Vulpus Labs

Speccy

Introduction

Speccy is a “spectral” delay effect. It divides an input signal up into a number of frequency bands, and applies delays of different lengths to each of these bands, which are then mixed together into an output signal.

The lengths of the delays are randomised, with a user-controllable random seed. Controls are provided for the size of the analysis window used to separate out frequency bands, the number of bands per delay line, a feedback amount and a wet/dry mix.

This module introduces some latency into processing, as a consequence of the Fast Fourier Transform algorithm used to separate out frequency bands. The amount of latency is user-adjustable, and an LED indicator shows when more latency is needed to prevent audio glitches.

Theory of Operation

Speccy separates out frequency bands by splitting up the input signal into a series of overlapping processing windows, then performing a Fast Fourier Transform on each window. The number of frequency bands obtained depends on the size of the processing window.

Rather than delaying the time-domain signal directly, Speccy applies delays to the frequency band information, mixing frequency information obtained from previous windows back into later windows. Each band can be delayed by up to 256 windows. The actual length of the delay in samples also depends on the window size.

Once delayed frequency information has been added to the frequency bands obtained by the Fast Fourier Transform, they are recombined to produce an output window, which is written into an output buffer. The output of the module reads from this buffer a number of samples behind where the processed windows are written, to leave time for complete input windows to be captured and processed. If input capture and processing takes too long, and the “read head” of the output buffer catches up with the “write head”, then a warning light is shown. The user can react by increasing the amount of latency added to the output signal.

Controls

Connect an input to the **IN** jack at the top of the module, and an output to the **OUT** jack at the bottom.

The **WIN SIZE** slider sets the size in samples of the windows sent to the FFT algorithm for processing into frequency bands, between 64 (32 bands) and 2048 (1024 bands). The larger this is, the greater the latency, and the smaller each individual frequency band is.

The **SEED** slider sets a random seed which is used to determine the amount of delay applied to each frequency band. If using two instances of the module to process in stereo, this can be used to ensure that delay times on each side match (if the seed values are equal) or do not match (if they are different).

The **BAND SIZE** slider sets the number of bands to which each delay line is obtained. With smaller values, frequencies very close to each other may be delayed by different amounts, producing a more “smeared” effect. Larger values are better if the “tinkling” effect of multiple filtered delay taps is preferred.

FEEDBACK controls the amount of the output signal that is fed back into the input. **MIX** controls the amount of the delayed signal that is added to the output: at 0% it is fully dry (no delay), and at 100% it is fully wet (nothing but delay).

The indicator LED next to the **OUT** jack will flash red if samples are read from the output buffer before a complete output window has been written into it (this will usually result in audio glitching). To remedy this, double-click on the LED and select a larger latency amount, giving the module time to complete processing before samples are sent to the output jack.

Credits and Acknowledgements

Speccy was written by Dominic Fox in August 2024.

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