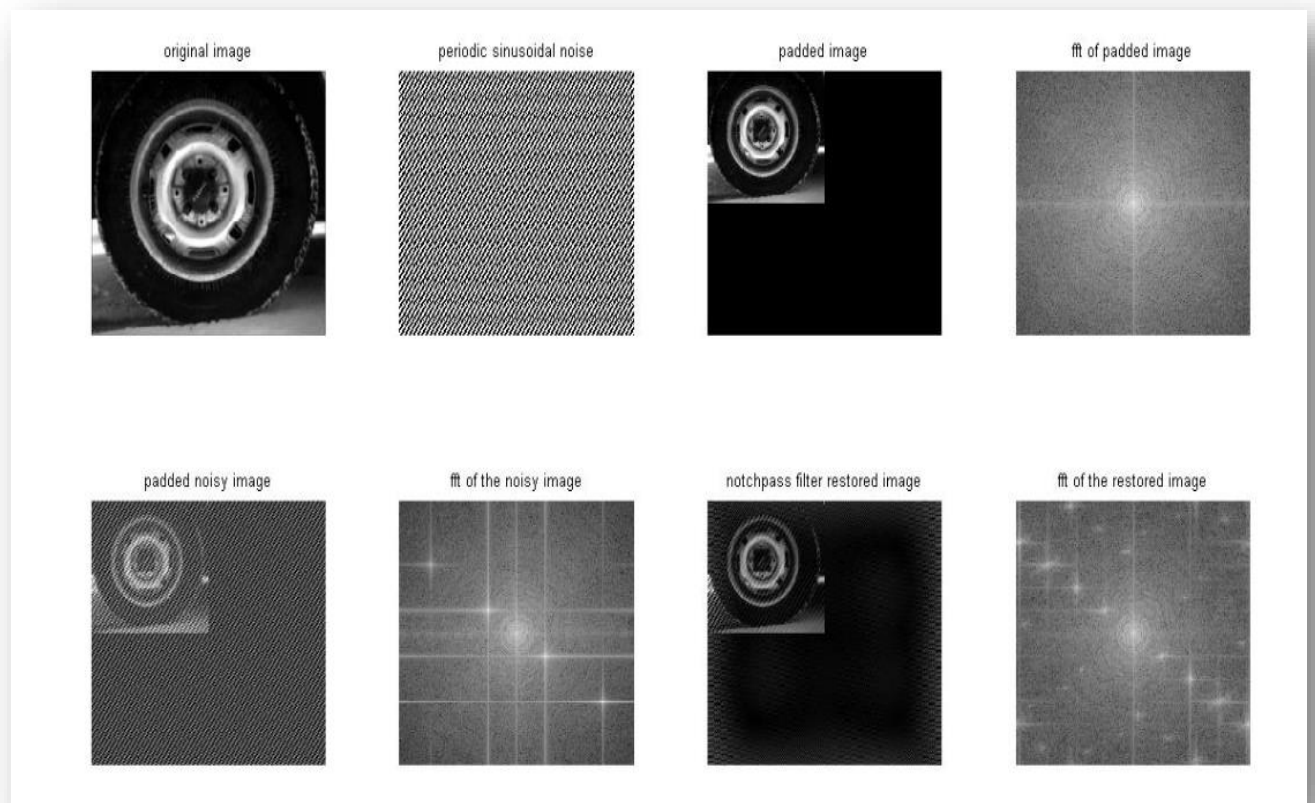
```

```

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');

```

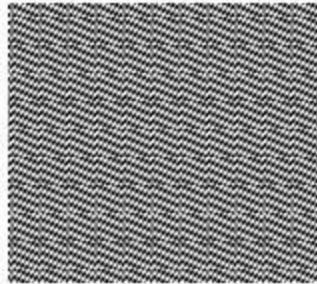
Output-----‘tire.tif’



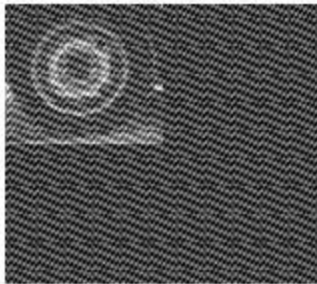
padded image



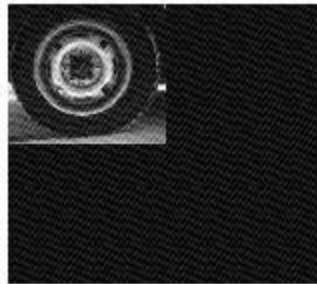
periodic sinusoidal noise



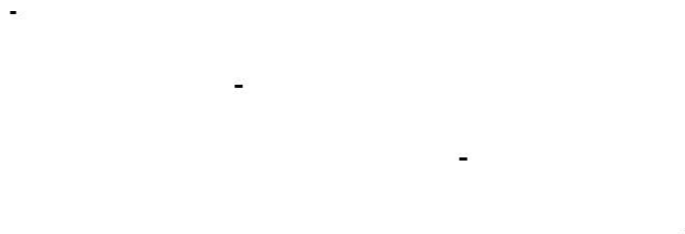
noisy image

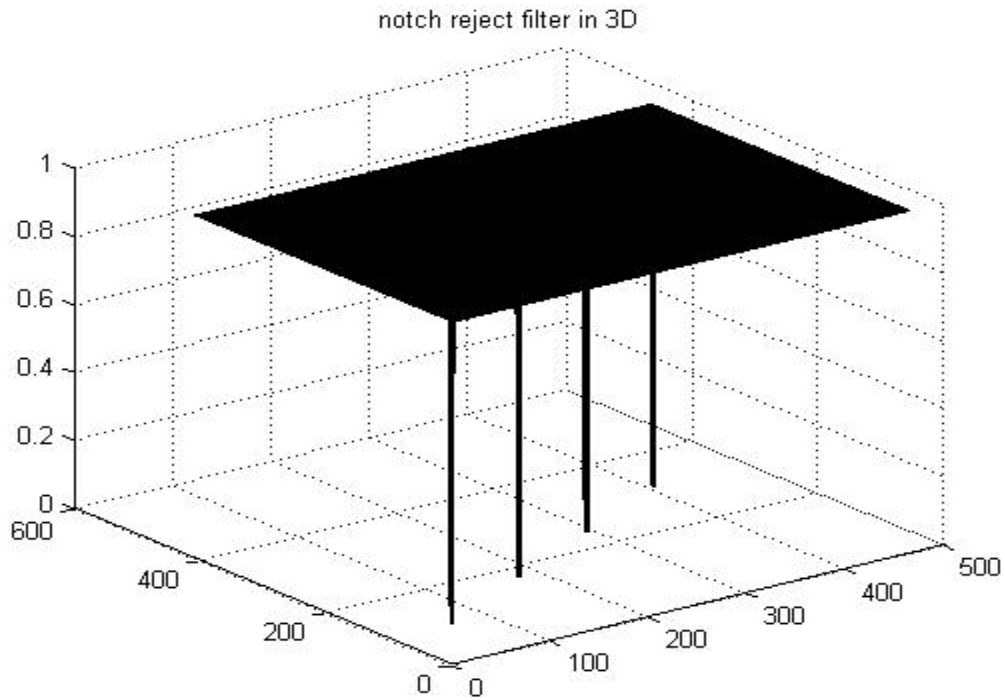


noisy image after optimum filtering



notch reject filter in 2-D





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

$W = 0.8165$ ----- (Optimum Filter)

Discussion

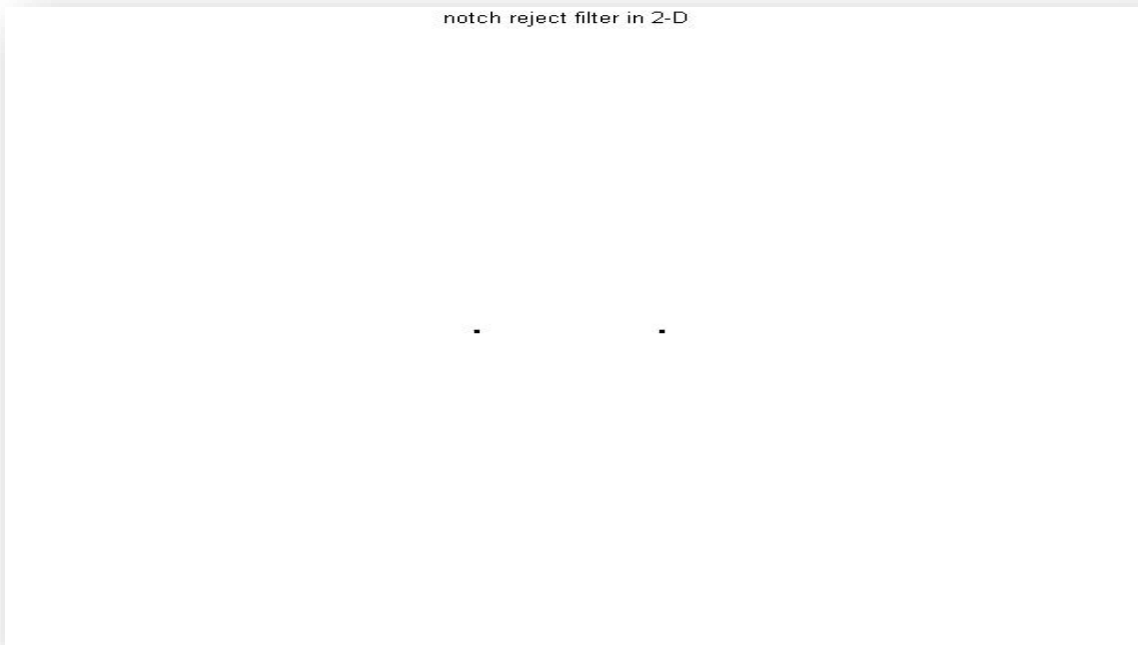
Lets Analyze Different Sinusoids, Optimum Weight and noise expression

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

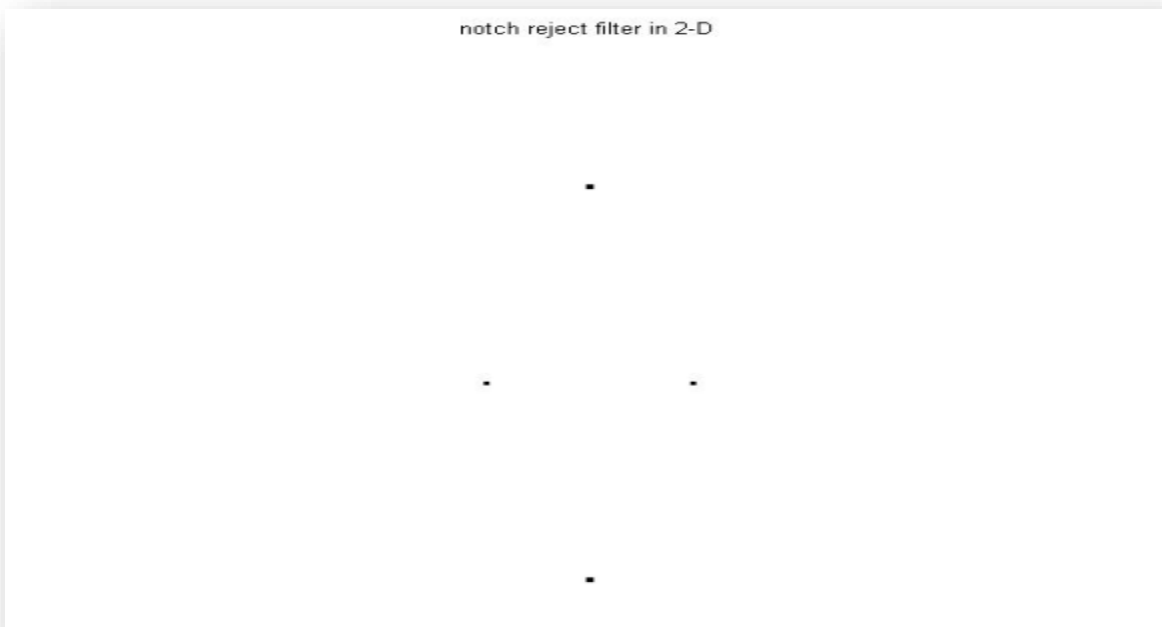
$w = 0.2181$

$$Z = 100 \cdot \sin(2 \cdot \pi \cdot 50 \cdot X / 512) + 100 \cdot \sin(2 \cdot \pi \cdot 150 \cdot Y / 512);$$

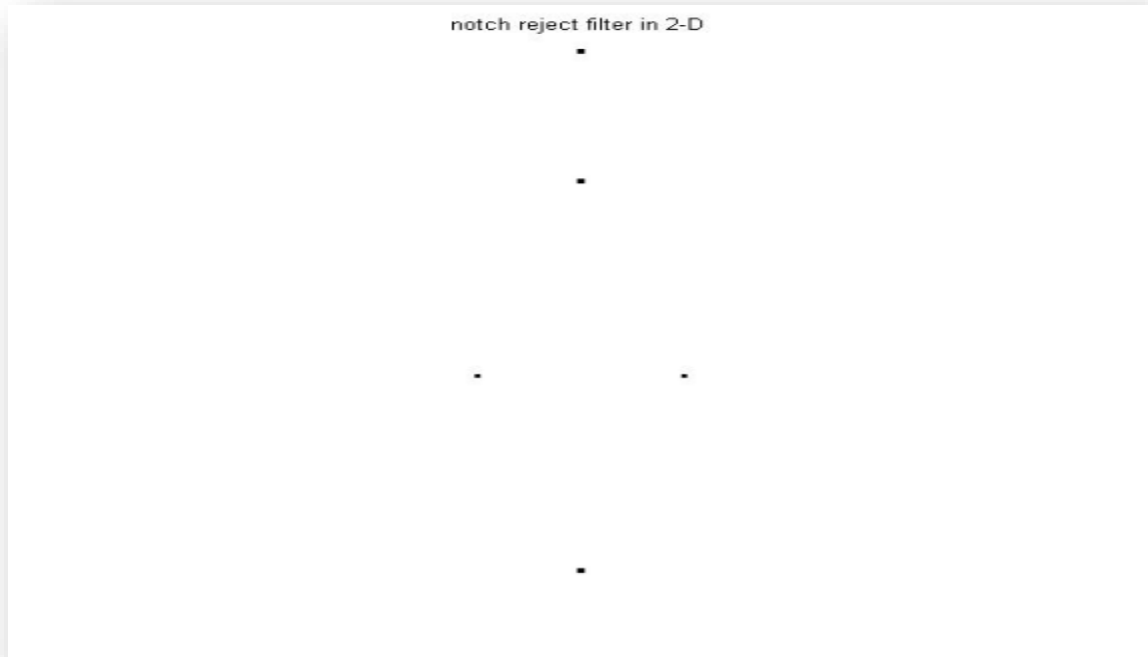
$w = 0.6894$



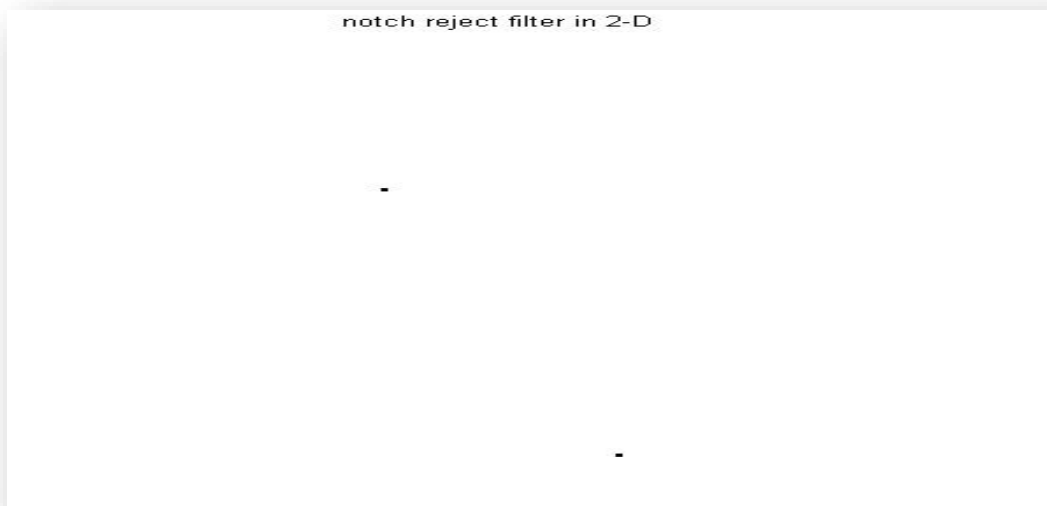
$Z = 100 \cdot \sin(2 \cdot \pi \cdot 50 \cdot X / 512) + 100 \cdot \sin(2 \cdot \pi \cdot 150 \cdot Y / 512) + 100 \cdot \sin(2 \cdot \pi \cdot 250 \cdot Y / 512);$
 $w = 0.7691$



$Z = 100 \sin(2\pi \cdot 50 \cdot X/512 + 2\pi \cdot 120 \cdot Y/512);$
 $w = 0.5266$

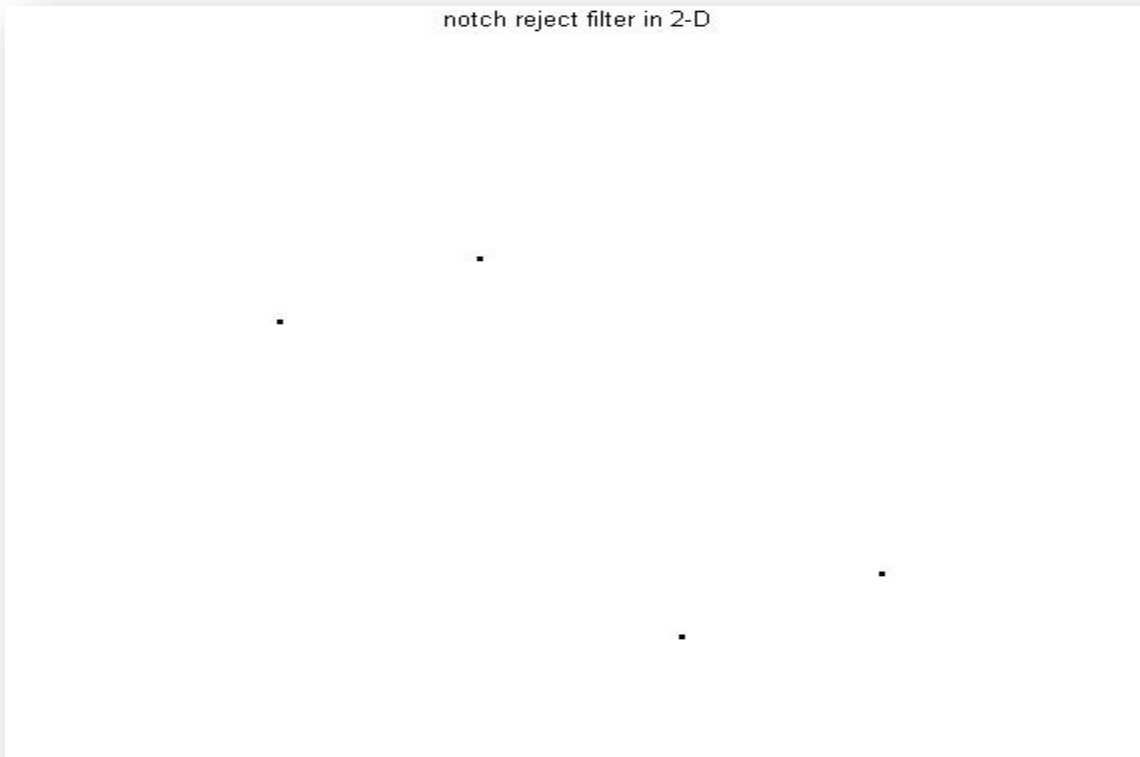


$Z = 100 \sin(2\pi \cdot 50 \cdot X/512 + 2\pi \cdot 120 \cdot Y/512) + 100 \sin(2\pi \cdot 150 \cdot X/512 + 2\pi \cdot 80 \cdot Y/512);$
 $w = 0.6899$



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

$w = 0.7694$



Thank you