Ahsanullah University of Science and Technology

Software Project - EEE 3218 – Digital Signal Processing Lab

Spring - 22

An audio file *'final.wav'* which contains combined and overlapping **modified** sounds of the instruments - trumpet, piano, violin, and guitar, has been provided. Another file '*NonOverlapping.wav*' contains the non-overlapping **modified** sounds of the musical instruments – guitar, piano, trumpet and violin (in this order). Use "audioread" for audio signal input in MATLAB. Your task is to achieve the following goals using MATLAB codes:

1) Find the spectrum of each of the instrument's sound from 'NonOverlapping.wav' file and determine the frequency ranges.

2) Find the spectrum of the combined sound signal from 'final.wav' file and determine the frequency range.

3) Design a digital filter that would separate the sound of each instrument from "final.wav" file. Mention the filter type, filter design methods, filter order, and the cutoff frequency of the filter.

4) Extract each instrument sound in separate '.wav' file.

5) Closely observe the spectrum of all 4 separated wav-files individually. Can you suggest any way to pass the individual wav files separately through a channel of bandwidth 0 to 10 kHz?

6) Send any 2 of the above 4 separated signals through a 2-channel FDM (frequency division multiplexed) link. Use a carrier of X Hz where X is the last 4 least significant digits of your 9 digit ID. Choose another carrier cleverly to optimize the FDM link bandwidth while keeping the signal fidelity as high as possible.

7) The signal extracted from the 'final.wav' audio file lacks melody. Can you convert this into an overlapping yet melodious one with proper synchronization of octaves using MATLAB code?

Rules for Submission:

- Submission of report is individual.
- Your report should contain all the necessary graphs, data, codes, your observation and an explanation of each curve.
- You can take help from the **'filter designer'** toolbox only to verify the result.
- Create a **zip file** containing the pdf of the project report, the extracted signals, and the codes. Submit the zip file through google form which will be made available for submission in Google Classroom.
- **Do not copy from others. Plagiarism is strictly discouraged.**