통신시스템 Matlab Project#1 (만점: 10점)

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○ 목표

- Matlab 기본 및 DFT를 사용한 Fourier transform 학습
- 주어진 프로그램을 활용하여 rectangular pulse의 폭이 변경됨에 따른 sinc함수의 변화

○ 제공되는 Matlab Program

- plot_sin.m
- dft_new.m
- rect.m

○ 제출

- 제출일: 4월 22일 목요일 중간시험전까지 이메일 제출(jaekwon@yonsei.ac.kr)
- 제출물: 1. plot_sin.m을 프린트 후 손글씨로 설명
  2. rectangular pulse의 폭을 임의로 3개 정하여 time domain 및 frequency domain 관찰 (2장 슬라이드 88참조), matlab program, 실험결과 및 해석
- 유의사항: Matlab Program을 제외한 모든 글은 손글씨로 작성.

```
%filename:plot_sin.m
clear all;
close all;

fs=256;
t=0:1/fs:2-1/fs
f1=2;
f2=5;

x1=sin(2*pi*f1*t);
x2=2*sin(2*pi*f2*t);
x3=x1+x2;

length_t=length(t);

%plotting time-domain signal
figure, plot(t,x1);
hold on, plot(t,x2);
legend('sin(2*pi*2*t)','2*sin(2*pi*5*t+pi/4)');
xlabel('t[sec]');
ylabel('x_1(t), x_2(t)');
axis([0 2 -4 4]);
grid;

figure, plot(t,x3);
xlabel('t[sec]');
ylabel('x_3(t)');
axis([0 2 -4 4]);
grid;

% frequency resolution decision
% frequency resolution = fs/N
N=2;
while(N<length_t)
        N=N*2;
```

```
end

X1=dft_new(x1,N);
X2=dft_new(x2,N);
X3=dft_new(x3,N);

% plotting frequency-domain signal
figure, stem([-fs/2:fs*1/N:fs*(N/2-1)/N],[abs(X1(N/2+1:N)) abs(X1(1:N/2))]);
xlabel('frequency [Hz]');
ylabel('|X_1(f)|');
grid;
axis([-10 10 0 600]);

figure, stem([-fs/2:fs*1/N:fs*(N/2-1)/N],[abs(X2(N/2+1:N)) abs(X2(1:N/2))]);
xlabel('frequency [Hz]');
ylabel('|X_2(f)|');
grid;
axis([-10 10 0 600]);


figure, stem([-fs/2:fs*1/N:fs*(N/2-1)/N],[abs(X3(N/2+1:N)) abs(X3(1:N/2))]);
xlabel('frequency [Hz]');
ylabel('|X_3(f)|');
grid;
axis([-10 10 0 600]);
```

```
function X=dft_new(x,N);
% author: Jaekwon Kim
% date: April 2008
% x: input sequence
% N: fs/N = frequency resolution
% X: output sequence

x_zero_padded=[x zeros(1,N-length(x))];
n=0:N-1;
k=transpose([0:N-1]);
DFT_matrix=exp(-j*2*pi*k*n/N);
X_temp=DFT_matrix*transpose(x_zero_padded);
X=transpose(X_temp);

function y=rect(x)
% author: Jaekwon Kim
% date: April 2008
% x: input sequence
% y: output sequence

non_zero_index=find (abs(x)<1/2);
y=zeros(1,length(x));
y(non_zero_index)=1;
```

```
%filename:Fig2p2.m
% author: Jaekwon Kim
% date: April 2008
% This program plot the Fig2.2 in the book.
clear all;
close all;
T=1;
A=1;
fs=100;
t=-5:1/fs:5;
length_t=length(t);

% frequency resolution decision
N=2;
while(N<length_t)
      N=N*2;
end

g=A*rect(t/T);
G=dft_new(g,N);

% plotting time-domain signal
figure, plot(t,g);
xlabel('time [s]');
ylabel('Arect(t/T)');
grid;
axis([-5 5 -0.1 1.1]);

% plotting frequency-domain signal
figure, plot([-fs/2:fs*1/N:fs*(N/2-1)/N],[abs(G(N/2+1:N)) abs(G(1:N/2))]);
xlabel('frequency [Hz]');
ylabel('|G(f)|');
grid;
axis([-fs/2 fs/2 -10 100]);
```