

SYNTH CHALLENGE 2022

Sound and Musical Instrument Synthesis



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Abstract

In this report, you can read about the synthesis of a Škoda vehicle, and the synthesis of a 'Barcarolle' music required to participate in the Synth Challenge 2022.

You will also be able to read about the possible improvements and the difficulties encountered to arrive at the result that you can listen to with the m4a files available in this report.

1. Introduction

Synth Challenge 2022 is a competition designed for university students who can participate by submitting two tasks. These two tasks are the production of Sound and Musical Instrument Synthesis by using a software environment.

For the 2022 edition, the first objective is to synthesize the sound of the Škoda auto electric vehicle based on the car's motion control and video.

The second objective is to synthesize the musical instruments from a MIDI file, for my part I chose 'Barcarolle' from 'The Tales of Hoffmann' by Jacques Offenbach.

2. Method

a. Barcarolle

To synthesize the musical instruments from a MIDI file, I used the MATLAB MIDI_toolbox environment. By executing the file 'main.m', we execute two main functions: 'synth.m' and 'synthchallenge.m' which I modified and other functions from the MIDI_toolbox folder which I did not modify.

In the 'synth.m' file, I modified the main loop to use the function. For that I had to add the signal source and the vibrato and determine the harmonics to finally have the synthesis of vibrato.

Once this step is done, we filter the signal with different filters and by calculating the resonator coefficients. The 'synthchallenge.m' file is used to create the result.

b. Electric vehicle

To synthesize, the sound of a vehicle, I used the data available to us in the 'control' file with its description. To produce a sound, I needed two essential data: the rotation per minute (RPM) and the time. Then I decided to display the curve linking these two data.

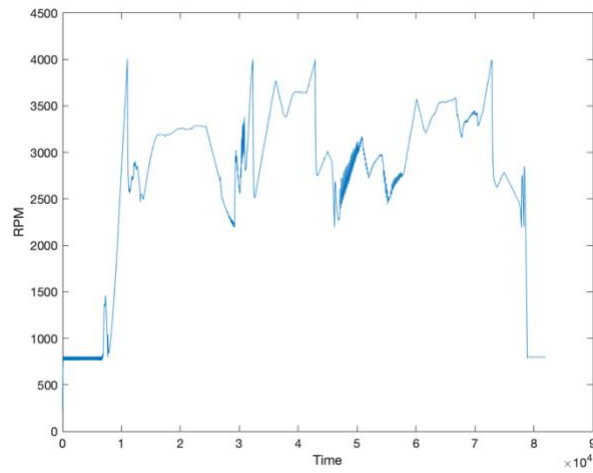


Figure 1: curve linking RPM and time.

I used the time variable to get a sound of the same length as the video. The RPM data was added to a continuous frequency signal to get frequency variations.

I iterated this with a 'for' loop (of the length of the RPM file). Once the iteration is finished, the data is inserted into a sine wave to obtain a sound.

3. Results

a. Barcarolle

The result of running the 'main' file returns a folder named 'result' in which there is the sound file 'Barcarolle.m4a' and a csv file ('Barcarolle.csv').

b. Electric vehicle

The result of the script execution is a mp4 file. You can find it in the attached folder under the name 'car.m4a'.

4. Conclusion

In conclusion, I managed to produce the two sound files needed for the Synth Challenge 2022. Nevertheless, I had some difficulties especially with the synthesis of the vehicle sound. Moreover, because I only used RPM and time, I could not have a sound that corresponded to my expectations.

Therefore, I know that it is possible to significantly improve the quality of the sound to get closer to the video.

For the Barcarolle music, it is also possible to increase the resemblance to the original by increasing the number of instruments and other parameters of the code.