PHYS-GA2000-PS8

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1 Introduction

In this problem set, we are interested in performing a Fast Fourier Transformation (FFT) for a data set obtained by recording piano and trumpet. By doing so, we are trying to find out which musical notes those instruments are playing. In the second part of this problem set, our objective is to solve Lorenz equations using numerical integration.

2 Results

Recorded data of piano and trumpet are presented in Figure 1 and 2 as a funtion of time, respectively.

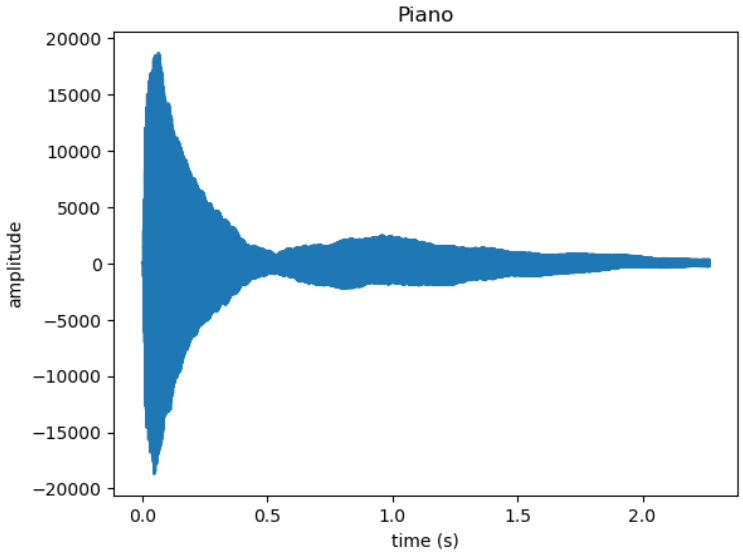

Figure 1: Recorded data of piano as a function of time.

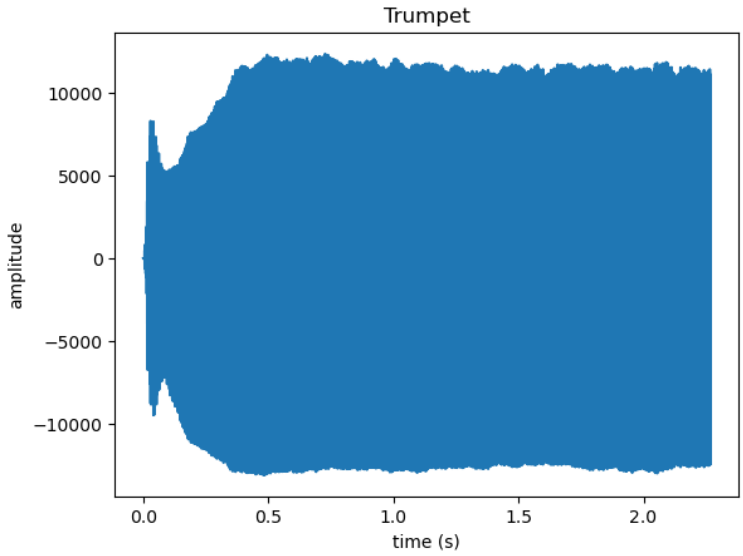

Figure 2: Recorded data of trumpet as a function of time.

To perform FFT, we made use of **scipy**'s FFT routines. The amplitude versus frequency plots for piano and trumpet data are presented in Figure 3 and 4, respectively. The ordinates of those plots correspond to the magnitude of the FFT coefficients whereas the abscissa to the index number of the coefficient. However, it is preferred to express the index number of coefficient as frequency (the signal under consideration is a function of time).

The dominant frequency in piano and trumpet are found as 524.79 and 1043.847 Hz, respectively. The corresponding musical notes are C_5 and C_6, respectively.

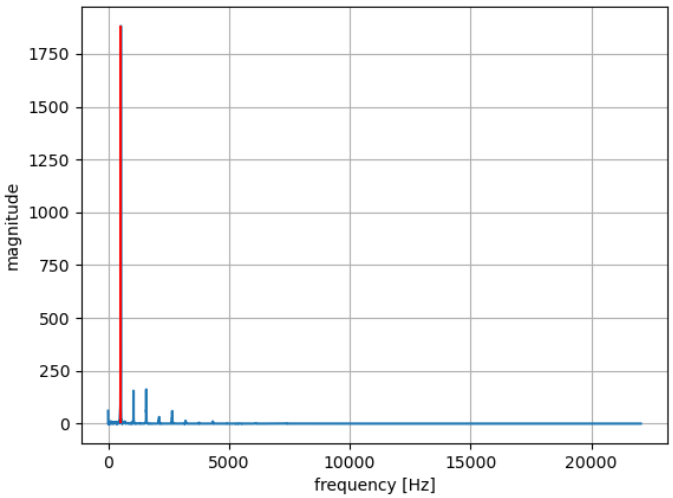

Figure 3: FFT of the recorded piano data as a function of frequency.

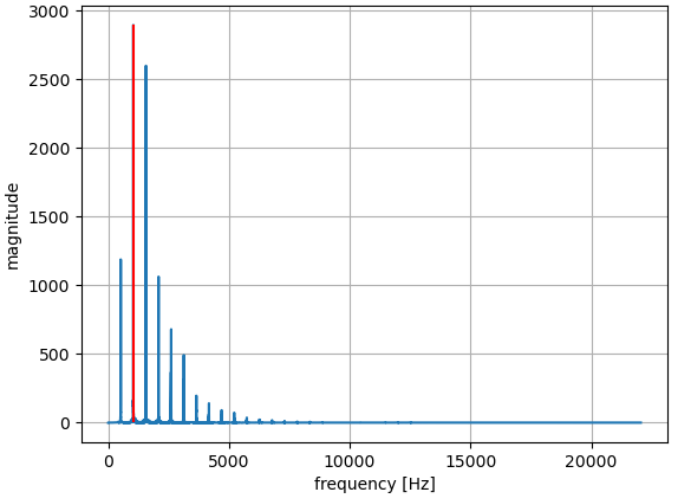

Figure 4: FFT of the recorded trumpet data as a function of frequency.

For the second problem, y as a function of time and the plot of z against x are presented in Figure 5 and 6, respectively.

For integration, the **scipy** function called **solveivp** is used, which numerically integrates a system of ordinary differential equations given an initial value.

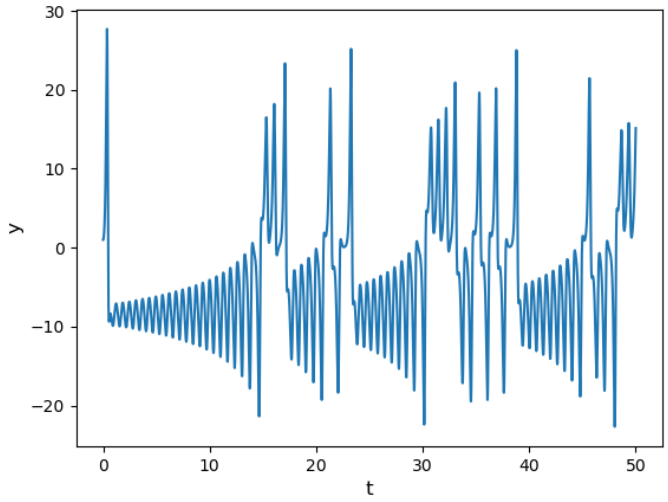

Figure 5: y as a function of t.

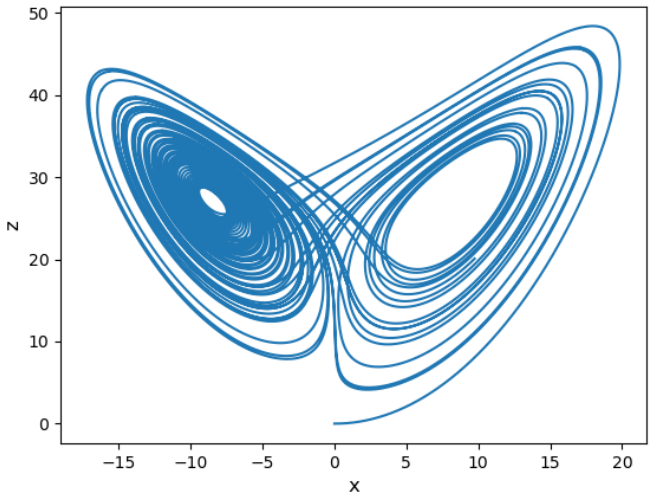

Figure 6: z against x.