CSD2C Design

Harold Groenenboom

A simple polyphonic unison synthesizer with midi, filters and distortion.

Background and motivation: This project functions as a building block for future synthesis projects. I've always had a high interest for digital audio synthesis and I want to build digital (and maybe analog) synthesizers.

Concept: I want to make well sounding midi controlled synthesizer, which will be easy to use and must have a solid architecture. The synthesizer will have mostly standard audio synthesis components, which should make it user-friendly and easily expandable. The end result will be a stable, user-friendly, well sounding and easily expandable synthesizer.

Learning objectives: My aim in this project is to create a logically, easily expandable system architecture for a polyphonic midi synthesizer. In which I focus on coding the most common synthesizer building blocks which I haven't yet worked with. The results must be esthetically pleasing at least, as the user should want to hear more of the sounds produced. The synthesizer building blocks I want to work with are:

- wavetables
- polyphony
- interpolation
- anti-aliasing
- detuning
- filters
- distortion

Basic technical specifications: The synthesizer will have MIDI input, the midi input will be separated into multiple voices. Every voice will have it's own unison / multivoiced oscillator with detune containing multiple oscillator objects. These objects will generate audio by reading from a 2048 samples long wavetable and applying interpolation. The wavetables will have waves which will be generated, anti-aliased and stored inside the wavetable object. The wavetable will be send to the oscillators via a pointer. Jack2 will be used for audio generation

The MUST, COULD, and SHOULDs

MUSTs:

- Wavetable
    - Some kind of enumeration of single waveforms
        - i.e. vectors, audio arrays, Waveform classes or something else. The optimal solution is being researched.
    - Interpolation
    - Anti-aliasing
- Oscillator class
    - Phase, frequency and amplitude variables
    - Midi pitch to frequency conversion method
    - A specific wave selected from the wavetable
        - The interaction of the wavetable and the oscillator class is not yet fully determined. This issue is also brought up in the Wavetable research
- Polyphonic voice splitting
- Unison/multivoiced oscillator class having:
    - Number of oscillators variables
    - multiple oscillators and methods for setting the oscillators objects parameters
    - detune
- MIDI input
- Implementation of audio processing through audio callback functions.

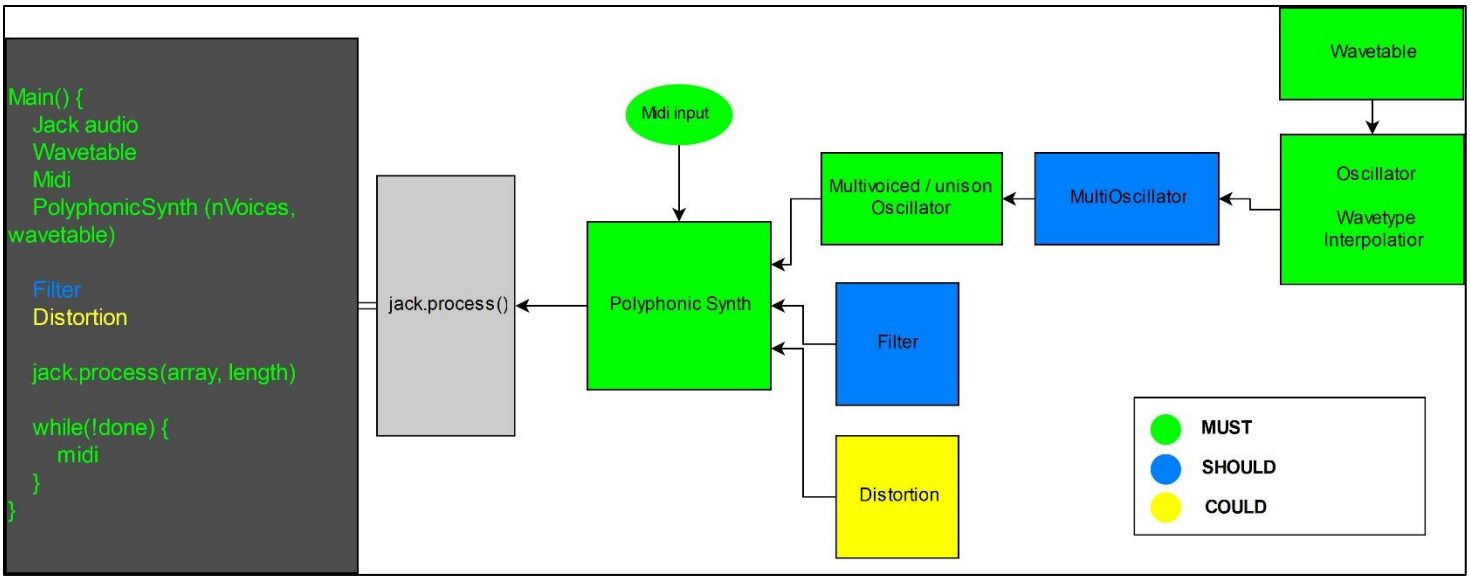
COULDs:

- Filter (lowpass), with resonance and cutoff parameters
- MultiOscillator instead of an Oscillator. The MultiOscillator has multiple oscillator objects, that together form a new more complex waveform.
    - Multiple oscillator objects
    - Pitch variable
    - Pitchoffset and amplitude variables per oscillator object.

WOULDs:

- Envelopes (ADSR)
    - Midi triggered envelopes
    - Filter & Amplitude Envelopes
- Distortion
    - Look-up table?
- LFO based morphing of the unison/multivoiced oscillator

SYSTEM SCHEMATIC



WAVETABLE AND OSCILLATOR DESIGN