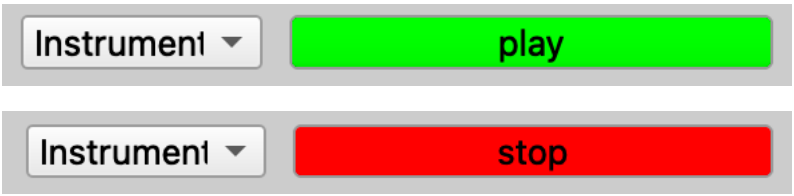
Multieffect effector

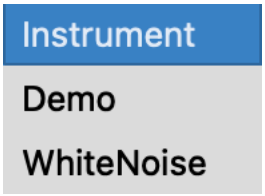
Our main goal is developing a wah-wah, phaser and flanger that work together. The instruction is shown in this link by video: https://youtu.be/AH2qjShTcqw.

We decided to connect filters consistently, one by one. The original sound comes into Wah-Wah. Afterwards, the processed signal goes to the next filter - Phaser. The last filter that modifies the signal is Flanger.

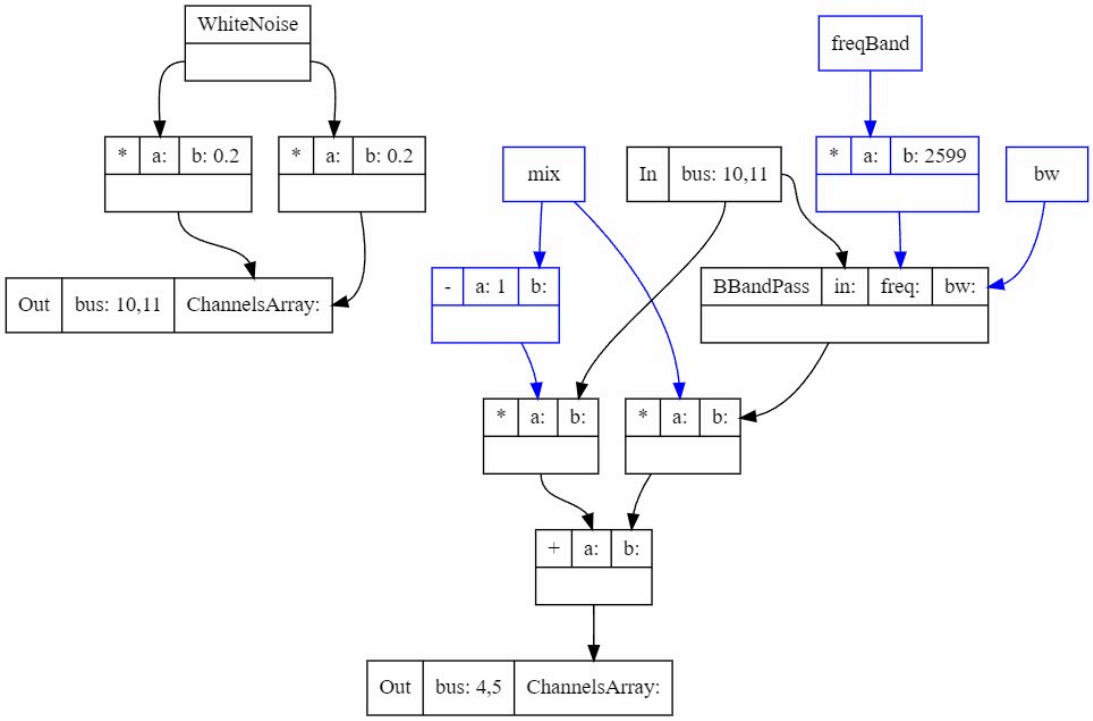
The application looks like this:

Our application has three regimes of working. First, the real-time filtering, users can plug in their instruments (e.g. guitar) and play with filters. The audio input is by default input channel 1 of the server. Secondly, the demo mode works with audio files loaded into the buffer. And the last one, WhiteNoise, helps to understand how filters work in a more efficient way.

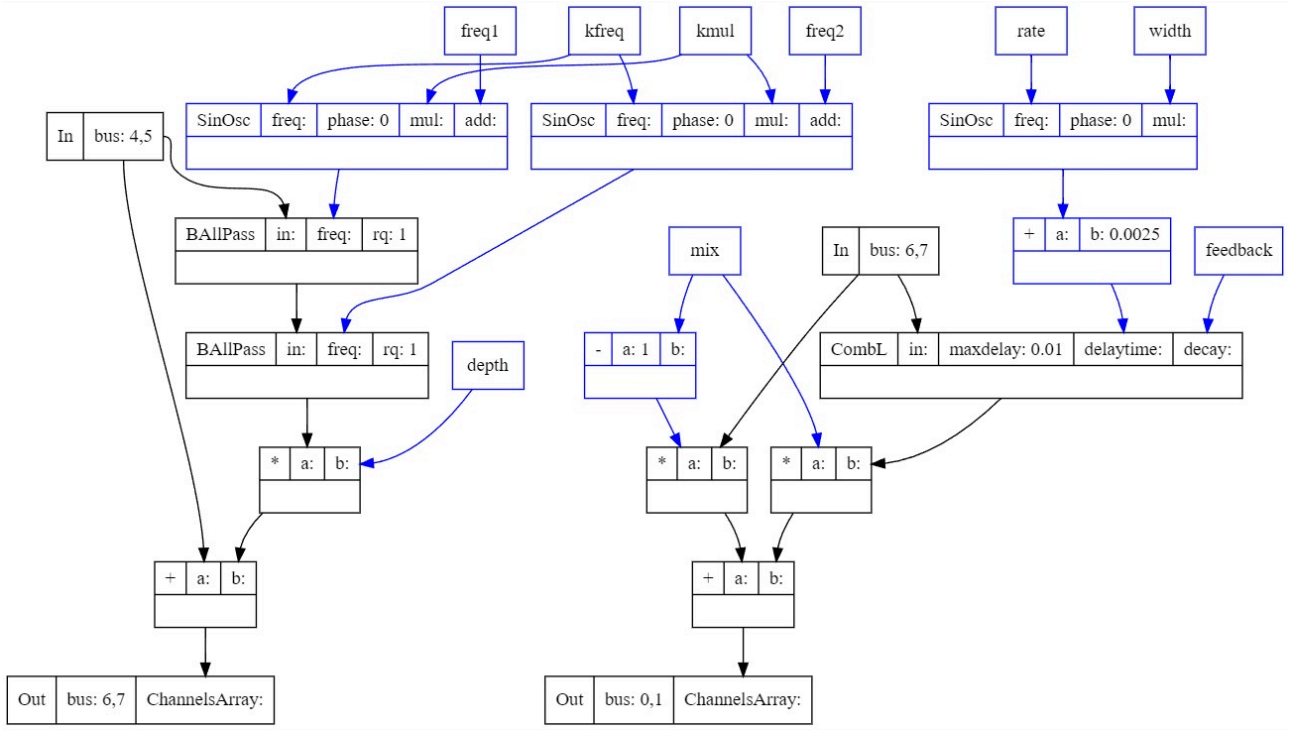




Block schemes



WhiteNoise and Wah-Wah



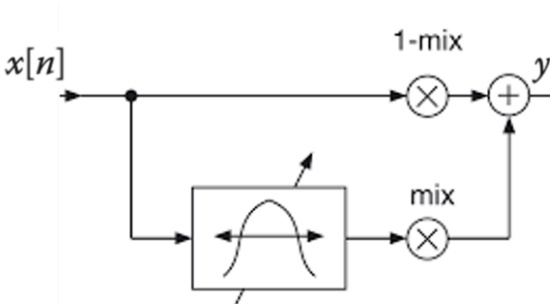
Phaser and Flanger

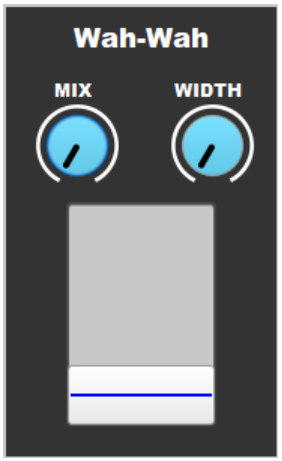
Filters

Wah-Wah

The wah-wah effect is produced mostly by foot-controlled signal processors containing a bandpass filter with variable center frequency and bandwidth.
In our project, we created two knobs that control the mixing and multiplication effects, and one slider that controls frequency bandwidth.

*sgn = BBandPass.ar(x_n, 2599*freqBand+300, 3*bw+0.05, mix);*





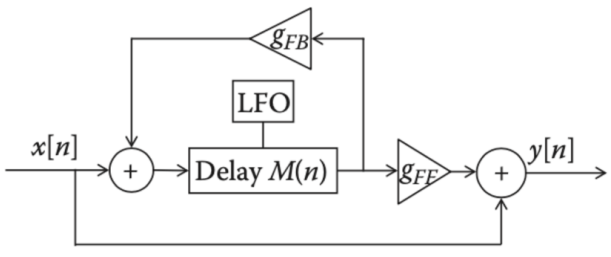
Flanger

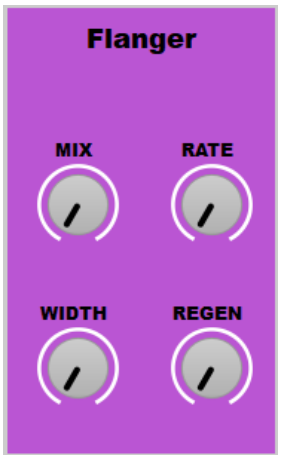
Flanger mixes two identical signals together, one signal delayed by a small and (usually) gradually changing period, usually smaller than 20 milliseconds. This produces a swept comb filter effect: peaks and notches are produced in the resulting frequency spectrum, related to each other in a linear harmonic series. Varying time delay causes these to sweep up and down the frequency spectrum

Four knobs control: the mixing effect, rate (it controls LFO), width (it controls multiplication) and regen (or feedback that controls delay time).

*lfo = SinOsc.kr(rate * 2, 0, 0.001 * width * 2);*

*delay = CombL.ar(inSig, 0.01, 0.0025 + lfo, 0.05 * feedback, 1, 0);*





Phaser

Phasor will first create a duplicate of the dry signal. Then the duplicated signal is processed with a cascade of a series of All-pass filters. In the end, the phasor will add the processed signal back with the original one with a weight called depth.

- Algorithm

All-pass filters only change the phase response of the signal but not the amplitude, thus the phase is reversed at specific frequencies. Adding the phase-shifted signal back to the dry signal creates cancellations at frequencies (notched) where the phase of the two signals are 90-degree reversed. N All-pass filters (also called n stages) will create n/2 notches. The notch frequencies are modulated through LFO.

- Code

BAllPass is a second-order all-pass filter. Note: AllpassL can not achieve the task, AllpassL is a Schroeder all-pass filter according to the documentation, this filter acts like a delay. It creates a Comb effect in the frequency domain, and its superclass is CombL which makes sense.

SelectX allows the user to use the if condition in a SynthDef. The output is selected from an array of inputs, plus it performs an equal power crossfade between two adjacent channels.