CT303 - Digital Communications

Autumn 2020

Lab 1: Introduction to Python3 — Submit by: 4/9/2020, 12 noon

1. Write a Python3 function `mysinplot` that takes in 3 arguments: frequency `f` in Hz, sampling frequency `fs` in Hz, and number of cycles `n`, and plots exactly `n` periods of a sine function of frequency f Hz, sampled at f_s Hz. In the report, briefly describe your logic, and give a few example plots.

2. Let $x(t) = \sin(2\pi ft), t \in [-T, T], T > 0$ and zero elsewhere. Consider the signal $y(t) = x(t), t \in [-T_1, T_1], T_1 > 0$ and zero elsewhere. In order to simulate and compute the amplitude spectrum of x, we will sample the signal y at f_s Hz in order to obtain a sampled sequence denoted by y_d, and apply Discrete Fourier transform on y_d (using `fft`). Write a function `myctft` that takes in `T, T1, fs`, and plots the amplitude spectrum of y. The x-axis must be scaled appropriately to show frequency in Hz.

   (a) Show a few example plots with different values for the input parameters.

   (b) Given $f = 10Hz, T = 1sec$, analytically compute the Fourier transform of x, and using appropriate values of T_1 and f_s try to obtain the amplitude spectrum as close as possible to the analytical result using your code, with proper justification.

   (c) What happens when we set $T = T_1$, and why?