EE 391
Signal Processing

Matlab Assignment 1

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Question A

I couldn't decide whether to write a Matlab program for part a or not so I decided to write it down as a program and also digital typed.

Here is the digital type out, code will be included in the code appended at the bottom.

ID: 21202377
digits: 12345678

Frequency (w0) = 23

A1 =3, A2 =7, A3 =7

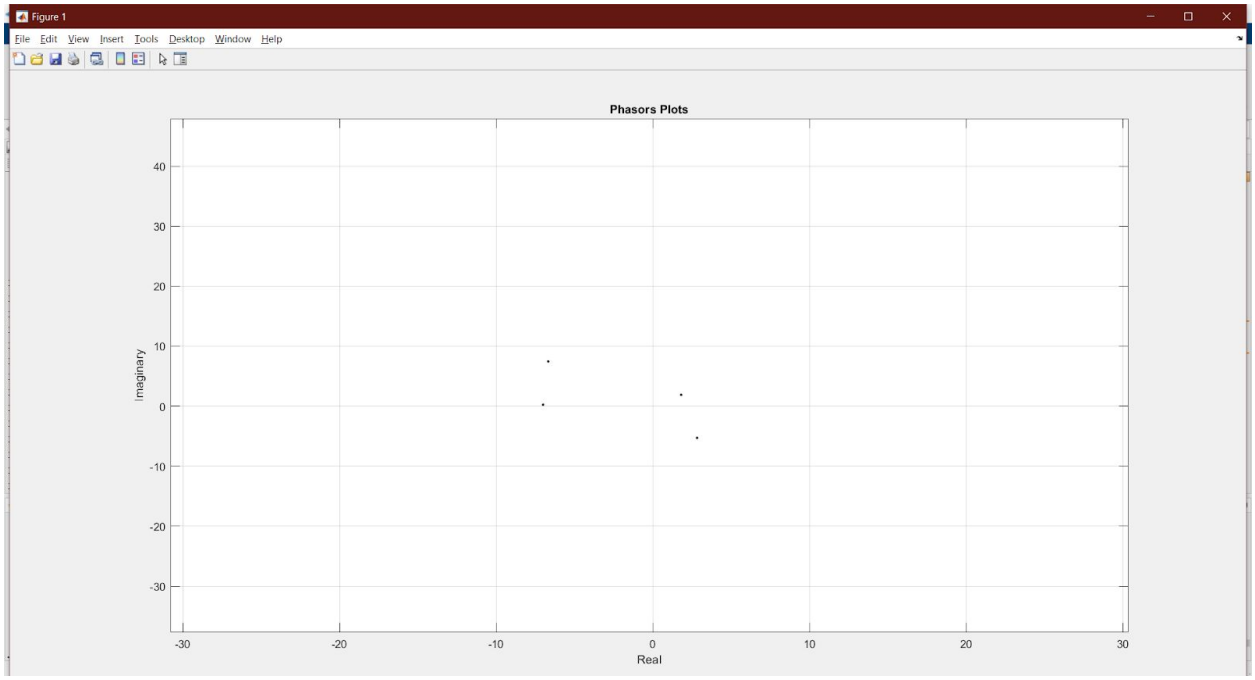
Phi1 = 023, Phi2 = 237, Phi3 = 377

Phi degrees in principle value
Phi1 = 23, Phi2 = 237, Phi3 = 17

Phi principle degrees in rads
Phi1 rad = 0.401426, Phi2 rad = 4.136430 , Phi3_rad = 0.296706

Question B

Plots



I have added the plot. I couldn't find the time to create a better looking plot. It prints all 4 of the phasors as one point each phasor. Real and imaginary parts are connected.

CODE

Part A

```
%% Part A ------------------------------------------------------------

% Set Student ID here
prompt = 'Please enter your id: ';
id = input(prompt);
%id = 21202377;

% Convert id to string and iterate through the new string
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% The loop goes goes from 0 to l. We phill an array of zeroes
% with our id digits in the correct order.
id_string = num2str(id);
l = length(id_string);
digits_arr = zeros(1,l);
for i = 1:l
   digits_arr(i) = str2num(id_string(i));
end

% set w0
w0 = (digits_arr(5)*10)+digits_arr(6);

% set A's
A1 = digits_arr(6);
A2 = digits_arr(7);
A3 = digits_arr(8);

% set phi values
phi1_degree = (digits_arr(4)*100) + (digits_arr(5)*10) + digits_arr(6);
phi2_degree = (digits_arr(5)*100) + (digits_arr(6)*10) + digits_arr(7);
phi3_degree = (digits_arr(6)*100) + (digits_arr(7)*10) + digits_arr(8);

% prinicple interval phi value
phi1_pr = rem(phi1_degree,360);
phi2_pr = rem(phi2_degree,360);
phi3_pr =  rem(phi3_degree,360);

% phi values in rads
phi1_rad = degtorad(phi1_pr);
phi2_rad = degtorad(phi2_pr);
phi3_rad = degtorad(phi3_pr);

fprintf("\n \n");

% Print all the values
% W0
fprintf("Frequency \n");
fprintf("w0 = %d \n",w0);

fprintf("\n \n");

% Amplitudes
fprintf("Amplitudes \n");
fprintf("A1 = %d \n",A1);
```

```
fprintf("A2 = %d \n",A2);
fprintf("A3 = %d \n",A3);

fprintf("\n \n");

% Phi in degrees
fprintf("Phi in degrees \n");
fprintf("Phi1 in degrees = %d \n",phi1_degree);
fprintf("Phi2 in degrees = %d \n",phi2_degree);
fprintf("Phi3 in degrees = %d \n",phi3_degree);

fprintf("\n \n");

% Phi in principle interval
fprintf("Phi in principle interval \n");
fprintf("Phi1 in principle = %d \n",phi1_pr);
fprintf("Phi1 in principle = %d \n",phi2_pr);
fprintf("Phi1 in principle = %d \n",phi3_pr);

fprintf("\n \n");

% Phi principle in rads
fprintf("Phi principle in rads \n");
fprintf("Phi1 in rads = %f \n",phi1_rad);
fprintf("Phi2 in rads = %f \n",phi2_rad);
fprintf("Phi3 in rads = %f \n",phi3_rad);

fprintf("\n \n");
```

Part B

```
%% Part B ------------------------------------------------------------


%% Part i

% Get all values from the user
prompt = 'Please enter a value for w0: ';
```

```
w0 = input(prompt);

prompt = 'Please enter a value for A1: ';
A(1) = input(prompt);

prompt = 'Please enter a value for A2: ';
A(2) = input(prompt);

prompt = 'Please enter a value for A3: ';
A(3) = input(prompt);

prompt = 'Please enter a value for phi1 in degrees: ';
phi_degree(1) = input(prompt);

prompt = 'Please enter a value for phi2 in degrees: ';
phi_degree(2) = input(prompt);

prompt = 'Please enter a value for phi3 in degrees: ';
phi_degree(3) = input(prompt);

% prinicple interval phi value
phi_pr(1) = rem(phi_degree(1),360);
phi_pr(2) = rem(phi_degree(2),360);
phi_pr(3) =  rem(phi_degree(3),360);

%% Part ii and Part iii
% Calculate the summation sinusoidal
sumRe = 0.0;
sumIm = 0.0;

% Calculate real part of three phasors
for i = 1:3
   Re = ( A(i) * cosd(phi_pr(i)) );
   sumRe = sumRe + Re;
end

% Calculate imaginary part of three phasors
for i = 1:3
   Im = ( A(i) * sind(phi_pr(i)) );
   sumIm = sumIm + Im;
end

% Find the amplitude of the final phasor
A_fin = sqrt(sumRe^2 + sumIm^2);
```

```
% Find phi of the final phasor
phi_fin = atand(sumIm/sumRe);
phi_fin = degtorad(phi_fin);

fprintf("Value of A: %f \n", A_fin);
fprintf("Value of phi: %f \n", phi_fin);

% Finally print the sum as requested
fprintf("x(t) = %.2f cos(%d t + %.2f ) \n", A_fin, w0, phi_fin);

%% Part iv

% t starts from 0 with an interval of 0.01 and goes up to 0.01
t = 0:0.001:30;

e = exp(1),
j = sqrt(-1);

p(1) = ( A(1) * e^( (phi_pr(1))* j ) );
% plot the graph
figure('units','normalized','outerposition',[0 0 1 1]) % fullscreen

plot(real(p(1)), imag(p(1)), '.k')

hold on % this makes program to keep the existing plot to stay
% and draw the new plot on top of it

% several settings
grid on;
xlabel('Real');
ylabel('Imaginary');
title('Phasors Plots');


p(2) = ( A(2) * e^( (phi_pr(2))* j ) );
plot(real(p(2)), imag(p(2)), '.k')
hold on % this makes program to keep the existing plot to stay

p(3) = ( A(3) * e^( (phi_pr(3))* j ) );
plot(real(p(3)), imag(p(3)), '.k')
hold on % this makes program to keep the existing plot to stay

% p(4) will be the final phasor's phasor
```

```
p(4) = ( A_fin * e^( (phi_fin)* j ) );
plot(real(p(4)), imag(p(4)), '.k')
```