Birla Institute of Technology & Science, Pilani, Rajasthan
First Semester 2021-2022
Lab-6 (PYTHON): DSB-SC

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

30-09-2021 THURSDAY (P1, P3:): PYTHON

Instructions

- Create a folder named Lab in your shared folder.
- Create a Lab6 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 modulated signals over a channel with additive noise.

Python Task 1

Generate three message signals as $m_1(t) = \cos 2\pi Nt$, $m_2(t) = 2Nsinc(2N\pi t)$, and raised cosine pulse $m_3(t) = 200\frac{\cos \pi 200t}{1-40000t^2}sinc(\pi 200t)$ each with duration one second. Randomly select one of the message signals and use DSB-SC to modulate the carrier of frequency 1 KHz and amplitude 2 Volts. Transmit the DSB-SC signal over a band-limited channel of appropriate bandwidth. Add AWGN $n(t) \sim (0, 0.01)$. Demodulate the signal using synchronous detector. Synchronous detector is implemented by multiplying the received signal with carrier signal followed by a low pass filter. Plot the modulated and demodulated signal both in time and frequency domain using the real time code for 30 seconds. Take N as the **sum** of the last three digits of your BITS ID.

Python Task 2

Repeat the task 1 if the demodulation is done using envelope detector. The envelope detector is implemented using the MATLAB function hilbert. Say, the received modulated signal is x_t, then use $y_t = \text{hilbert}(x_t) * e^{-j2\pi f_c t}$. The exponential signal is multiplied to shift the modulated signal from band-pass to low pass.

Python Task 3

Repeat the task 1 if there is a single message signal, which is the downloaded audio file of 30 second. Verify the accuracy of demodulated signal by listening the signal.

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 modulated signal over band-limited channel with additive noise in real time.