

Birla Institute of Technology & Science, Pilani, Rajasthan

First Semester 2021-2022 Lab-3 (Python): Bandwidth

Course: EEE F311 Communication Systems
Instructor-in-Charge: S M Zafaruddin

07-09-2021 TUESDAY (P2, P4:): PYTHON

Instructions

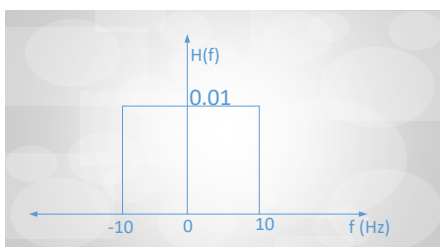
- Create a folder named Lab in your shared folder.
- Create a Lab3 Sub-folder in the Lab folder. This folder will be your working directory.
- Develop .py file corresponding to each task.
- You can start the tasks in any order.
- Once all tasks are done, paste your codes and plots/results/observations/conclusions in a word doc and upload through a Dropbox file request link. The link will be shared through Slack.
- Best of Luck

Objectives

In this task, the objective is to study signals and source encoding.

Python Task 1

Generate a band-limited system (i.e., communication channel) whose frequency response is as shown in the figure. Plot the impulse response $h(t)$. Use fft on $h(t)$ to confirm the magnitude spectrum $H(f)$.



Python Task 2

Plot the time-domain and frequency domain of the received signal if the message signal $m(t) = \sin(10\pi t) + \sin(40\pi t)$ is passed through the channel, as generated in Task 1. Demonstrate the effect of channel by comparing the received signal with the transmitted signal. What will happen if the bandwidth of channel is increased/decreased. Hint: Use `numpy.convolve` for convolution operation.

Python Task 3

Plot the time-domain and frequency domain of the received signal if the message signal $m(t) = 2f_m \text{sinc}(2f_m \pi t)$ is passed through the channel, as generated in Task 1. Use an appropriate f_m . Demonstrate the effect of signal bandwidth by comparing the received signal with the transmitted signal. What will happen if the bandwidth of signal is increased/decreased?.

Python Task 4

Plot the time-domain and frequency domain of the received signal if the message signal $m(t) = \Pi(t/T)$ (rectangular pulse) is passed through the channel, as generated in Task 1. Use an appropriate T . Demonstrate the effect of signal duration by comparing the received signal with the transmitted signal. What will happen if the duration of transmitted is increased/decreased.

Project Task

We have started individual tasks with a bigger picture: to design an end-to-end simulator for a digital communication system. In this task, we have transmitted signal over band-limited channel.