Synth Challenge 2022

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1 Musical instrument synthesis

I chose Barcarolle from 'The Tales of Hoffmann' by Jacques Offenbach in the musical instrument section of the challenge. I synthesized this composition with a piano and a violin ensemble using the provided MIDI files.

1.1 Piano synthesis

I used the Karplus–Strong algorithm to mimic the sound of a piano hammer hitting a piano string. White noise was used in the algorithm for the excitation of the filter. Then I used a resonator filter to amplify some desired frequencies. I also convoluted the created sound with the impulse response of the piano soundboard [1] and added a vibrato effect. Every piano note is also weighted by an ADSR envelope to create a note shape that better resembles a real piano sound.

1.2 Violin synthesis

The violin sound was made with formant synthesis. I used a sawtooth wave which I filtered with band–pass filters. These filters were made with the formats of a real violin. Then I added an ADSR envelope to the result. I also added a chorus effect to the finished violin sound.

2 Synthetic sound of an electric vehicle

The audio for the electric vehicle consists of three main parts:

1. Engine sound

2. Background wind noise

3. The sound of the car driving over an uneven surface.

The sound of the engine was created using a track that was downloaded from [2] (the track is called car sound effect by sdjy4zhhbd). To create the final audio, which is 80 seconds long, I clipped short 0.2 second long sound vectors from the downloaded track, weighted them with a Hamming window, and summed them up with a 50 % overlap for smooth transitions. Each of these vectors is modulated by a phase vocoder to change the pitch of the sound to mimic the speeding up or slowing down of the vehicle. The parameters of the vocoder are determined by the speed of the car. I compute this speed as a mean of the speeds measured in the range of 0.1 seconds (every new sound clip starts after 0.1 seconds because of the overlap).

I added background wind noise to the engine sound by filtering white noise. Then I added an envelope with a randomly generated amplitude to the filtered noise.

I used frequency modulation and an exponential envelope to create the dull noises of the car riding over an uneven surface. These noises' starting and ending times can be determined either from the pitch parameter or the provided video.

References

[1] http://www.lma.cnrs-mrs.fr/~kronland/IEEE_SAP/sounds.html.

[2] https://pixabay.com/users/u_sdjy4zhhbd-31505024/?utm_source=link-attribution&utm_medium=referral&utm_campaign=music&utm_content=126709.