# Assignment 8

R Sumedhan

June 9, 2021

## 1 Overview

Our objective is to compute the digital spectrum or the DFT of different continuous-time functions. The Fourier transform is given by

$$F(j\omega) = \int_{n=-\infty}^{\infty} f(t)e^{-j\omega t}dt$$

Replacing the integral with a summation and converting the continuous-time function to a discrete-time function, we get the DFT as

$$F(e^{j\theta}) = \sum_{n=-\infty}^{\infty} f[n]e^{-jn\theta}$$

If f[n] is periodic, it turns out that F[k], the DFT sequence is also periodic with the same period.

The python functions used for computing the Fourier transform and its inverse are

- `numpy.fft.fft()`
- `numpy.fft.ifft()`

## 2 Plots

The first plot is an example plot of the function (1+ 0.1cos(t))cos(10t)
The next two plots are the spectrum plots of $sin^3(t)$ and $cos^3(t)$
The next plot is the spectrum plot for the function cos(20t + 5cos(t)). For this function, we see that the phase plot for higher magnitude is mirrored about the origin because of the 't' term inside the outer cosine function, which makes it an odd function.
The final plot is the magnitude of the gaussian distribution, which is as follows

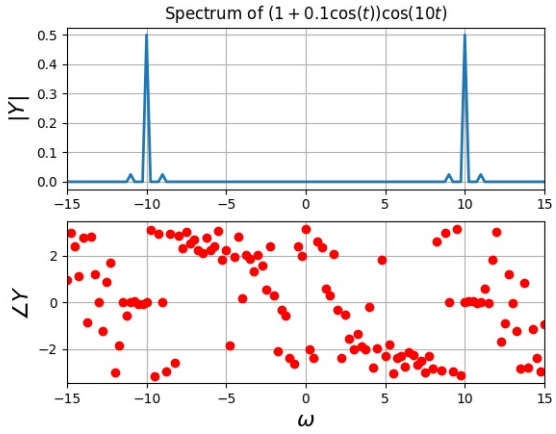


Figure 1: Example plot

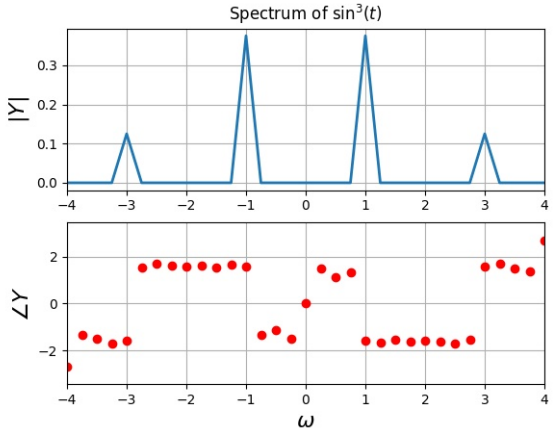


Figure 2: Plot of $sin^3(t)$

## 3 Conclusion

The code for the assignment can be referred to in the other file.

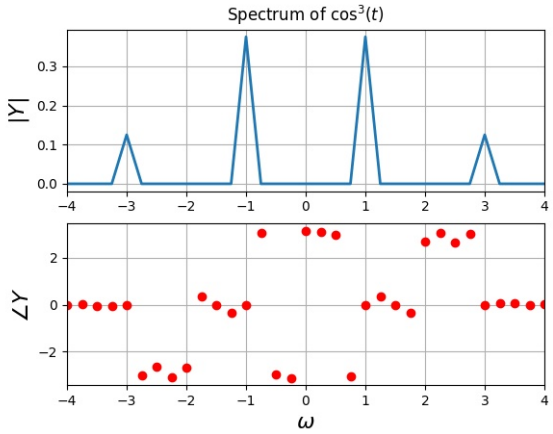


Figure 3: Plot of $cos^3(t)$

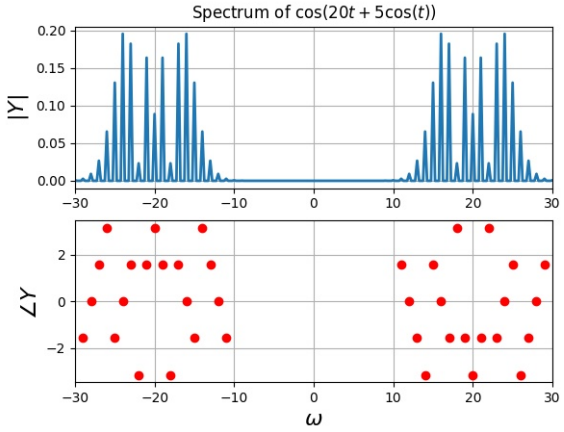


Figure 4: Plot of concatenated cosine function

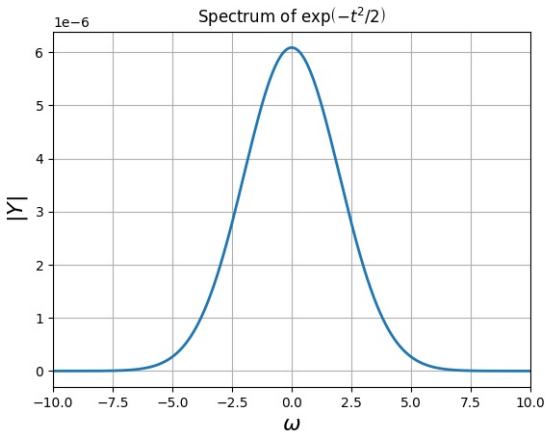


Figure 5: Gaussian plot