Birla Institute of Technology & Science, Pilani, Rajasthan
First Semester 2021-2022
Lab-4 (PYTHON): Real-Time

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

14-09-2021 TUESDAY (P1, P3:) PYTHON

Instructions

- Create a folder named Lab in your shared folder.
- Create a Lab4 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 real time transmissions of signals over a channel. Information signals are generally random which can be observed over time. Information signals are not transmitted as a whole but in smaller parts. Transmission rate is usually measured how many waveform (i.e., symbols) in a unit time are transmitted over channel. Thus, we use the rate of transmission in symbols/sec. For example, an audio file of 3 minutes duration is not transmitted in one go but transmitted over a time such that each time a smaller part of signal (i.e., of a certain duration) is transmitted. Transmission stops once whole information is transmitted. Time has come to visualize signals in real time.

For all the tasks, take N as the last digit of your BITS ID. If the last digit is 0 or 1, take $N = 6$.

PYTHON Task 1

Generate a message signal $m(t) = U\cos(2\pi \times N \times t)$ each of duration 1 second for a total duration of 30 seconds, where U is a uniform random variable which can take integer values from 1 to 5. Visualize the signal in real-time for the duration of 30 seconds. Also visualize the signal in frequency domain.

PYTHON Task 2

Generate message signals $m_1(t) = \cos(2\pi Nt)$, $m_2(t) = 2Nsinc(2N\pi t)$, $m_3(t) = \Pi(t/N)$. Also download an audio song (around 30 sec) and read its data and name $m_4(t)$. Randomly select one of the messages and plot time and frequency domain in real time for 30 seconds.

PYTHON Task 3

A message signal $m_1(t) = N\cos(2\pi f_1 t) + N\cos(2\pi f_2 t)$ is passed through a band-limited channel of bandwidth 50 Hz. The frequencies f_1 and f_2 are randomly selected. The maximum and minimum range for both f_1 and f_2 are between 10 Hz to 100 Hz. Plot the time-domain and frequency domain of the signal at the output of channel for 30 seconds.

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 generated real-time signals and its transmissions over band-limited channel.