

Matlab code example



1. Write a program for generating a composite signal (you could use sine or cosine waves). The parameters including the signal frequencies of 4 KHz, 8 KHz, 16 KHz with the amplitudes of 10 dB, 20 dB, 40 dB respectively, and the signal length should be limited to 1000 in samples.
- a. Plot the generated signal.
- b. Do standard sampling by following the Nyquist rate. Plot the sampled signal.
- c. Perform 8 point DFT, and show the amplitude spectrum and phase spectrum.

Matlab code

Got it 👍. The problem asks you to:

1. Generate a composite signal (sine/cosine waves) with given frequencies and amplitudes.
2. Plot the generated signal.
3. Sample the signal using Nyquist rate and plot it.
4. Perform **8-point DFT** and plot amplitude and phase spectra.

Here's the MATLAB code:

```
matlab

clc; clear; close all;

% Parameters
Fs = 64000;           % Sampling frequency (must be > 2 * highest freq = 32kHz)
N = 1000;             % Number of samples
t = (0:N-1)/Fs;       % Time vector

% Signal parameters
f1 = 4000; A1 = 10;    % 4 kHz, 10 dB
f2 = 8000; A2 = 20;    % 8 kHz, 20 dB
f3 = 16000; A3 = 40;   % 16 kHz, 40 dB

% Convert dB to linear amplitude
a1 = 10^(A1/20);
a2 = 10^(A2/20);
a3 = 10^(A3/20);

% Generate composite signal
x = a1*sin(2*pi*f1*t) + a2*sin(2*pi*f2*t) + a3*sin(2*pi*f3*t);

% (a) Plot the generated signal
figure;
plot(t, x);
title('Generated Composite Signal');
xlabel('Time (s)');
ylabel('Amplitude');

% (b) Standard Sampling (Nyquist rate)
Nyquist_rate = 2 * max([f1 f2 f3]); % 32 kHz
Ts = 1/Nyquist_rate;
n = 0:Ts:(N-1)*Ts;
x_sampled = a1*sin(2*pi*f1*n) + a2*sin(2*pi*f2*n) + a3*sin(2*pi*f3*n);

figure;
stem(n, x_sampled);
title('Sampled Signal at Nyquist Rate');
xlabel('Time (s)');
```

```
ylabel('Amplitude');

% (c) Perform 8-point DFT
X = fft(x_sampled, 8);

% Amplitude spectrum
amp_spectrum = abs(X);

% Phase spectrum
phase_spectrum = angle(X);

% Plot amplitude spectrum
figure;
stem(0:7, amp_spectrum);
title('8-point DFT - Amplitude Spectrum');
xlabel('k');
ylabel('|X[k]|');

% Plot phase spectrum
figure;
stem(0:7, phase_spectrum);
title('8-point DFT - Phase Spectrum');
xlabel('k');
ylabel('∠X[k]');
```

✅ This code will:

- Generate and plot the **composite signal**.
- Sample it at the **Nyquist rate**.
- Perform an **8-point DFT** and display amplitude and phase spectra.

Do you want me to also provide a **version with subplots** (so all results appear in one figure)?