Computational Physics HW8

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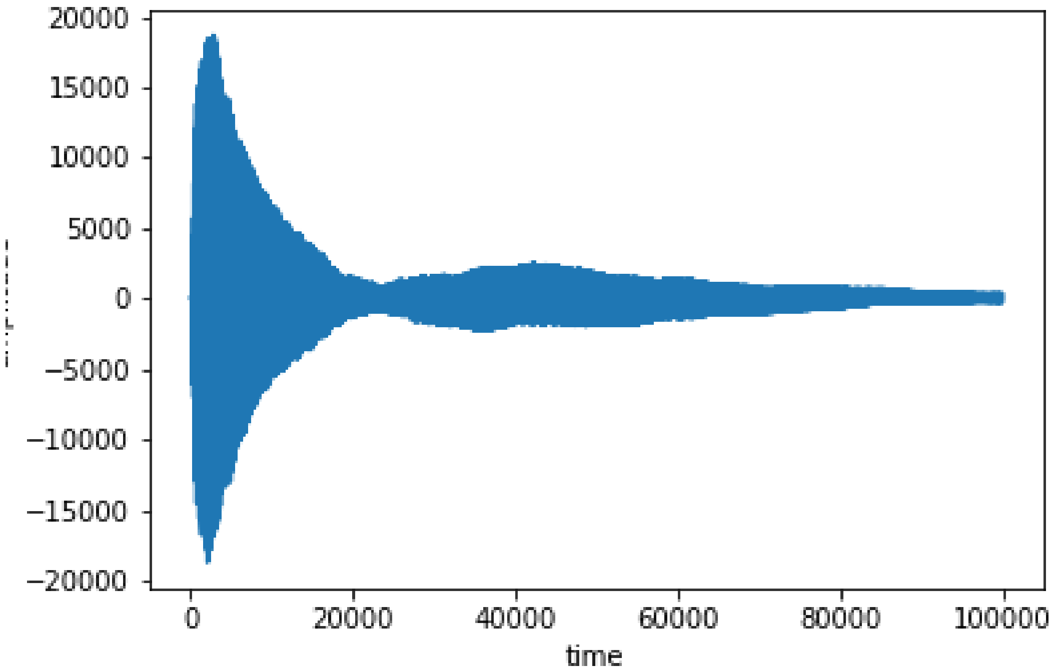

Figure 1: **P1: Waveform of piano data.**

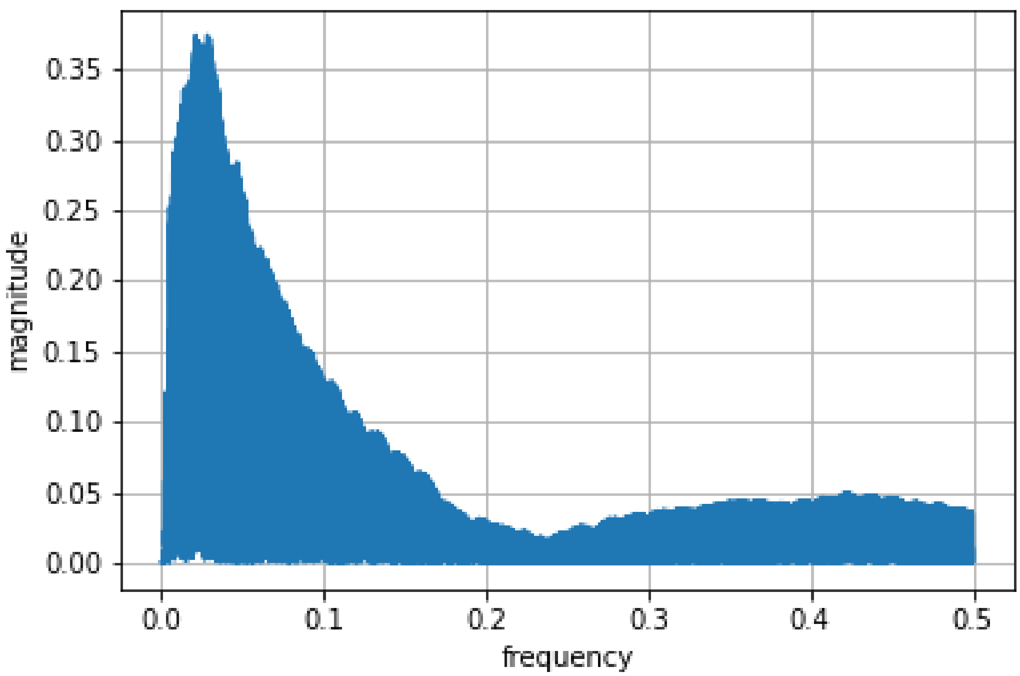

Figure 2: **P1: Fourier transform of piano data.**

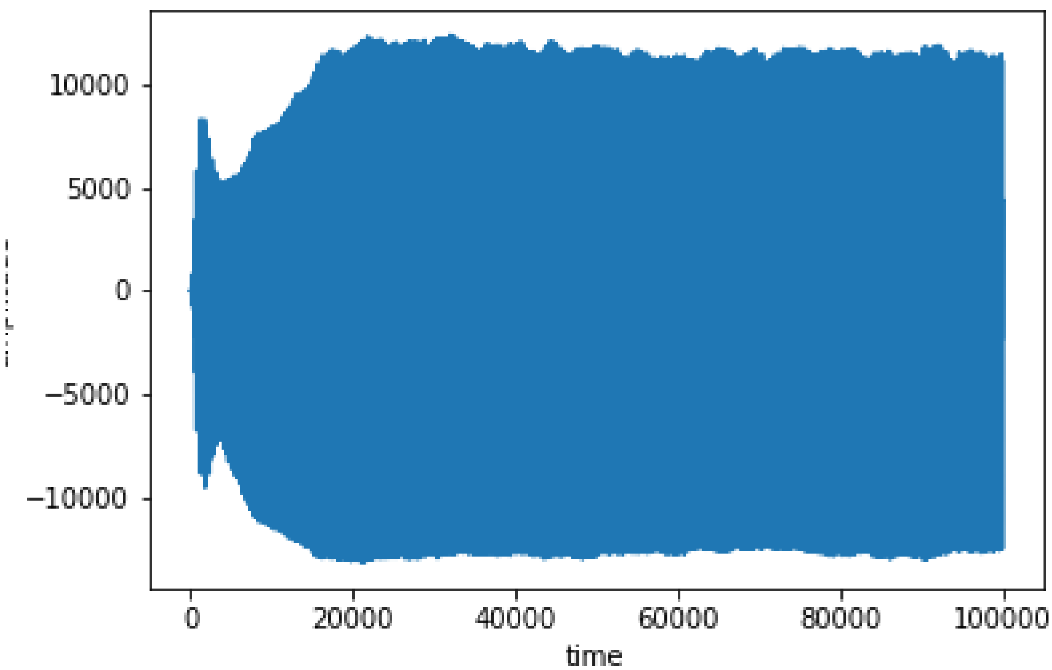

Figure 3: **P1: Waveform of trumpet data.**

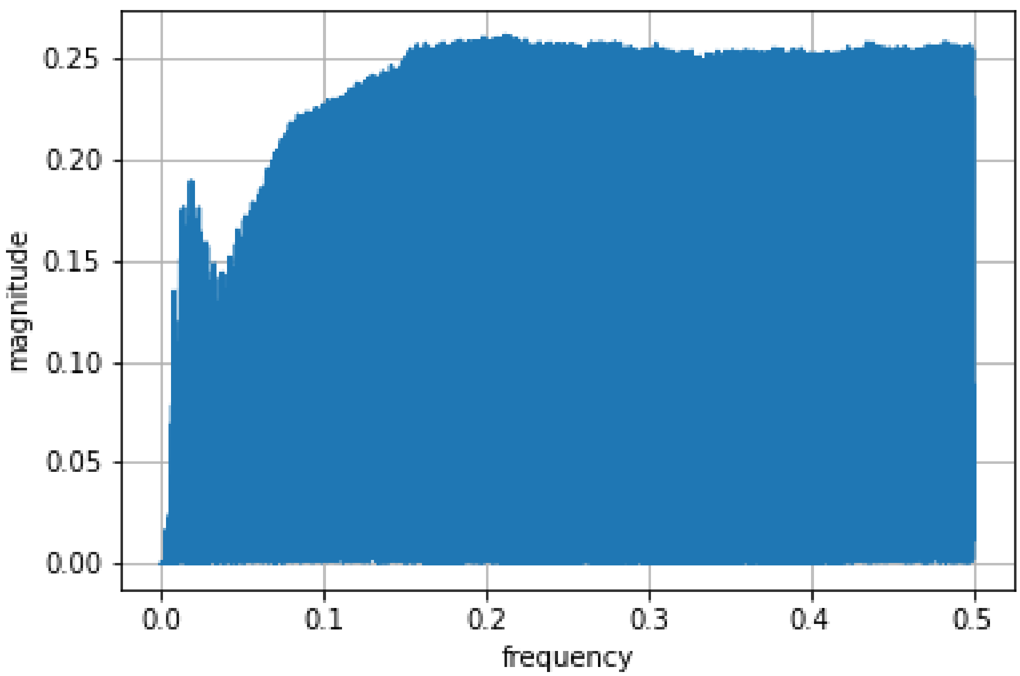

Figure 4: **P1: Fourier transform of piano data.**

P1: Figure 1-4 are plots of waveforms and fourier transforms of the piano and trumpet data. Comparing Fig.2 and Fig.4, we observe that the sound of piano is more compacted to a narrower frequency, while trumpet has wider and more averaged frequencies. This is due to the special color of different instruments. Given that the time unit of original data is 1/44100 second, the frequency unit is thus 44100 Hz. Knowing that both data are of the same note, we can see that there is a peak at 0.025 frequency unit in both Fig.2 and Fig.4. We can interpret the large and flat magnitude from 0.2 to 0.5 in Fig.4 as the special color of sound of trumpet instrument. Thus the note is of 0.025*44100=1102Hz, which is C#6.

P2: Treat lorentz equations parallelly as [fx,fy,fz] with input f=[x,y,z]. Feed into python built-in integrator solve_ivp to get the integration results. Plot y(t) and z(x). Results shown in Fig.5 and Fig.6.

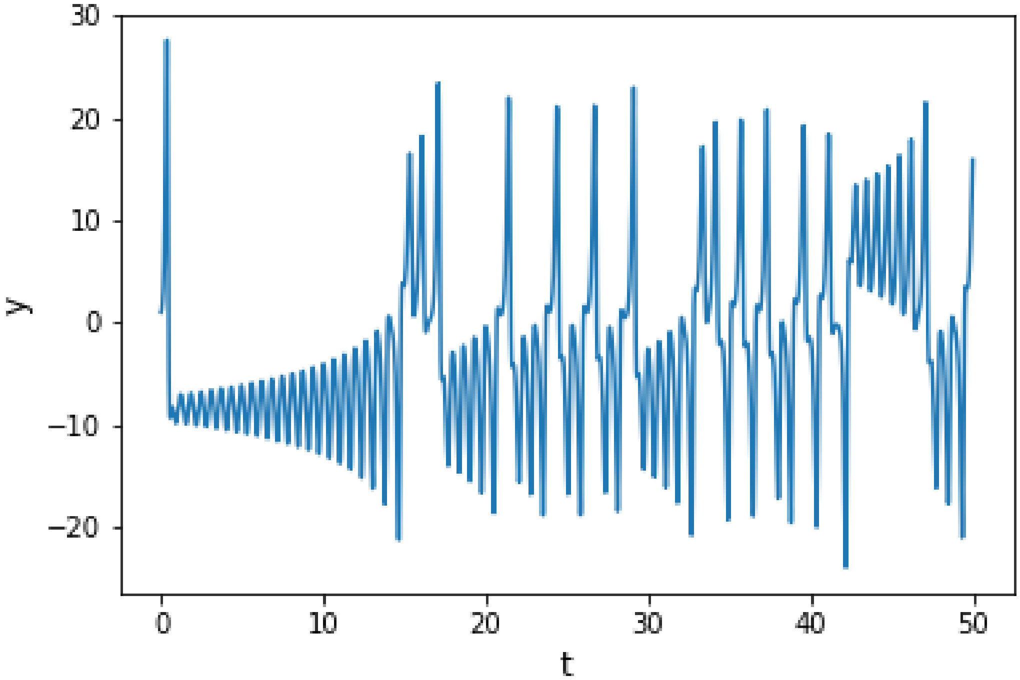

Figure 5: **P2: Plot of y(t).**

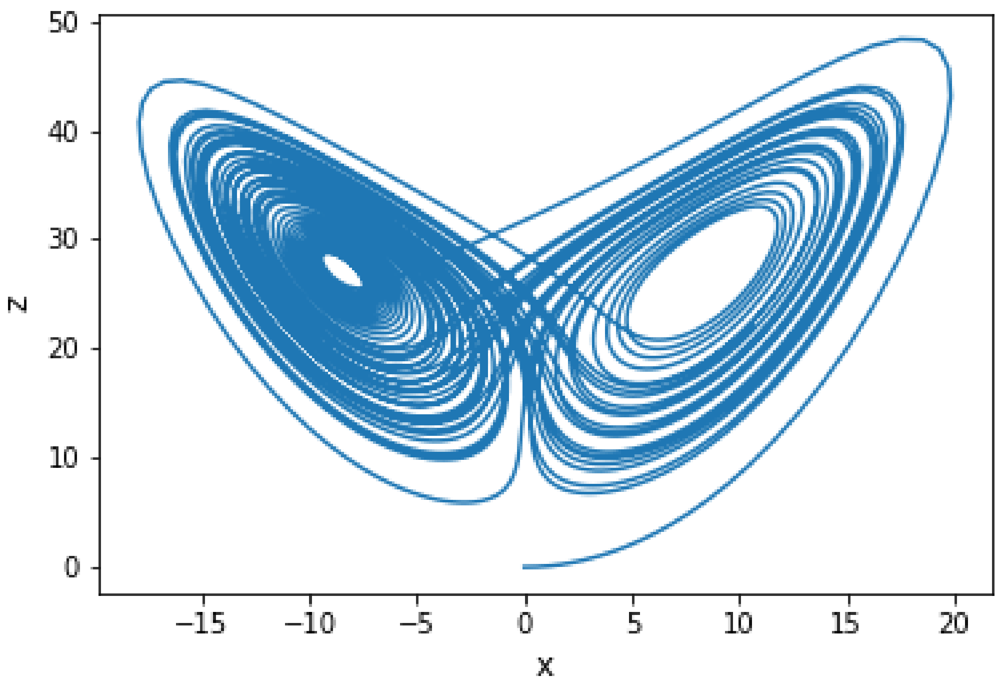

Figure 6: **P2: Plot of z(x).**