Cosine fourier transform matlab

Key focus: Learn how to track sine wave and sine wave FFT using Matlab. Understand FFTshift. Draws the one-sided spectrum, on two sides and normalized. IntroductionNumber of texts are available to explain the basics of Discrete Fourier Transform and its very efficient implementation - Fast Fourier Transform (FFT). We often face the need to generate simple and standard signals (sine, sittine, Gaussian pulse, square wave, isolated rectangular pulse, exponential decay, chirping signal) for simulation purposes. I intend to show (in a series of articles) how these base signals can be generated in Matlab and how to represent them in the frequency domain using FFT. If you're prone to Python programming, visit here. Sine waveIn order to generate a sine wave in Matlab, the first step is to fix the frequency of the sine wave. For example, I intend to generate a sine wave f = 10 Hz whose minimum and maximum amplitudes are and respectively. Now that you've determined the frequency of the sine wave, the next step is to determine the sampling frequency. Matlab is a software that processes everything digitally. To generate/plot a smooth sine wave, the sampling frequency must be far higher than the required minimum sampling rate prescribed which is at least twice the frequency - as per Nyquist's Shannon theorem. Here an oversampling factor of is chosen - this is to track a smooth sine wave similar to a continuous (If this is not the requirement, reduce the oversampling factor to the desired level). Therefore, the sampling frequency becomes . If you want a phase shift for the sine wave, also specify it.f=10; %sina wave frequency overSampRate=30; %oversampling rate fs=overSampRate*f; %sampling frequency phase = 1/3*pi; %desired phase shift in radians nCyl = 5; %to generate five sine wave cycles t=0:1/fs:nCyl*1/f; %time base x=sin(2*pi*f*t+phase); %replace with cos if you want a plot(t,x) siech wave); title(['Sine wave f=', num2str(f), 'Hz']); xlabel('Time(s)'); ylabel('Breadth'); The representation of the signal given in the frequency domain is performed through the Fast Fourier Transform (FFT) which implements the discrete Fourier transform (DFT) efficiently. Usually, the power spectrum is desired for analysis in the frequency domain. In a power spectrum, the power of each frequency component of the given signal is tracked relative to its frequency. The command calculates the DFT -point. The number of points – – in the DFT calculation is taken as the power of (2) to facilitate an efficient calculation with FFT. Here a value of is chosen. It can also be chosen as the next power of 2 of the signal length. Different FFT:Since FFT is just a numerical calculation of DFT-point, there are many ways to track the result.1. Plot of raw DFT values:The x-axis is executed from to , representing the sample values. Because DFT values are complex, the DFT size is plotted the y-axis. From this plot we cannot identify the frequency of the sineoid that was generated. NFFT=1024; %NFFT-point DFT X=fft(x,NFFT); %calculate DFT using FFT nVals=0:NFFT-1; Sample points chart %DFT(nVals,abs(X)); title('Double Sided FFT - without FFTShift'); xlabel('Sample points (N-point DFT)') ylabel('DFT values'); In the next version of the plot, the frequency axis (x-axis) is normalized into units. Just divide the sample index on the x-axis by the length of the FFT. This normalizes the x-axis with respect to the sampling frequency. However, we cannot understand the frequency of sine from the plot. NFFT=1024; %NFFT-point DFT X=fft(x,NFFT); %calculates DFT using FFT nVals=(0:NFFT-1)/NFFT; %Normalized DFT Sample Points Chart(nVals,abs(X)); title('Double Sided FFT - without FFTShift'); xlabel('Normalized frequency') ylabel('DFT values'); As you know, in the frequency domain, values will assault both the positive and negative frequency axis. To plot DFT values on a frequency axis with both positive and negative values, the DFT value based on the sample index must be centered in the center of the array. This is done using the function in Matlab. The x-axis goes from where the endpoints are the normalized folding frequencies with respect to the sampling frequency. NFFT=1024; %NFFT-point DFT X=fftshift(fft(x,NFFT)); %calculate dft using FFT fVals=(-NFFT/2:NFFT/2-1)/NFFT; %DFT Sample points plot(fVals,abs(X)); title('Double Sided FFT - with FFTShift'); xlabel('Normalized frequency') ylabel('DFT values'); Here, the normalized frequency axis is simply multiplied by the sampling frequency. From the underlying texture we can ascertain that the absolute value of FFT reaches the peaks at and . So the frequency of the generated sine is . Small lateral lobes next to peak values a and are due to spectral losses. NFFT=1024; X=fftshift(fft(x,NFFT)); fVals=fs*(-NFFT/2:NFFT/2-1)/NFFT; plot(fVals,abs(X),'b'); title('Double Sided FFT - with FFTShift'); xlabel('Frequency (Hz)') ylabel('| DFT values|'); Below is the most important representation of FFT. Tracks the power of each frequency component on the y-axis and the frequency on the x-axis. Power can be tracked linearly or at log scale. The power of each frequency component is calculated asWhere is the representation of the frequency domain of the signal. In Matlab, the power must be calculated with appropriate scale terms (since the signal length and transformation length of FFT may differ from case to case). NFFT=1024; L=length(x); X=fftshift(fft(x,NFFT)); Px=X.*conj(X)/(NFFT*L); %Power of each freq component fVals=fs*(-NFFT/2:NFFT/2-1)/NFFT; plot(fVals,Px,'b'); title('Spectral power density'); xlabel('Frequency ylabel('Food'); If you want to check the total signal strength from the time domain and frequency domain graphs, follow this link. Plotting the spectral power density (PSD) with the y-axis on the log, log, the most encountered type of PSD graph in signal processing. NFFT=1024; L=length(x); X=fftshift(fft(x,NFFT)); Px=X.*conj(X)/(NFFT*L); %Power of each freq component fVals=fs*(-NFFT/2:NFFT/2-1)/NFFT; plot(fVals,10*log10(Px),'b'); title('Spectral power density'); xlabel('Frequency (Hz)') ylabel('Nutrition');6. Power spectrum – One-sided frequenciesIn this type of graph, the negative frequency part of the x-axis is omitted. Only FFT values corresponding to the DFT sample points of the point are plotted. As a result, the normalized frequency axis ranges from to . The absolute frequency (x-axis) is performed from to . L=length(x); NFFT=1024; X=fft(x,NFFT); Px=X.*conj(X)/(NFFT*L); %Power of each freq component fVals=fs*(0:NFFT/2-1)/NFFT; plot(fVals,Px(1:NFFT/2),'b','LineSmoothing','on','LineWidth',1); title('One-sided power spectral density'); xlabel('Frequency (Hz)') ylabel('PSD'); Rate this article: (105 votes, average: 4.64 out of 5)For more readings[1] Spectral power density - MIT open course articles↗Topics in this chapterBooks by the author I'm starting with Matlab and our professor told us to do some exercises to keep it going. One of them is to plot the Fourier transform of a little thing (cos(2*pi*t)), but sampled with a sampling frequency of fs=12Hz.So I did the following:>> fs=12;>> n=0:1/fs:11/fs;>> x=cos(2*pi*n);>> <3> <1> stem(n,x)Which gives me the following:Then I calculated the fft of x:>> y=abs(fft(x));>> k=0:fs:11*fs;>> stem(k,y)Which should give me the real part of the transform of Fourier of a little thing, but if I remember correctly, the FT of a little thing is two points, one a (wave frequency)/2*pi and another a -(wave frequency)/2*pi greek , but I got this:Why am I getting both peaks on the positive side of the axis? One could argue that the DFT is periodic, which it is, but it should be periodic with 2*pi, right? I think I messed up DTFT and DFT of coseno, but I can't figure out what I can do to fix my plot. Thank you in advance. Answer: Walter Roberson on February 27, 2017 The complete code I'm using is:t = 0:1.66E-12:40E-9; A = 1; A2 = 2;f=3E9;signal = cos(2*pi*f*t).*(A.*(heaviside(t)-heaviside(t-39E-9)));signal_2 = [cos(2*pi*f*t).*(A2.*(A2.*(heaviside(t)-heaviside(t-19E-9)))]+[cos(2*pi*f*t).*(A2.*(heaviside(t-21E-9)-pesanteside(t-39E-9))];I I'm trying to calculate the Fourier transform of the two signals and plot the Fourier transform of them. It should be a sinc function when it's Fourier Transform, but I can't get it plotted correctly using fft. Here's a code I found online (I'm not sure where, so I can't quote it), but I tried and couldn't make it work I don't really know what er?signal = = fft(signal);m2 = abs(y2);p 2 = angle(y2);er2 = (0:length(y2)-1)*1,66E-12/length(y2);figure (3)subtrama(2,1,1)plot(er2,m2) Hi Sufyan,First of all, please delete duplicate posts so that people can contribute in the same place. Le Le spectrum tells you what the frequency components are in your signal. The number of points in the spectrum is determined by the number of points in the FFT. In this case, you chose 512. Also, you only tracked half of it. I think the most important question is why are you seeing the signal frequency within 50 Hz when it really should be at 100 kHz. This is due to the incorrect sampling frequency specified in the calculation. 512 is the number of points in FFT, but it is not the sampling frequency. You should actually write your variable f as if you do, you can see that the peak appears in the right place. Note that the sampling frequency is actually 10 MHz, not 1 MHz. Because in your signal You are actually sampled 1e7 points per second since your n is 0:0.1:10.HTH Hi, I have to calculate DFT of g(t)=cos(0.5 *t). So I write the code below>> N=128; %number of time points sampled>> t=linspace(0.128,N); %domain now>> Fs=1/(t(2)-t(1)); %sampling frequency>> Fn=Fs/2; %Nyquist Frequency>> g=cos(0.5*t); %input signal>> G=fftshift(fft(g)/N); %Fourier transform of g>> w=linspace(-Fn,Fn,N)*2*pi; %angular frequency domain >> subplot(2,1,1)>> plot(w,abs(G)); % to see amplitude>> subpable(2,1,2)>> plot(w,angle(G)); % to see phase<The result= of= above= code=>In this situation, my question is1) In amplitude graph, I expected it to have the formation of two Dirac delta function Aδ(w-0.5)+Aδ(w+0.5), i.e. shoudn't amplitude having values at w=/0.5 and w=/-0.5. But it has values. How can I change the code to make these two functions delta?2) In the amplitude graph, I also expected the peak coordinates to be (-0,5,0,5) and (0.5,0,5), but it is not. How can I change the code to make spikes at these coordinates?? Thank you..!! You..!! </The>

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