Αρχές και Εφαρμογές Σημάτων και Συστημάτων

Μέλη Ομάδας

- Νικόλας Πατέρας – **Π17172**
- Ανδρέας Θεοδωρίδης – **Π17164**
- Βασίλειος Παπαχαραλάμπους – **Π17168**

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Ερώτημα Γ'.1

(Γ'.1.1)

(Γ'.1.2)

(Γ'.1.3)

```
clc

dt = 0.001;
t_min = -10 ;
t_max = 10;
t = (t_min:dt:t_max);
x = cos(100*pi*t) + cos(200*pi*t) + sin(500*pi*t);
figure ('Name', 'Original Signal Representation');
plot(t, x, '-r', 'LineWidth', 1.5);
xlabel('-0.1 \leq t \leq +0.1');
ylabel('x(t)');
grid on

Ts = 0.002;
t1 = (t_min : Ts : t_max);
Nmax = t_max/Ts;
h1 = (-Nmax : 1 : Nmax);
Xs = cos(100*pi*h1*Ts) + cos(200*pi*h1*Ts) + sin(500*pi*h1*Ts);
x1 = zeros(1,length(t));
for k=1:1:length(t)
   x1(k) = Xs * sinc((t(k) - h1*Ts)/Ts)';
end;
figure ('Name','Reconstructed Signal for Ts=0.002 sec');
   hold on
   plot(t , x, '-r', 'LineWidth', 1.5, 'Color', [0.4940, 0.1840, 0.5560]);
   plot(t , x, '*b', 'LineWidth', 1.5);
   xlabel('-10 \leq t \leq +10');
   ylabel('x(t) and x1(t)');
   grid on
   hold off
```

(Γ'.1.4)

(Γ'.1.5)

(Γ'.1.6)

Ερώτημα Γ'.2

(Γ'.2.1)

```
clc


asc = 0:30:330;
nums = [400 70 -50 5 290 805 1250 1500 1600 1450 1150 800];
figure ('Name' , 'Periodic Signal Representation FFT');
plot (asc, nums, 'ro', 'LineWidth', 2, 'Color', '[0, 0, 1]');
xlim([0 360])
xlabel('Degrees')
ylabel('Minutes')
title('{\bf SMT}')
grid on

d = fft(nums);
m = length(nums);
M = floor((m+1)/2);
a0 = d(1)/m;
an = 2 * (real(d(2:M))/m);
a6 = d(M+1)/m;
bn = -2*imag(d(2:M))/m;
hold on
x = 0:0.01:360;
n = 1:length(an);
y = a0 + an * cos(2* pi * n' * x/360) + bn * sin(2 * pi * n' * x/360) + a6 * cos(2
* pi * 6' * x/360);
plot(x, y, 'LineWidth', 2, 'Color', '[1, 0, 0]')
legend('Data', 'DFT', 'Location', 'NW')
```

(Γ'.2.2)

```
n = 100;
x = linspace(-3, 3, n);
y = 1./((x-0.5).^2+1);
z = fft(y);
padsize = 28/2;
if mod(length(z), 2)
   zp = ifftshift([zeros(1, padsize) fftshift(z) zeros(1, padsize)]);
else
   zp = fftshift(z);
   zp(1) = zp(1)/2;
   zp(end+1) = zp(1);
   zp = ifftshift ([zeros(1, padsize) zp zeros(1, padsize-1)]);
end
xp = linspace (x(1), x(end), length(zp));
yp = ifft(zp)/length(z) * length(zp);
figure()
plot(xp, yp, 'b', x, y, 'r')
```

Ερώτημα Γ'.3

(Γ'.3.1)

```
t=0:1/80000:2;
for i=0:11
   y=sin(220*2^(i/12)*2*pi*t);
   soundsc(y,8000)
   pause(1/2)
end
```

(Γ'.3.2)

Πάνω:

```
t=0:1/8000:2;
for i=0:11
   y=sin(440*2^(i/12)*2*pi*t);
   soundsc(y,8000)
   pause(1/2)
end
```

Κάτω:

```
t=0:1/8000:2;
for i=0:11
   y=sin(110*2^(i/12)*2*pi*t);
   soundsc(y,8000)
   pause(1/2)
end
```

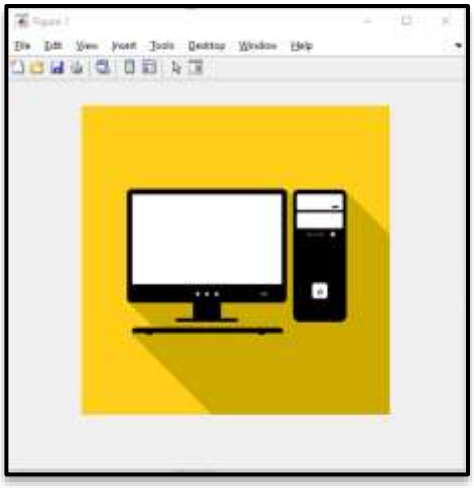
(Γ'.3.3)

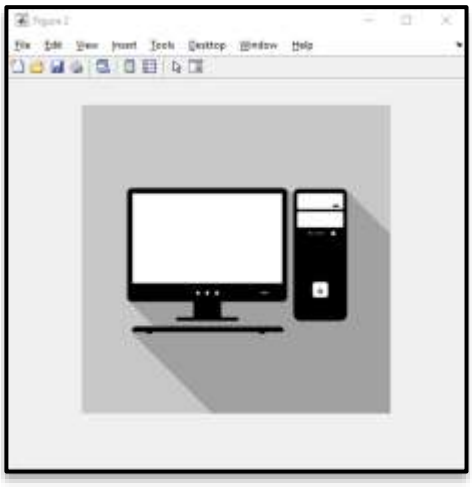
```
t=0:1/8000:2;
for i=0:11
   y=exp (-t.*220.*2^(i/12)).*sin(220*2^(i/12)*2*pi*t);
   soundsc(y,8000)
   pause(1/2)
end
```

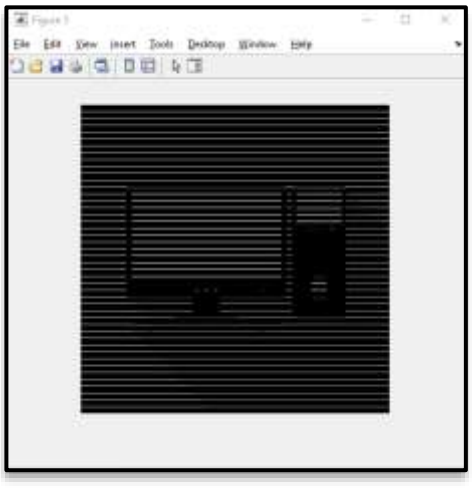
Ερώτημα Γ'.4

(Γ'.4.1)

```
RGB = imread('image-for-exercise.png');
I = rgb2gray(RGB);
I = im2double(I);
T = dctmtx(8);
dct = @(block_struct) T * block_struct.data * T';
B = blockproc(I,[8 8],dct);
mask = [1   1   1   1   0   0   0   0
        1   1   1   0   0   0   0   0
        1   1   0   0   0   0   0   0
        1   0   0   0   0   0   0   0
        0   0   0   0   0   0   0   0
        0   0   0   0   0   0   0   0
        0   0   0   0   0   0   0   0
        0   0   0   0   0   0   0   0];
B2 = blockproc(B,[8 8],@(block_struct) mask .* block_struct.data);
invdct = @(block_struct) T' .* block_struct.data * T;
I2 = blockproc(B2,[8 8],invdct);
imshow(RGB),figure,imshow(I), figure, imshow(I2)
```


File Edit View Insert Tools Desktop Window Help


File Edit View Insert Tools Desktop Window Help


File Edit View Insert Tools Desktop Window Help

Ερώτημα Γ'.5

(Γ'.5.1)

```
function[Ihighpassed]= highpassfilter(original_image,a)
I=imread(original_image);
I=double(I/255);
[rows, columns, colors]=size(I);
IF=zeros(rows, columns, colors);
for c=1:1:colors
   Ic=I(:,:,c);
   Fc=fft2(Ic);
   Cc=sqrt(Fc.*conj(Fc));
   F=reshape(Fc,1,rows*columns);
   C=reshape(Cc,1,rows*columns);
   [SC,IC]=sort(C, 'ascend');
   L=length(C);
   Na=round(L*a);
   Is=1;
   If=Na;
   Izeros=IC([Is:If]);
   F(Izeros)=0;
   F=reshape(F,rows, columns);
   IFc=ifft2(F);
   IFc=real(IFc);
   IF(:,:,c)=IFc;
end;
Ihighpassed=uint8(IF*255);
imshow(Ihighpassed);
```

(Γ'.5.3)

```
RGB = imread('image-for-exercise.png');
LEN = 31;
THETA = 11;
PSF = fspecial('motion',LEN,THETA); % create PSF
Blurred = imfilter(RGB,PSF,'circular','conv');
figure; imshow(Blurred); title('Blurred Image');
```

❶ Πληροφορίες

- **Workspace**
  - Matlab R2018b