CZECH TECHNICAL UNIVERSITY IN PRAGUE
FACULTY OF ELECTRICAL ENGINEERING

SYNTH CHALLENGE 2019

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Introduction

The task of this project was to synthesize musical instrument sounds in MATLAB. The project is consists of three parts. The first task was to choose between two pieces, namely "Tři oříšky pro popelku" by Karel Svoboda or "Waterloo" by Benny Andersson & Björn Ulvaeus. I chose the first mentioned. It is a composition from Czech fairytale Three Wishes for Cinderella (1973). The second task was to create a musical scale (3 octaves) where all created instruments are used. The final task was to do any synthesis in MATLAB. It could be more musical instruments on any other sounds. I tried to connect both music and unmusical sounds in my composition, which consist of sounds inspired by the opening scene of the movie Once Upon a Time in the West (1968). We can hear, arriving train, harmonica and gun fight.

Instruments created for „popelka.mid"

String Ensemble – function string_ensemble.m

Additive synthesis with vibrato was used for this instrument. The envelope is trapezoid.

Piano – function piano.m

Sound is created by additive synthesis. The envelope of the sound is exponential.

Flute – function flute.m

For creation of flute sound I used formant synthesis with 3 formants. The saw tooth signal was used as excitation. The envelope is a trapezoid and tremolo effect was used.

Bassoon – function bassoon.m

Sound is created with additive synthesis. The envelope is a trapezoid.

Pizzicato Strings – function pizzicato.m

Karplus–Strong string algorithm was used for this instrument.

Music scale

All the instruments play 3 notes (except acoustic grand piano, which plays 4) in this order: bassoon, bright acoustic piano, string ensemble, acoustic grand piano, harmonica, pizzicato strings and flute.

Instruments and other sounds created for „west.m“

Harmonica – function harmonica.m

Sound is created by additive synthesis. The envelope is a trapezoid with a tremolo effect.

Bright Acoustic Piano – function bright_piano.m

Karplus–Strong string algorithm was used for this instrument to achieve the sound of strings more clearly.

Other sounds:

Wind – generated by moving filtration of white noise

Train – amplitude modulation of periodic signal on noise

Train whistle – formant synthesis of noise with very narrow bands

Gunshots – filtration of white noise and exponential envelope

Conclusion

I tried synthesis of both musical instruments and other unmusical sounds. I used mainly additive synthesis, formant synthesis and Karplus–Strong algorithm, because I am most familiar with those algorithms and since I have used them in the past, I know what results I can expect.

Sources

[1] http://sami.fel.cvut.cz/syn/ - information

[2] https://freesound.org/ - sound samples

[3] https://freewavesamples.com/ - sound samples

[4] https://www.midieditor.org/ - software

[5] http://www.gnmidi.com/gnmidfmten.htm - software